2nd Meeting of the Academic Council on 10th May, 2021

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ITEM 1

CONFIRMATION OF THE MINUTES OF THE 1ST MEETING OF THE ACADEMIC COUNCIL HELD ON 25.07.2020

Item 1: The Minutes of the 1st meeting of the Academic Council was circulated to all the members. There were no comments or request for any changes. The same is placed below for confirmation:

MINUTES OF THE MEETING OF THE FIRST ACADEMIC COUNCIL
HELD ON 25TH JULY, 2020 AT 10.30AM AT CONFERENCE HALL, E-BLOCK, ANURAG UNIVERSITY

Members Present / Absent

S.No	Name of the Member	Designation	Present/Absent
1	Prof.S.Ramachandram Vice- Chancellor	Chairperson	Present
2	Dr.V.Vijay Kumar Dean, R& D & BOS Chairperson, CSE	Member	Present
3	Dr.G.Vishnu Murthy Dean, Engg & HOD CSE	Member	Present
4	Dr.VasudhaBakshi Dean, Pharm & BOS Chairperson, Pharm	Member	Present
5	Prof.M.Mutha Reddy Dean. Examinations	Member	Present
6	Dr.K.Sudheer Reddy Dean. Acad. & Plng, HOD IT & BOS Chairperson, IT	Member	Present
7	Dr.Sathees Kumaran HOD ECE & BOS Chairperson, ECE	Member	Present
8	Dr.M.Anil Kumar HOD EEE & BOS Chairperson, EEE	Member	Present
9	Dr.S.Madhu HOD MEC &BOS Chairperson, MEC	Member	Present
10	Dr.M.Mukunda Vani HOD CHE &BOS Chairperson, CHE	Member	Present
11	Dr.B.Narendar HOD CIV &BOS Chairperson, CIV	Member	Present
12	Dr. G.Sabitha HOD MBA &BOS Chairperson, MBA	Member	Present
13	Dr.G.V.S.Anantha Lakshmi HOD English &BOS Chairperson, English	Member	Present
14	Dr.K.Shiva Reddy HOD Mathematics	Member	Present
15	Dr.Savita Belwal HOD Chemistry & BOS Chairperson,Chemistry	Member	Present
16	Dr.M.Srinivas Reddy HOD Physics &BOS Chairperson, Physics	Member	Present
17	Dr.V.Srinivasa Rao BOS Chairperson, Mathematics	Member	Present

Governing Body Nominees			
18	Dr.ShantaThoutam Innovation Director, THUB	Member	Present
19	Prof.E.Sai Baba Reddy Former Rector & Prof, Dept. of Civil Engg, JNTUH	Member	Present
20	Prof.B.N.Bhandari Professor Dept. of ECE, JNTUH	Member	Present
21	Dr.B.Satyanarayana Reddy MD, Nosch Labs, Hyderabad	Member	Absent
Student Nominees			
22	YeluriKushalVidyaMohanji CSE III year	Member	Absent
23	B.Sravanthi ECE III year	Member	Absent
Sponsoring Body Nominees			
24	Dr.P.Rajeshwar Reddy Chairman, GECT	Member	Present
25	Mrs.S.Neelima Managing Trustee, GECT	Member	Present
26	Mr. Palla Anurag Trustee, GECT	Member	Present
27	Dr.K.S.Rao, Director AGI	Member	Present
28	Dr.M.Srinivasa Rao, Asso. Prof, English, AGI	Member	Present
Vice - Chancellor Nominees			
29	Dr.M.Sikindar Baba Asso. Prof, Dept. of MEC & Controller of Examination	Member	Present
30	Dr.LakshmiRamana Asso. Professor, Dept. of English	Member	Present
Registrar			
31	Dr.S.Sameen Fatima	Member Secretary	Present
Special Invitee			
32	Dr UB Desai, Chancellor, Anurag University	Special Invitee	Present

At the outset on behalf of the Vice Chancellor, the Registrar, welcomed all the members to the First Academic Council Meeting. The Chairman, GECT, Dr Palla Rajeshwar Reddy gave the background of AGI and the setting up of Anurag University. The Chancellor, Prof UB Desai stressed the need to collaborate with industry by signing MoUs to add value to the programs. The Vice Chancellor, Prof S Ramachandram, lauded the services of all the visionaries who set up AGI and established AU. He also gave the future plans of the University, which included setting up of various Centres of Excellence namely: AI&ML Centre of Excellence, Cyber Security Centre of Excellence, Educational Technologies Centre of Excellence.

The following agenda items were taken up for discussion:

Item 1: The Vice Chancellor introduced the various programs being offered in the academic year 2020-2021 with the respective intake and sought approval:

S.No	School	Program	Branch	Intake
1	**Engineering**	**B. Tech**	Artificial Intelligence	120
2			Artificial Intelligence and Machine Learning	60
3			Civil Engineering	180
4			Construction Technology & Management	60
5			Chemical Engineering	60
6			Computer Science and Engineering	240
7			Computer Science and Systems Engineering	60
8			Computer Science and Engineering with specialization on Cyber Security	60
9			Computer Science and Engineering with specialization on Data Science	60
10			Electrical and Electronics Engineering	120
11			Electronics and Communication Engineering	240
12			Information Technology	180
13			Mechanical Engineering	240
14	**Engineering**	**M. Tech**	Computer Science and Engineering	36
15			Electrical Power Systems	18
16			Embedded Systems	24
17			Machine Design	24
18			Power Electronics and Electrical Drives	36

19			Structural Engineering	36
20			VLSI System Design	36
21		**Ph. D**	Chemical Engineering	As per the availability of Research Supervisors
22			Civil Engineering	
23			Computer Science and Engineering	
24			Electrical & Electronics Engineering	
25			Electronics and Communication Engineering	
26			Information Technology	
27			Mechanical Engineering	
28	**Pharmacy**	**B.Pharm**	Bachelor of Pharmacy	100
29		**M.Pharm**	Industrial Pharmacy	15
30			Pharmaceutics	15
31			Pharmacology	15
32			Pharmaceutical Analysis and Quality Assurance	15
33		**Pharm D**	Pharm D	30
34		**Pharm D**	Pharm D (PB)	10
35		**Ph. D**	Pharmacy	As per the availability of Research Supervisors
36	**Business Management**	**BBA**	Bachelor of Business Administration	120
37		**MBA**	Master of Business Administration	120
38		**Ph. D**	Business Management	As per the availability of Research Supervisors

Resolution 1: It was resolved to offer the above programs at Anurag University from the academic year 2020-2021.

Item 2: The Vice Chancellor sought the approval for establishing a new "Department of Artificial Intelligence" in the School of Engineering

Resolution 2: It was resolved to establish the "Department of Artificial Intelligence" in the School of Engineering

Item3: The Dean, Academic and Planning, D Sudheer Redd, presented an overview of the academic regulations for the UG and PG programs in the School of Engineering, School of Pharmacy and School of Management. After a lot of deliberation the following resolutions were adopted:

Resolution 3: It was resolved to adopt the following distribution and weightage of marks for theory courses, along with the minimum pass percentage in the Academic Regulations for UG / PG programs:

	CIE	SEE	Minimum Pass Percentage (SEE)	Minimum Pass Percentage (CIE+SEE)
UG Programs	40%	60%	35	40
PG Programs	40%	60%	40	50

* 10% relaxation in case of physically challenged students

Resolution 4: It was resolved to adopt the following distribution and weightage of marks for Laboratory/Practicals, Mini Project, Project work, Comprehensive Viva-Voce, Seminars, Project Reviews, wherever applicable, along with the minimum pass percentage in the Academic Regulations for UG / PG programs:

	CIE	SEE	Minimum Pass Percentage (SEE)	Minimum Pass Percentage (CIE+SEE)
UG Programs	50%	50%	35	40
PG Programs	50%	50%	40*	50

*****For courses where there is only SEE and no CIE, the minimum Pass percentage (SEE) is 50%

Resolution 5: It was resolved to approve the following Credit Distribution, Promotion Rules, Grading System, and Award of Class in the Academic Regulations for UG / PG programs

Credit Distribution:

	Undergraduate	Postgraduate
Engineering	**160**	**88**
Pharmacy	**196**	**88**
Business Management	**138**	**102**

Promotion Rules based on Credits:

	I Yr. to II Yr.	II Yr. to III Yr.	III Yr. to IV Yr.
B. Tech, B. Pharm	**50% (up to I Yr. II Sem)**	**60%(up to II Yr. I Sem)**	**60%(up to III Yr. I Sem)**
BBA	**50% (up to I Yr. II Sem)**	**60%(up to II Yr. I Sem)**	**--**
M. Tech, MBA, M. Pharm	**50%(up to I Yr. II Sem)**	**--**	**--**
Pharm-D, PB	As per PCI guidelines		

Grading System:

	Undergraduate Programs		Postgraduate Programs	
% of Marks Secured	Letter Grade	Grade Points	Letter Grade	Grade Points
≥ 90%, ≤ 100%	**O (Outstanding)**	**10**	**O (Outstanding)**	**10**
≥ 80%, < 90%	**A+ (Excellent)**	**9**	**A+ (Excellent)**	**9**
≥ 70%, < 80%	**A (Very Good)**	**8**	**A (Very Good)**	**8**
≥ 60%, < 70%	**B+ (Good)**	**7**	**B+ (Good)**	**7**
≥ 50%, < 60%	**B (Average)**	**6**	**B (Above Average)**	**6**
≥ 40%, < 50%	**C (Pass)**	**5**	**F (Fail)**	**0**
< 40%	**F (Fail)**	**0**	**NA**	**NA**
Absent	**Ab**	**0**	**Ab**	**0**

Award of Class:

	Undergraduate Programs (CGPA)	Postgraduate Programs (CGPA)
First Class with Distinction*	**≥ 8.00**	**≥ 8.0**
First Class	**≥6.50 - <8.00**	**≥ 6.75 - < 8.0**
Second Class	**≥5.50 - <6.50**	**≥ 6.00 - < 6.75**
Pass	**≥5.00 - <5.50**	**--**

*Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason

Resolution 6: It was resolved to accept the introduction of Honors Degree in BTech, BPharm and BBA programs and the details shall be worked out and placed before the next Academic Council meeting.

Resolution 7: It was resolved to approve the below Rules for Revaluation and Challenge valuation in the Academic Regulations for UG / PG programs

Rules for Revaluation	**Rules for Challenge Valuation:**
◂ Evaluation by two subject experts ◂ If variation>=15, will be sent for 3rd valuation ◂ Nearest of two valuations out of three will be considered, the average of these two will be taken as the final marks obtained ◂ If difference is >=15, then revaluation marks will be taken	◂ A student who is not satisfied with the Revaluation, he/she can apply for Challenge Valuation on payment of prescribe free ◂ Photo copy of the answer booklet will be given ◂ Valuation will be done in presence of the candidate ◂ If the change is >=15 marks, new marks will be given and fee paid will be refunded

Item 6: PhD Rules and Regulations, were presented by the Dean, R&D, Prof V Vijay Kumar

Resolution 8: It was resolved to approve the PhD Rules and Regulations and the same is attached

Item 7: The Structure and Syllabus of the School of Engineering was presented by the Dean, Engineering, Dr Vishnu Murthy

Resolution 9: It was resolved to approve the Minutes of the following Board of Studies in Engineering and adopt the respective Structure and Syllabus as given below:

I. **Board of Studies in Artificial Intelligence**:

UG Programs

(i) BTech(Artificial Intelligence): 1st Year Course Structure and Syllabus and 2nd, 3rd, and 4th year Course Structure

(ii) BTech(Artificial Intelligence and Machine Learning): 1st Year Course Structure, Syllabus and 2nd, 3rd, and 4th years Course Structure

II. Board of Studies in Computer Science and Engineering:

UG Programs:

(i) BTech(Computer Science and Engineering): 1st Year Course Structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

(ii) BTech(Computer Science and Systems Engineering): 1st Year Course Structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

PG Programs:

(i) MTech(Computer Science and Engineering): Course Structure and Syllabus .

III. Board of Studies in Information Technology:

UG Program:

BTech(Information Technology): 1st Year Course Structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

IV. **Board of Studies in Chemical Engineering**:

UG Program:

BTech(Chemical Engineering): 1st Year Course structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

V. Board of Studies in Civil Engineering:

UG Programs:

(i) BTech(Civil Engineering): 1st Year Course structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

(ii) BTech(Construction Technology and Management): 1st Year Course structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

PG Programs:

(i) MTech(Structural Engineering): Course Structure and Syllabus .

VI. Board of Studies in Electrical and Electronics Engineering:

UG Program:

(i) BTech(Electrical and Electronics Engineering): 1st Year Course Structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

PG Programs:

(i) MTech(Power Electronics and Electric Drives): Course Structure and Syllabus .

(ii) MTech(Electrical Power Systems): Course Structure and Syllabus .

VII. Board of Studies in Electronics and Communications Engineering:

UG Programs:

(i) BTech(Electronics and Communications Engineering): 1st Year Course structure, Syllabus and 2nd, 3rd, and 4th year Course Structure

PG Programs:
(i) MTech(VLSI System Design): Course Structure and Syllabus .
(ii) MTech(Embedded Systems): Course Structure and Syllabus .

VIII. **Board of Studies in Mechanical Engineering**:
UG Program:
(i) BTech(Mechanical Engineering): 1st Year Course structure, Syllabus and 2nd, 3rd, and 4th year Course Structure
PG Program:
(i) MTech(Machine Design): Course Structure and Syllabus .

Resolution 10: It was resolved to approve introduction of BTech (CSE with Cyber Security) in the Department of Computer Science and Engineering.

Resolution 11: It was resolved to approve introduction of BTech (CSE with Data Science) in the Department of Artificial Intelligence.

Item 8: To approve the minutes of the Board of Studies in Pharmacy. The Structure and Syllabus of the UG and PG programs in the School of Pharmacy was presented by the Dean, Pharmacy, Dr Vasudha Bakshi

Resolution 12: It was resolved to approve the Minutes of the Board of Studies in Pharmacy and adopt the respective Structure and Syllabus as given below:

UG Programs
B.Pharm, Pharm.D: Structure and Syllabi was framed according to the PCI guidelines.
PG Programs:
Pharm.D (PB) and M.Pharm: Structure and Syllabi was framed according to the PCI guidelines

Item 9: Toapprove the minutes of the Board of Studies in Management. The Structure and Syllabus of the programs in the School of Management were presented by the Head, Dept of Management, Dr Sabitha

Resolution 13: It was resolved to approve the Minutes of the Board of Studies in Management and adopt the respective Structure and Syllabus as given below:

UG Program:
BBA: Structure and Syllabi
PG Program:
MBA: Structure and Syllabi

Any other items:
Resolution 10: It was resolved that the Sponsoring Body shall nominate FIVE (5) members including TWO (2) faculty members of the Anurag University to the Academic Council.

The meeting ended with a Vote of Thanks by the Registrar

ITEM 2

ACTION TAKEN ON THE DECISIONS OF THE 1ST ACADEMIC COUNCIL

Item 2: The following are the decisions taken in the 1st Academic Council and the action taken on them. The same is placed before the Academic Council for information and directions, if any.

Resolution 1: It was resolved to offer the above programs at Anurag University from the academic year 2020-2021.

Action Taken: All the three Schools offer PG and PhD courses. School of Engineering and School of Pharmacy offer UG courses and the School of Business Management is ready to offer UG from the Academic Year 2021-22.

Resolution 2: It was resolved to establish the "Department of Artificial Intelligence" in the School of Engineering

Action Taken: The Department of Artificial Intelligence has been established through University order no. dated.

Resolution 3: It was resolved to adopt the following distribution and weightage of marks for theory courses, along with the minimum pass percentage in the Academic Regulations for UG / PG programs, as presented in the meeting

Action Taken: The same has been adopted into practice.

Resolution 4: It was resolved to adopt the following distribution and weightage of marks for Laboratory/Practicals, Mini Project, Project work, Comprehensive Viva-Voce, Seminars, Project Reviews, wherever applicable, along with the minimum pass percentage in the Academic Regulations for UG / PG programs, as presented in the meeting:

Action Taken: The same has been adopted into practice.

Resolution 5: It was resolved to approve the Credit Distribution, Promotion Rules, Grading System, and Award of Class in the Academic Regulations for UG / PG programs, as presented in the meeting.

Action Taken: The same has been adopted into practice.

Resolution 6: It was resolved to accept the introduction of Honors Degree in BTech, BPharm and BBA programs and the details shall be worked out and placed before the next Academic Council meeting.

Action Taken: A proposal to introduce Honors and Minor in B.Tech Programmes is being implemented as per the recommendations of the AICTE ‘Model Curriculum - 2018’ for U.G Program in Engineering & Technology. AICTE has recommended that a student will be eligible to get under-graduate degree with ‘Honours’ or ‘Additional Minor Engineering’, if he / she completes an additional 20 credits and these extra credits could be acquired through MOOCs. However, the total no. of credits is modified as 18 - 20 in the Approval Process Hand Book, 2020-21 of AICTE.

The Dean, Academic and Planning conducted meetings during which it was decided that:

a. an undergraduate engineering student can get a degree in Anurag University in B.Tech. (Hons.) or B.Tech. (Addl. Minor Engg.) instead of B.Tech. degree.

b. by opting for 'Honours’ / ‘Additional Minor Engg.’, the student should earn 18 to 20 additional credits through professional courses.These additional credit courses shall not be part of the regular curriculum.

c. after successful completion of ‘Honours’ / ‘Additional Minor Engg.’, degree the student will be better equipped to perform P.G and research in relevant / multi-disciplinary area.

The Eligibility, Conditions and Registration process was defined as given below:

1. Eligibility

a. B.Tech. (Hons. / Addl. Minor Engg.) degree is open to all current Engineering / Technology undergraduates who have taken admission on or after the academic year 2020 – 21.
b. A student who joined under B.Tech (Reg.) scheme should secure a CGPA of atleast 7.5 by the end of 2nd Semester (I yr. I sem.) without any backlog courses.
c. A student joined under B.Tech (LES) scheme should secure a SGPA of atleast 7.5 in the 3rd Semester (II yr. I sem.)) without any backlog courses.
d. Students securing ‘F’ grade in any previous semester(s) are not eligible for registration.

2. Conditions

a. A student shall have to complete the additional credits within four years from the date of admission.
b. These additional credit courses shall not be part of the regular curriculum.

c. Earning of these additional credits shall be through on-line platforms like MOOCs / NPTEL / Department / any other on-line courses, which are approved by the respective (parent / non-parent) BoS.
d. Any student who has registered for B.Tech.(Hons. / Addl. Minor Engg.) but could not complete extra credits, will be awarded B.Tech. (Reg.) as per the Rules & Regulations of the University, upon his / her request for cancellation of registration.
e. A student has to choose a Theory course and Project work / Laboratory course offered by the Department in the domain of additional courses.
f. The Project work (if any) as a part of additional courses should be completed by the end of 6^{th} Semester (III yr. II sem.)

3. Registration

a. Registration of additional courses for B.Tech. (Reg.) students will be allowed from the 3^{rd} Semester (II yr. I sem.)
b. Registration of additional courses for B.Tech. (LES) students will be allowed from the 4^{rd} Semester II ys. II sem.)
c. A student should not register for more than two additional courses in each semester and complete the course within a maximum period of six years from his / her date of admission into B.Tech. I Sem.
d. It is the responsibility of the student to register for the courses and the required registration fee shall be borne by the student only.
e. A student should obtain approval from concerned Head of the Department and Dean, School of Engg. to register for B.Tech. (Hons.) / B.Tech. (Additional Minor Engg.).
f. A student is permitted to register either B.Tech. (Hons.) or B.Tech. (Addl. Minor Engg.), but not both.
g. The credits completed for B.Tech. (Hons.) are not inter-changeable to the credits of B.Tech. (Addl. Minor Engg.) and vice-versa.

Resolution 7: It was resolved to approve the below Rules for Revaluation and Challenge valuation in the Academic Regulations for UG / PG programs, as presented in the meeting.

Action Taken: The same has been adopted into practice.

Resolution 8: It was resolved to approve the PhD Rules and Regulations, , as presented in the meeting.

Action Taken: The same has been adopted into practice.

Resolution 9: It was resolved to approve the Minutes of the following Board of Studies in Engineering and adopt the respective Structure and Syllabus.

Action Taken: The same has been adopted into practice.

Resolution 10: It was resolved to approve introduction of BTech (CSE with Cyber Security) in the Department of Computer Science and Engineering.

Resolution 11: It was resolved to approve introduction of BTech (CSE with Data Science) in the Department of Artificial Intelligence.

Action Taken for Resolutions 10 and 11: These programmes were started during academic year 2020-21 with an intake of 30 each.

Resolution 12: It was resolved to approve the Minutes of the Board of Studies in Pharmacy and adopt the respective Structure and Syllabus as presented in the meeting.

Action Taken: The same has been adopted into practice.

Resolution 13: It was resolved to approve the Minutes of the Board of Studies in Management and adopt the respective Structure and Syllabus.

Action Taken: The same has been adopted into practice.

Resolution 14: It was resolved that the Sponsoring Body shall nominate FIVE (5) members including TWO (2) faculty members of the Anurag University to the Academic Council.
Action Taken: The decision is communicated to CEO and action is awaited.

ITEM 3

PRESENTATION OF THE MINUTES OF THE BOARD OF STUDIES (BoS), INCLUDING COURSE STRUCTURE AND SYLLABI, BY THE RESPECTIVE CHAIRPERSONS FOR DISCUSSION AND APPROVAL

a) Minutes of the Meeting of the BoS in Artificial Intelligence

Minutes of the Second Board of Studies (BoS) Meeting in Artificial Intelligence held on Saturday, 27th March 2021 at 4 pm in Online Mode

Members Present:

1. Prof S Sameen Fatima, Head, Dept of AI & Registrar, AU, Chairperson
2. Dr G Vishnu Murthy, Dean Engineering, AU, Member
3. Dr Sumohana S Channappayya, Associate Professor, IIT Hyderabad, Member
4. Dr P Radha Krishna, Professor, NlT, Warangal, Member
5. Dr MV Krishna Murthy,Managing Director, United Online Software Development, Hyderabad, Member
6. Mr Bala Prasad Peddigari, Principal Consultant, Tata Consultancy Services Limited, Hyderabad, Member
7. Mr Ramakrishna Lingireddy, Vice President, Capgemini, Hyderabad, Member
8. Mr Samir Goswami, Director (MIS), DDUGKY Division, NIRDPR, Member
9. Dr P V Sudha, Professor and Head, Dept of CSE, UCE, OU, Member
10. Dr Salman A Moiz, Professor, SCIS, UoH, Member
11. Dr VijayaKumari Gunta, Professor, JNTUH, Member
12. Dr Tilottama Goswami, Professor, Dept of AI, AU, Member
13. Dr Pardeep Kumar, Asst.Professor, Dept of AI, AU, Member
14. Mr M Hari Prasad, Asst.Professor, Dept of AI, AU, Member
15. Mr Malladi Harikrishna, Associate Architect, Kore.ai, Hyderabad, Alumni,Member

Special Invitee Present:

16. Prof S Ramachandram, Vice Chancellor, AU,Special Invitee

The Chairperson welcomed all the members and gave a brief introduction of Anurag University. The following agenda items were then taken up one by one for discussion:

1. **Course Structure for BTech (AI) and BTech (AI & ML) for all the four years:**

   The structure for all the four years of BTech(AI) and BTech(AI&ML) was presented by the Chairperson. The salient points were as follows:

   a. The professional core courses offered in common to BTech(AI) and BTech(AI&ML) were Computer Systems-I, Data Structures, Python Programming, Java programming, Data Wrangling, Design and Analysis of Algorithms, Fundamentals of Artificial Intelligence, Fundamentals of Software Engineering , Database Management Systems, Machine Learning, Computer Systems-II, Web Technologies, Automata Theory and Applications, Data Science, Computer Vision, Natural Language Processing and Deep learning. However the BTech(AI) and BTech(AI&ML) differed in one core course. In BTech(AI) III Year II Sem the course "Data Science" was included and in BTech(AI&ML) III Year II Sem the course "Advanced Machine Learning" was included.

   b. Few of the core courses need special mention. The course Computer Systems-I covers fundamental concepts from both "Digital Logic Design" and "Computer Organization". The course Computer Systems-II covers fundamental concepts from both "Operating Systems" and "Computer Networks". The "Data

Wrangling" course covers how to load, transform, visualize and clean the data, which is available in different formats in today's data-driven organizations. Also there are good job prospects in this field for undergraduates. TheLinux Programming Lab has exercises from "Shell Scripting", "Operating Systems" and "Computer Networks" and hence, was renamed as "Computer Systems Lab". The course Automata Theory and Applications was to be designed keeping in mind at least two applications: Compilers and Natural Language Processing. A good book written by Elaine Rich is available which covers these applications

c. The professional elective courses offered were common to both BTech(AI) and BTech(AI&ML).

The members expressed that the Course Structure was well thought of. However, a few suggestions were made, based on which the following resolutions were drawn:

a. Rename the BTech (AI) and BTech(AI&ML) II Yr II Sem "Data Wrangling" Course to"Data Wrangling and Visualization" and the breakup was decided as: Theory (2hrs) + Tutorial (1 hr)
b. Rename BTech(AI) and BTech(AI&ML) II Yr II Sem "Data Wrangling Lab" as "Data Wrangling and Visualization Lab"
c. To take the help of Mr. Bala Prasad Peddigari in providing case studies from industry to understand the real world scenarios for the course "Data Wrangling and Visualization"
d. Rename the BTech(AI) and BTech(AI&ML) III yr I Sem "Linux Lab" to "Computer Systems Lab".
e. Switch the elective courses "Cloud Computing" in BTech (AI) and BTech (AI&ML) III Yr II Sem with "Distributed Systems" in BTech (AI) and BTech (AI&ML) IV Yr I Sem, as Distributed Systems is a prerequisite for offering Cloud Computing.
f. To take the help of Mr. Sameer Goswami from NIRD in teaching "Application of AI in e-Governance"
g. Include Optimization Lab in the list of labs under PEC-III Lab in IV Year I Sem
h. Syllabus of Project Management offered by MBA as OEC III needs to be checked with current and best practices offered by PMI. organization to undergraduates and upgraded if required in the next cycle of Board of Studies

2. B.Tech(AI) and BTech (AI&ML) with Honors in Cyber Security

The Chairperson proposed to offer BTech (AI) and BTech (AI&ML) Honours in Cyber Security. She informed that as per AICTE, BTech Honors degree is awarded to a student who earns18 to 20 credits in addition to the credits earned through their regular BTech program. Of these 10 credits are to be earned by doing project work. The remaining 8 to 10 credits are to be earned by undergoing MOOCs / NPTEL / Department / any other on-line courses, which are approved by the Board of Studies. Few course names suggested were: Linux Operating Systems/Linux Bash Shell Scripting, Computer Networks and Internet Protocols, Network Security, Web Security, Mobile Security, Secure Code Writing, Cryptography.

The following resolutions were made:

a. The members agreed to the proposal to offer BTech (AI) and BTech (AI&ML) Honours in Cyber Security.
b. The members agreed to authorize the Chairperson to choose from the available and relevant courses from Swayam/NPTEL and other MOOCs for earning 8 to 10 credits.

3. PhD programme

The Chairperson sought permission to start a PhD program in Artificial Intelligence , as faculty was available to supervise. The members agreed in principle to start a PhD program. Dr Krishna Murthy suggested that the PhD program can be offered under Computer Science and Engineering with specialization in Artificial Intelligence. The members seconded his decision.

The following resolution was passed

1. The PhD programme can be offered under Computer Science and Engineering with specialization in Artificial Intelligence.

4. Any other matter

Dr Krishna Murthy, Mr Bala Prasad and other members expressed that in the next cycle of Board of Studies, Math courses should be defined keeping in mind the AI / ML orientation. They suggested that the following courses be offered with respective labs:

1. Linear Algebra and its applications in Artificial Intelligence
2. Optimization and its applications in Artificial Intelligence
3. Mathematical Foundations of Artificial Intelligence

The chairperson welcomed the suggestion. She mentioned thatfor the sake of uniformity in the courses offered in the first year, across all branches of Engineering, it could not be implemented last year. However, in the next cycle, this will be incorporated in the scheme and syllabus

The members authorized the Chairperson to give the panel of examiners and evaluators. The meeting ended with the chairperson proposing a vote of thanks to all the esteemed Board of Studies members

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Structure & Syllabus
for
BTech (AI) II Year
and
BTech (AI&ML) II Year

BTech (AI) & BTech (AI&ML) II YEAR I SEM (6T +2L)+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	ESC	Computer Systems I	3	0	0	3
2	PCC	Data Structures	3	0	0	3
3	PCC	Python Programming	2	0	0	2
4	BSC	Discrete Mathematics	3	0	0	3
5	BSC	Probability and Statistics	3	0	0	3
6	PCC	Java Programming	2	1	0	3
7	PCC-Lab	Python Programming Lab	0	0	3	1.5
8	PCC-Lab	Data Structures & Java Lab	0	0	3	1.5
9	MC	Environmental Studies	2	0	0	0
Total						20

BTech (AI) & BTech (AI&ML) II YEAR II SEM (5T+3L)+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Data Wrangling and Visualization	2	1	0	3
2	PCC	Design and Analysis of Algorithms	3	1	0	4
3	PCC	Fundamentals of Artificial Intelligence	2	1	0	3
4	PCC	Fundamentals of Software Engineering	3	0	0	3
5	PCC	Database Management Systems	3	0	0	3
6	HSS&MC	Soft Skills for Success Lab	0	0	2	1
7 7	PCC-Lab	Data Wrangling and Visualization Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

B.Tech (AI) & BTech (AI&ML) II Year - I Sem	L	T / P / D	C
	3	0	3

COMPUTER SYSTEMS I

Prerequisites: None

Course Objectives:

1. Learn various number systems.
2. Apply Boolean Algebraic principles.
3. Design various combinational and sequential circuits.
4. Describe the basic organization of computer.
5. Analyze various issues related to memory hierarchy

Course Outcomes:

After completion of the course student will be able to:

1. Understand various number systems, floating point representations, complements, error detecting and correcting codes.
2. Apply Boolean algebraic principles and k-maps for simplification of boolean functions.
3. Design combinational circuits – multiplexer, adder and sequential circuits using flip-flops.
4. Describe the basic organization of computer.
5. Learn the memory hierarchy.

UNIT-I

Signals and Number Systems: Analog Signals, Digital Signals, Number Systems (Converting Binary to Decimal, Decimal to Binary; Decimal Fraction to Binary, Hex to Binary), Binary additions, Complement and Two's Complement, Unsigned and Signed magnitude, Signed Two's complement Binary Number, Binary Addition using Two's Complement, Floating Point Representation, Binary-Coded Decimal (BCD), Coding Schemes(ASCII and Universal Code), Parity Bit, Clock, Transmission Modes (Asynchronous and Synchronous), Transmission Methods (Serial and Parallel).

UNIT-II

Boolean Logics and Logic Gates: Boolean Logics and Logic Gates, Integrated Circuit Classification, Boolean Algebra Theorems, Boolean functions.
Minterms, Maxterms, Karnaugh Map and Universal Gates: Minterms, Maxterms, Karnaugh Map (Three and Four Variable K- Map), Sum of Products and Product of Sums, Don't Care Conditions, Universal Gates.

UNIT-III

Combinational Logic: Analysis of Combinational Logics, Design of Combinational Logics, Decoder, Encoder, Multiplexer, Half and Full Adder, Binary Adder and Subtractor, Arithmetic Logic Unit.

UNIT-IV

Sequential Logic: S-R Latch, D Flip-Flop, J-K Flip-Flop, T Flip-Flop, Register, Frequency Divider Using J-K Flip-Flop, Analysis of Sequential Logics, State Diagrams, Flip-Flop Excitation Table, Counter.

UNIT-V

Introduction to Computer Architecture: Introduction, Components of a Microcomputer, CPU Technology, CPU Architecture, Intel Microprocessor Family, Multicore Processors, CPU Instruction Execution, Disk Controller, Microcomputer Bus, FireWire.
Memory: Semiconductor Memory, Hard Disk, Solid-State Drive (SSD), Memory Hierarchy.

Text Book:

1. Ata Elahi, Computer Systems Digital Design, Fundamentals of Computer Architecture and Assembly Language, Springer International Publishing, 2018

Reference Books:

1. Irv Englander, The Architecture of Computer Hardware, Systems Software, & Networking An Information Technology Approach, 5th Edition, Wiley 2014
2. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2012
3. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI, 2016
4. M. Morris Mano, Computer System Architecture, Revised Third Edition, Pearson/PHI, 2017.
5. Carl Hamacher, ZvonksVranesic, SafeaZaky, Computer Organization,5th Edition, McGraw Hill,2011.

B.Tech (AI) & BTech (AI&ML) II Year - I Sem	**L**	**T / P / D**	**C**
	3	**0**	**3**

DATA STRUCTURES

Prerequisite: Any programming language

Course Objectives:

1. Understand various static and dynamic representationsof data structures.
2. Understandfundamentalalgorithmicproblemsofvariousnonlineardatastructures.
3. To be familiar with Graph representations and traversals.
4. Know the basic concepts of Hashing.

Course Outcomes: After completion of the course student will be able to:

1. Analyze the representation of various static, dynamic and hierarchicaldatastructures
2. Design and implement the mechanism of stacks, general tree data structures with their applications.
3. Implement various algorithms on graph data structures, including finding the minimum spanning tree,shortest path with real time applications
4. Implementation of various advanced concepts of binary trees and graphs with realtime applications.
5. Outline the concepts of hashing, collision and its resolution methods using hash functions

UNIT-I

Introduction: What is data stricture, Types of data structures, Static and Dynamic representation of data structure and comparison.Stacks: Stacks definition, operations on stacks, Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack.

UNIT-II

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees and In order Threading. RepresentationofTreesusingArraysandLinkedlists(advantagesanddisadvantages).Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals.Heaps: Introduction, types of Heaps — Min binary heap, Max binary heap.

UNIT-III

Advanced concepts on trees: Representation and Creation of Binary Search Trees (BST), Algorithm for Inserting, deleting and searching in BST Representation and advantages of AVL Trees, algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees, B + Trees, Red-Black Trees, M-way trees with examples.

UNIT-IV

Graphs-Basic terminology, Representation of graphs: sequential representation (Adjacency, Path Matrix) Linked representation. Graph Traversals: Breadth First Search, Depth First Search with algorithms. Definition and properties of Spanning Tree, Minimum Spanning Tree, Dijkstra Algorithm.

UNIT-V

Hashing: General Idea, Hash Functions, Separate Chaining Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extensible Hashing, Collisions in Hashing, Implementation of Dictionaries

Text Books:

1. Seymour Lipschutz, Schaum'sOutlines Data Structures, Special Second Edition,Tata McGraw-Hill,.
2. Richard F.Gillberg&Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, Second Edition, Cengage Learning, India Edition,**2005.**

Reference Books:

1. Aaron M. Tenenbaum,YedidyahLangsam and Moshe J. Augenstein, Data Structures Using C and C++, PHILearning Private Limited, DelhiIndia.
2. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd DelhiIndia.
3. A.K. Sharma, Data Structure Using C, PearsonEducation India.

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L	T / P / D	C
2	0	2

PYTHONPROGRAMMING

Prerequisite: Any programming language

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Know the classes and objects in Python Programming Language.
4. Use the reusability concepts in Python Programming Language.
5. Use Exception Handling mechanism in Python Programming Language.

Course Outcomes: After completion of the course student will be able to:

1. Identify the differences between scripts and programs
2. Solve the problems based on decision control statements
3. Develop programs on functions and data strictures.
4. Write the programs on string operations
5. Use of python exceptions and packages

UNIT- I

Introduction to Python:Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O OperationsFunctions and Modules:Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings, Built-in Functions

UNIT-II

Strings and Regular Expressions: String Operations, Built-in String Methods and Functions, Comparing Strings, function inRegularExpression.Sequence:List, Tuples, Dictionaries.

UNIT- III

Implementation of classes and objects in Python:Classes and Objects, Class Method and Self Argument. The Init Method, Class Variables andObjectVariables,The_DelMethod,Publicand PrivateData Members,PrivateMethods,Built-inFunctionstoCheck,Get,SetandDeleteClassAttributes,GarbageCollection(DestroyingObjects).

UNIT- IV

Implementation of Inheritance in Python:Inheriting Classes in Python, Types of Inheritance, Composition/Containership, Abstract ClassesandInterfaces,Metaclass,Implementation of Operator Overloading in Python:Introduction, Implementing Operator Overloading, Overriding Methods

UNIT-V

Exception Handling in Python:Introduction, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.Python Packages:Introduction to Numpy, Pandas, Matplotlib, Tkinter

Text Books:

1. ReemaThareja, Python Programming using Problem Solving Approach, First Edition, Oxford Higher Eduction.
2. James Payne, Beginning Python using Python 2.6 and Python 3

Reference Books:

1. Kenneth A.Lambert, Fundamentals of Python
2. Charles Dierach, Introduction to Computer Science using Python

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	L	T / P / D	C
	3	**0**	**3**

DISCRETE MATHEMATICS

Prerequisites: Mathematics I and II

Course Objectives:

1. 1.Interpret the Sets, syntax and semantics of propositional and predicate logic.
2. 2. Solve applications involving Permutations and Combinations.
3. 3. Formulate Recurrence relations to solve problems involving an unknown sequence.
4. 4. Explain the concepts of Relations and Graphs.
5. 5. Illustrate the Algebraic Systems.

Course Outcomes: After completion of the course student will be able to:

1. Analyze Statement Logic and Predicate Logic.
2. Apply the principles of Permutations and Combinations with repetition & without repetitions
3. Solve Recurrence Relations by using generating functions
4. Apply the knowledge of Relations and Graph Theory in the field of Computer Science.
5. Analyze the Algebraic Systems with their properties

UNIT-I

Foundations: Basics, Sets and Operations of Sets, Fundamentals of Logic, Logical Inferences, First order logic and other methods of Proof, Rules of Inference for Quantified Propositions. (Problems Only and Theorems without Proofs)

UNIT-II

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumerating Combinations and Permutations with & without repetitions, constrained repetitions, and Principle of Inclusion and Exclusion. (Problems Only and Theorems without Proofs)

UNIT-III

Recurrence Relations: Generating Functions, Calculating coefficient of Generating Function, Solving Recurrence relations by substitution method and Generating Functions, The Method of Characteristic Roots, Solutions to inhomogeneous recurrence relations. (Problems Only and Theorems without Proofs)

UNIT IV

Relations and Digraphs: Relations and Directed Graphs, Special Properties of Binary Relations, Equivalence Relations, Ordering Relations, Lattices, Operations on Relations, Paths and Closures, Directed Graphs and adjacency matrices. (Problems Only and Theorems without Proofs) ;Graphs: Basic Concepts, Isomorphism's and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs. (Problems Only and Theorems without Proofs)

UNIT V

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. (Problems Only and Theorems without Proofs)

Text Books:

1. Joe L. Mott, Abraham Kandel, Theodare P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition, PHI, 2019.

2. J. P.Tremblay and P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2007

Reference Books:

1. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill.

2. S. K. Chakraborthy and B.K. Sarkar," Discrete Mathematics ", Oxford, 2011.

3. C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.

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	L	T / P / D	C
	3	**0**	**3**

PROBABILITY & STATISTICS

Prerequisites: None

Course Objectives:

1. Understand Chance causes and random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
2. In the discrete case study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide every good insight and are essential for industrial applications.
3. To perform polynomial Curve Fitting, General Curve fitting and Interpolation, various types of Skewness and kurtosis, Correlations.
4. The types of sampling, Sampling distribution of means, Sampling distribution of variance,Estimationsofstatisticalparameters,Testingofhypothesisoffewunknown statistical parameters.
5. Understanding the Experiments.

Course Outcomes: After completion of the course student will be able to:

1. Identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables involved in the probability models. It is quite useful for all branches of engineering.
2. Calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations. It is mainly useful for non-circuit branches of engineering.
3. To interpolate using curve fitting and identify the Correlation between variables.
4. To estimate an unknown population parameter.
5. Design their experiment with the basic norms and test their design efficiency. It is useful to all the branches of engineering.

UNIT-I

Introduction to Probability: Addition theorem, Multiplication theorem (Two events only), Baye's theorem. Random variables, Discrete and continuous random variable, Definitions of Probability Distribution function, Probability mass function, Probability density function and properties. Definitions of Mathematical expectation, Variance of discrete and continuous random variable. Bivariate distributions and their properties, marginal and conditional distribution

UNIT-II

Discrete Distributions: Bernoulli, Binomial, Poisson distributions (definition and problems) their mean, variance and moment generating function.Continuous Distribution: Normal, exponential distributions (definition and problems) related properties.

UNIT-III

Measures of Central tendency: Moments, Skewness and Kurtosis. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Correlation and regression — Rank correlation

UNIT-IV

Estimation: Concept of Point estimation and its properties (definition only), Concept of interval estimation with examples. Test of Hypothesis: Null & Alternative Hypothesis, Critical region, Type I and Type II errors, level of significance, one tail, two-tail tests. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means.

UNIT-V

Small Sample tests: t-Test for single mean, difference of means, paired I-test, F- test. Chi-square test for goodness of fit and independence of attributes. ANOVA: Introduction, ANOVA for one way classification only.

TextBooks:

1. Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press.
2. Probability and Statistics for Engineers by Richard A Johnson, Pearson Education.

Reference Books:

1. Introduction to Probability by Charles M Grinstead, J Laurie Snell, American Mathematical Society.
2. Miller and John E. Freund, Probability & Statistics for Engineers, Prentice Hall of India. Montgomery: Design and Analysis of Experiments, Wiley

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	2	0	3

JAVA PROGRAMMING

Prerequisite: Any programming language

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUIapplications.

Course outcomes: After completion of the course student will be able to:

1. Explain the Object Oriented Programming concepts
2. Design programs using package and interfaces.
3. Apply the concepts of Exceptions and multithreading.
4. Develop GUI applications and AWT using Frames.
5. Design the programs using Applet and JDBCConcepts.

UNIT-I

Java Basics: History of Java, Java buzzwords , data types, variables, scope and life time of variables , arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword,garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

UNIT-II

Inheritance - Introduction, forms of inheritance- specialization, specification, construction, extension, limitation,combination, Member access rules super uses, using final with inheritance. Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, CharacterStreams

UNIT-III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.Multi-Threading:Differences between multi-threadingand multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT-IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. AWT: class hierarchy, component, container, panel, window, frame, canvas, graphics, Layout Manager - layout manager types - boarder, grid, flow, card and gribbag.

UNIT-V

AWT controls: Labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels - dialogs, menu bar.Applets - Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.JDBC Connectivity:JDBC Type **1** to 4 Drivers, connection establishment, QueryExecution

TextBooks:

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGrawHill
2. Database Programming with JDBC & JAVA, Second Edition,GeorgeReese,O'ReillyMedia

Reference Books:

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, BruceEckel
3. Introduction to Java programming, Y. Daniel Liang, PearsonEducation

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	0	3	1.5

PYTHON PROGRAMMING LAB

Prerequisite: Any programming language

Course Objectives:

1. Understand the string operation and sequences used in Python Programming Languages.
2. Know the classes and objects in Python Programming Language.
3. Use the reusability concepts in Python Programming Language.
4. Use Exception Handling mechanism in Python Programming Language.

CourseOutcomes: After completion of the course student will be able to:

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write the programs on strings and functions
4. Implement programs on class and related issues.
5. Use of python exception handling and packages.

Week-1:

Installation and Environment set up of Python & Programs on Data types

Week-2:

Programs on Standard I/O, Operators and Expressions

Week-3:

Programs on Functions

Week-4

Programs on different argument types

Week-5:

Programs on lists and Tuples

Week-6:

Programs on Dictionaries

Week-7:

Programs on Strings and string operations

Week-8:

Programs on Regular Expressions.

Week-9:

Programs on class & object, static and instance method implementation

Week-10:

Programs on Inheritance and Polymorphism

Week-11:

Programs on Abstract classes and interfaces

Week-12:

Programs on Exception Handling

Weekl3:

Demonstration of Numpy package

Demonstration of Pandas package

Week-14:

Demonstration of matplotlib package

Week-15:

Demonstration of Tkinter package

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	L	T / P / D	C
	0	**3**	**1.5**

DATA STRUCTURES & JAVA LAB

Prerequisites: Any programming language and a parallel course on data structures.

Course Outcomes: After completion of the course student will be able to:

1. Develop the programs on stacks and its applications.
2. Demonstrate the operations on trees.
3. Demonstrate the implementation of various advanced trees.
4. Design and implementation of programs on BST and Graph Traversals.
5. Explain Java Environment and use of Java Development Kit for the creation and execution of Javaprograms
6. Develop programs on various concepts like data abstraction & data hiding, encapsulation, inheritance,polymorphism.
7. Develop the programs using interfaces andpackages
8. Create and use threads and handle exceptions

Part-A

1. Program to illustrate string built in functions
2. Program to evaluate postfix notations
3. Program to convert infix to postfix notation
4. Program to illustrate tree traversals
   a) In order b) Preorder c) Post order
5. Program to illustrate insertion, deletion and searching in Binary Search Tree.
6. Program to illustrate Graph traversals
   a) Breadth First Search
   b) Depth First Search
7. Program to illustrate Insertion, deletion and Rotation on AVL Trees.

Part-B

1. a) Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object
   b) Write a program to find total, average of given two numbers by using static keyword and thiskeyword?
   c) Write a program to illustrate types of constructors and constructoroverloading

2. a) Write ajava program to illustrate Methodoverloading

   b) Write a Java program to practice using String class and itsmethods.

   c) Write a program to illustrate parameter passing Techniques.

3. a) Write a program to illustrate types ofinheritance.

   b) Write a program to illustrate the use of creation ofpackages.

   c) Write ajava program to illustrate MethodOverriding

4. a) Write a program to illustrateInterfaces

   b) Write aprogram to illustrateFiles

5. a)Write a program to illustrate try, catch, throw, throws and finallykeywords

   b) Write a program to implement the concept of UserdefinedExceptions.

6. a) Write a program to illustrateStringTokenizer,Date, Random and Scannerclasses?
   b) Write a program to illustrate collection classes andinterfaces
   c) Write a program to illustrateMultithreading

7. a) Write a program toillustrate passing parameters toapplet
   b) Write a program toillustrate EventHandling(keyboard,Mouseevents)

8. a) Write a program to illustrate AWTcontrols.

   b) Write a program to develop a calculator application usingAWT

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	2	0	0

ENVIRONMENTAL STUDIES

Prerequisite: Engineering Chemistry

Course Objectives:

1. To introduce the knowledge about Environment.
2. To introduce students to the concepts of pollution, Biodiversity
3. To develop an awareness about global Environmental problems.
4. To learn to protect environment and awareness on legal issues
5. To learn about importance of sustainable development and role of IT in environment.

Course Outcomes: After completion of the course student will be able to:

1. Understand fundamental physical and biological principles that govern natural processes.
2. Understand fundamental concepts from the social sciences and humanities underlying environmental thought and governance.
3. Integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
4. Communicate integrated perspectives on complex environmental problems in the form of written and oral argument to both professional and lay audiences.
5. Design and conduct independent research that contributes to environmental thought and/or problem solving.

UNIT-I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance— Need for Public Awareness.Ecosystems: Concept of an ecosystem — Classification, structure and function of different ecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids.Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-II

Natural Resources: Renewable and non-renewable — Natural resources and associated problems: Forest resources — Use and over — exploitation, deforestation,— Timber extraction, mining, dams and other effects on forest and tribal people: Water resources — Use and over utilization of surface and ground water — Floods, drought, conflicts over water, dams — benefits and problems — Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources: Equitable use of resources for sustainable lifestyles.

UNIT-III

Environmental Pollution: Definition, Cause, effects and control measures of different kinds of pollution (Air, Water, Soil, Marine, Noise, Thermal, Nuclear, e —Waste). Carbon Capture & Sequestration — different storage sources, major disadvantages, environmental effectsSocial Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

UNIT-IV

Waste management technology: Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.Waste water and sewage treatment technology: primary, secondary and tertiary treatments. Bioremediation, Phyto-remediation, ZLD (zero liquid discharge), membrane technology.Application of GIS and GPS system in environmental science.Environmental policy, Rules and regulations. EIA (Environmental Impact Assessment) & EMP (ENVIRONMENTAL Management Plan) — Environment Protection Act. - Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act - Wildlife Protection Act —Forest Conservation Act.-Public awareness. Global environmental problems and global efforts.

UNIT- V

Towards sustainable future: concept of sustainable development, threats of sustainability, population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources.Urban sprawl, sustainable cities and sustainable communities, human health. Role of IT in environment, environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha, University Press Private Limited, Reprinted in 2005.

2. Environmental Studies: From Crisis to Cure by R.Rajagopa1an, Oxford University Press, 2“ Edition, 2005

Reference Books:

1. Environmental Science: Towards a Sustainable Future by Richard T.Wright. PHL Learning Private Ltd .New Delhi, 2008
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela.PHI Learning Pvt. Ltd. 4" Edition, 2008

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	2	**1**	**3**

DATA WRANGLING AND VISUALIZATION

Prerequisites: Python Programming

Course Objectives:

1. To introduce the basic concepts of data wrangling using Python
2. To obtain the input data from a variety of sources
3. To extract the data and convert it into representations suitable for data analytics
4. To visualize the data

Course Outcomes: At the end of this course, students will be able to:

1. Use the pandas library
2. Load, store data in different file formats
3. Clean and prepare the data
4. Plot and Visualize data
5. Do data aggregation

UNIT-I

Getting started with pandas: Introduction to pandas Data Structures, Series, Data Frame, Index Objects. Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data

UNIT-II

Data Loading, Storage, and File Formats: XML and HTML: Web Scraping, Binary Data Formats: Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Web APIs, Interacting with Databases

UNIT-III

Data Cleaning and Preparation: Handling Missing Data, Filtering Out Missing Data, Filling In Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, String Manipulation, String Object Methods, Regular Expressions

UNIT-IV

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot,Saving Plots to File, matplotlib Configuration, Plotting with pandas and seaborn, Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data, Other Python Visualization Tools, Conclusion

UNIT-V

Data Aggregation and Group Operations: Group By Mechanics, Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels, Data Aggregation, Column-Wise and Multiple Function Application, Returning Aggregated Data Without Row Indexes, Pivot Tables and Cross-Tabulation

Text Books:

1. Wes McKinney. Python for Data Analysis: Data Wrangling with pandas, NumPy and IPython. O'Reilly, 2017, 2nd Edition
2. Jacqueline Kazil and Katharine Jarmul. Data Wrangling with Python. O'Reilly, 2016

Reference Books:

1. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
2. TyeRattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, and Connor Carreras. Principles of Data Wrangling: Practical Techniques for Data Preparation. O'Reilly, 2017
3. Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language. Fabio Nelli, Apress, 2015

BTech(AI) & BTech(AI&ML) II Year - II Sem	L	T / P / D	C
	3	**1**	**4**

DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisite: Data Structures

Course Objectives:

1. Course Objectives of Design and Analysis of Algorithms are to:
2. **Analyze the asymptotic performance of algorithms.**
3. **Apply the Paradigms and approaches to appreciate the impact of algorithm design in practice.**
4. **Synthesize efficient algorithms in common engineering design situations.**
5. **Analyze complex engineering problems using back tracking.**
6. **Utilize data structures and algorithmic design techniques in solving new problems.**

Course Outcomes: After completion of the course student will be able to:

1. At the end of this Design and Analysis of Algorithms course, students will be able to:
2. Acquire the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm.
3. Design the major graph algorithms for model engineering problems and knowledge of the greedy paradigm
4. Apply the dynamic-programming paradigm and recite algorithms that employ this paradigm.
5. Illustrate the concept of back tracking, branch and bound paradigm for real time problems.
6. Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples.

UNIT-I

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Disjoint Sets- disjoint set operations, union and find operations. .[TB-1,CH-1] [TB-2,CH-3]**Divide and conquer:** General method, applications-Binary search, Quick sort, Merge sort. .[TB-1,CH-3]

UNIT-II

Graphs: breadth first search, depth first search, spanning trees, connected and bi connected components. [TB-1,CH-2]. **Greedy method:** General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem. [TB-1,CH-4]

UNIT-III

Dynamic Programming: General method, Multi stage graph, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem. .[TB-1,CH-5]

UNIT- IV

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. .[TB-1,CH-7]. **Branch and Bound:** General method, applications - Travelling sales person problem, 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution. [TB-1, CH-8]

UNIT-V

Lower Bound Theory: Comparison trees,NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Clique Decision Problem (CDP), Node cover decision problem. .[TB-1,CH-10,11]

Text Books:

1. Ellis Horowitz, SatrajSahni and Rajasekharam, Fundamentals of Computer Algorithms,Galgotia publications pvt. Ltd, Second Edition, 2007.
2. Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivert and Clifford Stein, Introduction to Algorithms, Third Edition ,PHI Learning Private Limited , Eastern Economy Edition, 2008.

Reference Books:

1. Aho, Ullman and Hopcroft,Design and Analysis of algorithms, Pearson education, Reprint 2002
2. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai,Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill,2005.
3. Allen Weiss,Data structures and Algorithm Analysis in C++,Third edition, Pearson education.

BTech(AI) & BTech(AI&ML) II Year - II Sem

	L	T / P / D	C
	3	0	3

FUNDAMENTALS OFARTIFICIAL INTELLIGENCE

Prerequisites: Data Structures and Discrete Mathematics OR Programming and Problem Solving I & II and Probability and Statistics

Course Objectives:

1. The main objective of this course is to introduce the basic concepts of artificial intelligence, its foundations
2. To analyze various search strategies in intelligent systems
3. To apply search algorithms in games
4. To learn various representations of logic and knowledge
5. To understand production systems and its components

Course Outcomes: At the end of this course, students will be able to:

1. Understand Strong AI and Weak AI and identify problems applicable to AI
2. Compare and contrast various uninformed and informed search algorithms to find an optimal solution for a given problem
3. Apply appropriate search algorithms for winning games
4. Learn various representations applicable to logic and knowledge useful in reasoning
5. Learn to apply appropriate inference methods in production or expert systems

UNIT-I

Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versusWeak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, EarlyHistoryofAI, Recent HistoryofAIto thePresent, AIIn the New Millennium

UNIT-II

Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs, Generate-and-Test Paradigm, Blind Search Algorithms, Implementing and Comparing BlindSearch Algorithms. Informed Search**:** Introduction, Heuristics, Informed Search Algorithms–Finding Any Solution, The Best-First Search, The Beam Search, Additional Metrics for SearchAlgorithms, Informed Search–FindingAn OptimalSolution

UNIT-III

Search Using Games: Introduction, Game Trees and Minimax Evaluation, MinimaxWith Alpha-Beta Pruning, Variations and Improvements To Minimax, Games of Chance and theExpectiminimaxAlgorithm

UNIT-IV

LogicinArtificialIntelligence: Introduction, Logic and Representation, Propositional Logic, Predicate Logic – Introduction, Several Other Logics, Uncertainty and Probability. Knowledge Representation: Introduction, Graphical Sketches and the Human Window, Graphs and the Bridges of Königsberg Problem, Search Trees, Representational Choices,ProductionSystems,Object Orientation, Frames,SemanticNetworks

UNIT-V

Production Systems: Introduction, Background, Production Systems and InferenceMethods, Production Systems and Cellular Automata, Stochastic Processes and Markov Chains,BasicFeatures and Examples of Expert Systems

Text Book:

1. StephenLucci,DannyKopec.ArtificialIntelligenceinthe21stCentury.ALivingIntroduction. MercuryLearningandInformation.2ndEdition.2016

Reference Books:

1. Russell, Norvig: ArtificialIntelligence, AModernApproach,PearsonEducation, Second Edition. 2004
2. Rich,Knight,Nair:ArtificialIntelligence,TataMcGrawHill,ThirdEdition2009
3. SarojKaushik.ArtificialIntelligence.CengageLearning.2011

BTech(AI) & BTech(AI&ML) II Year - II Sem	L	T / P / D	C
	3	0	3

FUNDAMENTALS OF SOFTWARE ENGINEERING

Prerequisite: Any programming language

Course Objectives:

1. The main objective of this course is to introduce the basics of software engineering and types of software development projects in software industry
2. To learn various Software Life Cycle Models
3. To understand the Software Project Management Processes
4. To learn about the steps or phases of Software Development Process and related artifacts
5. To get exposure to Agile Software Development practices and DevOps

Course Outcomes: At the end of this course, students will be able to:

1. Understand the emergence of software engineering and types of software development projects
2. Assess merits and demerits of software life cycle models and selecting appropriate model for a project
3. Learn the software project management practices and techniques essential for successful completion of a project
4. Learn the steps or phases involved in software development processes and its related artifacts
5. Learn about Agile Software Development practices and DevOps

UNIT- I

Introduction: Evolution from an Art Form to an Engineering Discipline, Software Development ProjectsEmergence of Software Engineering: Notable Changes in Software Development Practices, Computer Systems Engineering

UNIT-II

Software Life Cycle Models: A Few Basic Concepts, Waterfall Model and its Extensions – (Iterative, V Model, Prototyping, Incremental, Evolutionary Model), Rapid Application Development (RAD), Spiral Mode, Comparison of Different Life Cycle Models and Selecting an Appropriate Life cycle Model for a Project

UNIT-III

Software Project Management: Software Project Management Complexities. Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation; Project Estimation Techniques: Introduction to COCOMO—A Heuristic Estimation Technique. Introduction to Halstead's Software Science—An Analytical Technique; Scheduling - Critical Path Method (CPM).PERT Charts. Gantt Charts; Risk Management, Software Configuration Management

Unit – IV

Phases of Software Development Processes, Requirements Analysis and Specification phase– Software Requirements Specification (SRS) Document, Functional requirements and Non Functional Requirements, Software Design phase – Cohesion and Coupling, Function Oriented Design (Data Flow Diagrams) and Object Oriented Design (Object Modelling using UML), Coding phase - Coding Standards and Guidelines. Code Review, .Software Documentation, Debugging, Testing Phase - Design Test Cases, Black-box Testing, White-Box Testing, Integration Testing, Smoke Testing, and Deployment Phase – Deployment Diagram, and Software Maintenance

Unit –V

Roles and Responsibilities – Business owner, Product Manager, Designers, Backend, Frontend, Quality Assurance, DevOps. Agile Development Methodologies- The agile philosophy, agile process models, agile project management, SCRUM, SPRINT

Text Books:

1. Rajib Mall (2014), Fundamentals of Software Engineering, PHI Learning
2. Olga Filipova, RuiVilao (2018) Software Development from A to Z_ A Deep Dive Into All the Roles Involved in the Creation of Software

Reference Books:

1. Pressman, R. S., (2009), Software Engineering: A Practitioner's Approach, Tata McGrawHill
2. Jalote, P., (2005), An Integrated Approach to Software Engineering, Narosa Publishing House
3. McConnell, S., (2014), Code Complete: A Practical Handbook of Software Construction (2nd Ed.), Microsoft Press
4. Ahmed, A., (2011), Software Project Management: A Process-Driven Approach, Auerbach Publications 6. Beck, K., (2002), Test Driven Development: By Example, Addison-Wesley Professional
5. Williams, L. & Kessler, R., (2002), Pair Programming Illuminated, Addison-Wesley Professional

BTech(AI) & BTech(AI&ML) II Year - II Sem	L	T / P / D	C
	3	0	3

DATABASE MANGEMENT SYSTEMS

Prerequisite: Discrete Mathematics

Course Objectives:

1. To provide a sound introduction to Database management systems, databases and its applications and familiarize the student to give a good formal foundation on the relational model of data
2. To Introduce SQL for storing and retrieving databases
3. To give an introduction to systematic database design approaches
4. To introduce the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. To Explore the File organizations, indexing and hashing mechanisms.

Course Outcomes: After completion of the course student will be able to:

1. Model Entity-Relationship diagrams for enterprise level databases
2. Formulate Queries using SQL and Relational Formal Query Languages
3. Apply Various Normal forms for schema refinement
4. Differentiate various concurrency control protocols and recovery algorithms
5. Use of suitable File organization, Indices and Hashing mechanisms for effective storage and retrieval of Data

UNIT-I

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT-II

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus.

UNIT-III

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+,}$ Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition AlgorithmTransactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

UNIT-IV

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

UNIT-V

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Text Book:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books:

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eighth Edition Pearson 2006
3. P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems,Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

BTech(AI) & BTech(AI&ML) II Year - II Sem

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	0	**2**	**1**

SOFT SKILLS FOR SUCCESS LAB

Prerequisites: None

Introduction:

The primary focus of the course is to highlight various categories and applications of Soft Skills through various cases taken from the real field and other research case studies. The fundamental concepts and distinctions between Soft Skills and Hard Skills are discussed. The course is tailored very effectively to introduce various Soft Skill application examples.

Objectives:

To identify and participate in meaningful conversations

Course Outcomes: After completion of the course student will be able to:

1. Exhibit communication skills in various situations
2. Handle the emotions with peers and classmates
3. Demonstrate respect for the opinions, personal space, and beliefs of others
4. Connect and work with others to achieve a set task
5. Assess and identify the requirements and strengths within the team

UNIT-I

Soft Skills Development: An Introductory Overview - Self-Discovery & Goal Setting - Johari Window

UNIT-II

Personality Development - Body Language - Etiquette & Manners

UNIT-III

Presentation Skills (Individual & Team) Oral & Written - Teamwork & Leadership Qualities

UNIT-IV

Debates - Group Dynamics - Dos & Don’ts - Techniques to Participate and Conclude

UNIT-V

Emotional Intelligence - Conflict Management - Stress Management

Minimum requirements of infrastructural facilities for “Soft Skills for Success”

Laboratory:

A spacious room with movable chairs, a Public Address System, and a Digital Stereo-Audio & Video system

Reference Books:

1. Soft Skills for Everyone by Butterfield, Jeff. New Delhi: Cengage Learning. 2010.
2. Soft Skills by Chauhan, G.S. &Sangeeta Sharma. New Delhi: Wiley. 2016.
3. Working with Emotional Intelligence by Goleman, Daniel. London: Banton Books. 1998.
4. Theories of Personality by Hall, Calvin S. et al. New Delhi: Wiley. 2011.
5. Corporate Conversations by Holtz, Shel. New Delhi: PHI. 2007.

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DATA WRANGLING AND VISUALIZATION LAB

Prerequisite: Data Wrangling and Visualization

Objective:

The main objective of this laboratory is to put into practice the ETL (extract, transform, load) pipeline which will extract raw data, clean the data, perform transformations on data, load data and visualize the data. Case Studies may be provided from industry to understand the real world scenarios.

Datasets

For this laboratory, appropriate publicly available datasets, can be studied and used.
Example:
MNIST (http://yann.lecun.com/exdb/mnist/),
UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets.html),
Kaggle (https://www.kaggle.com/datasets)
Twitter Data

Exercises

1. Write programs to use the pandas data structures: Frames and series as storage containers and for a variety of data-wrangling operations
2. Write programs to parse text files, CSV, HTML, XML and JSON documents and extract relevant data. After retrieving data check any anomalies in the data, missing values etc.
3. Write programs for reading and writing binary files
4. Write programs for searching, splitting, and replacing strings based on pattern matching using regular expressions
5. Design a relational database for a small application and populate the database. Using SQL do the CRUD (create, read, update and delete) operations.
6. Create a Python MongoDB client using the Python module pymongo. Using a collection object practice functions for inserting, searching, removing, updating, replacing, and aggregating documents, as well as for creating indexes
7. Use matplotlib and draw plots using the datasets
8. Write programs to Split a pandas object into pieces using one or more keys (in the form of functions, arrays, or DataFrame column names), calculate group summary statistics, like count, mean, or standard deviation, or a user-defined function, Compute pivot tables and cross-tabulations

BTech(AI) & BTech(AI&ML) II Year - II Sem	L	T / P / D	C
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DATABASE MANGEMENT SYSTEMS LAB

Prerequisites: Database Management Systems

Course Objectives:

1. To provide a sound understanding of DDL,DML,DCL and TCL
2. To write the queries for the schemas
3. To introduce PL/SQL Programming

Course Outcomes: After completion of the course student will be able to:

1. Use the SQL commands such as DDL, DML, DCL, TCL to create, manipulate, access data from database objects and providing authorization to access database by different users (L3)
2. Apply various integrity Constraints on the database tables for preserving the integrity of the database(L3)
3. Develop PL/SQL programs which include procedures, functions, cursor and triggers (L3)

Week 1:

Database user creation**,** Data definition Language commands, Data Manipulation commands, Data Control Language Commands , Transaction Control Language commands

Week 2:

1.Database Schema for a customer-sale scenario

Customer(<u>Cust id : integer</u>, cust_name: string)

Item(<u>item_id: integer</u>,item_name: string, price: integer)

Sale(bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints

b) Insert around 10 records in each of the tables

c) List all the bills for the current date with the customer names and item numbers

d) List the total Bill details with the quantity sold, price of the item and the final amount

e) List the details of the customer who have bought a product which has a price>200

f) Give a count of how many products have been bought by each customer

g) Give a list of products bought by a customer having cust_id as 5

h) List the item details which are sold as of today

i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

J) Create a view which lists the daily sales date wise for the last one week

Week 3:

2 Database Schema for a Student Library scenario

Student(Stud_no : integer,Stud_name: string)

Membership(Mem_no: integer,Stud_no: integer)

Book(book_no: integer, book_name:string, author: string)

Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints

b) Insert around 10 records in each of the tables

c) List all the student names with their membership numbers

d) List all the issues for the current date with student and Book names

e) List the details of students who borrowed book whose author is CJDATE

f) Give a count of how many books have been bought by each student

g) Give a list of books taken by student with stud_no as 5

h) List the book details which are issued as of today

i) Create a view which lists out the iss_no, iss _date, stud_name, book name

j) Create a view which lists the daily issues-date wise for the last one week

Week 4:

3 Database Schema for a Employee-pay scenario

employee(emp_id : integer,emp_name: string)

department(dept_id: integer,dept_name:string)

paydetails(emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)

payroll(emp_id : integer, pay_date: date)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints

b) Insert around 10 records in each of the tables

c) List the employee details department wise

d) List all the employee names who joined after particular date

e) List the details of employees whose basic salary is between 10,000 and 20,000

f) Give a count of how many employees are working in each department

g) Give a names of the employees whose netsalary>10,000

h) List the details for an employee_id=5

i) Create a view which lists out the emp_name, department, basic, deductions, netsalary

j) Create a view which lists the emp_name and his netsalary

Week 5:

4 Database Schema for a Video Library scenario

Customer(cust_no: integer,cust_name: string)

Membership(Mem_no: integer, cust_no: integer)

Cassette(cass_no:integer, cass_name:string, Language: String)

Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints

b) Insert around 10 records in each of the tables

c) List all the customer names with their membership numbers

d) List all the issues for the current date with the customer names and cassette names

e) List the details of the customer who has borrowed the cassette whose title is " The Legend"

f) Give a count of how many cassettes have been borrowed by each customer

g) Give a list of book which has been taken by the student with mem_no as 5

h) List the cassettes issues for today

i) Create a view which lists outs the iss_no, iss_date, cust_name, cass_name

j) Create a view which lists issues-date wise for the last one week

Week 6:

Database Schema for a student-Lab scenario

Student(stud_no: integer, stud_name: string, class: string)

Class(classno: string,descrip: string)

Lab(mach_no: integer, Lab_no: integer, description: String)

Allotment(Stud_no: Integer, mach_no: integer, dayof week: string)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints

b) Insert around 10 records in each of the tables

c) List all the machine allotments with the student names, lab and machine numbers

d) List the total number of lab allotments day wise

e) Give a count of how many machines have been allocated to the ‘CSIT’ class

f) Give a machine allotment details of the stud_no 5 with his personal and class details

g) Count for how many machines have been allocatedinLab_no1 for the day of the week as “Monday”

h) How many students class wise have allocated machines in the labs

i) Create a view which lists out the stud_no, stud_name, mach_no, lab_no, dayofweek

j) Create a view which lists the machine allotment details for “Thursday”.

Week 7:

Write a program to find largest number from the given three numbers.

Simple programs using loop, while and for iterative control statement.

Write a program to check whether the given number is Armstrong or not

Write a program to generate all prime numbers below 100.

Week 8:

Write a program to demonstrate the GOTO statement.

Write a program to demonstrate %type and %rowtype attributes

Week 9:

Write a program to demonstrate predefined exceptions

Write a program to demonstrate user defined exceptions

Create a cursor, which displays all employee numbers and names from the EMP table.

Week 10:

Create a cursor, which update the salaries of all employees who works in deptno 10.

Create a cursor, which displays names of employees having salary > 50000.

Week 11:

Create a procedure to find reverse of a given number

Create a procedure to update the salaries of all employees whose salary is between

25000 to 50000

Week 12:

Create a procedure to demonstrate IN, OUT and INOUT parameters

Create a function to check whether given string is palindrome or not.

Week 13:

Create a function to find sum of salaries of all employees working in depart number 10.

Create a trigger before/after update on employee table for each row/statement.

Week 14:

Create a trigger before/after delete on employee table for each row/statement.

Create a trigger before/after insert on employee table for each row/statement.

Week 15:

Overview

Text Book:

1. Ivan Bayross, SQL,PL/SQLThe programming Language of Oracle , Fourth Revised Edition,BPB Publications.

BTech(AI) & BTech(AI&ML) II Year - II Sem	**L**	**T / P / D**	**C**
	2	**0**	**0**

GENDER SENSITIZATION

Prerequisites: None

Course Objectives:

1. To develop students sensibility with regard to issues of gender in contemporaryIndia.
2. To provide a critical perspective on the socialization of men andwomen.
3. To introduce students to information about some key biological aspects ofgenders.
4. To expose the students to debates on the politics and economics ofwork.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men andwomen.

Course Outcomes: After completion of the course student will be able to:

1. Students will have developed a better understandingof important issues related to gender in contemporaryIndia.
2. Student will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature andfilm.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counterit.
4. Students will acquire insight into the gendered division of laborand its relation to politics andeconomics.
5. Men and women students and professionals will be better equipped to work and live together asequals.
6. Students will develop a sense of appreciation of women in all walks oflife.
7. Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to genderviolence.

UNIT-I

UnderstandingGender: Gender: Why Should We Study It? (Towards a World of Equals: Unit-1) Socialization: Making Women Making Men (Towards a World of Equals: Unit-2), Introduction. Preparing for Womanhood .Growing up Male.First lesions in Caste.Different Masculinities .Just Relationships: Being Together as Equals (Towards a World ofEquals: Unit-12)MaryKorn and Onler. Love and Acid just do not Mix. Love Letters. Othersand Fathers. Further Reading: Rosa Parks-The BraveHeart.

UNIT-II

Gender and Biology: Missing Women: Sex Selection and Its Consequences, (Towards a World of Equals: Unit-4) DecliningSex Ratio. Demographic, Consequences. Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit-lO)Two or Many? Struggles with Discrimination.Additional Reading: Our Bodies, Our Health (Towards a Worldof Equals: Unit-13)

UNIT-III

Gender and Labour: Housework: the Invisible Labour(Towards a World of Equals: Unit t-3)"My Mother doesn't Work." "Share the Load. “Women’s Work: Its Politics and Economics (Towards a World of Equals; Unit-7) Fact and Fiction. Unrecognized and Unaccounted work .Further Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (Towards a World of Equals: Unit-6)SexualHarassment not Eve-Teasing- Coping with Everyday Harassment- FurtherReading: "Chupulu" .Domestic Violence: Speaking Out (Towards a World of Equals: Unit-8) Is Home a Safe Place? When Women Unite (Film).Rebuilding Lives. Further Reading: New Forums for Justice. Thinking about Sexual Violence (Towards a World of Equals: Unit-ll)Blaming the Victim-"! Fought for my Life " - Further Reading: The Caste Face of Violence.

UNIT-V

Gender Studies: Knowledge: Through the Lens of Gender (Towards a World ofEquals: Unit-5), Point of View. Gender and the Structure of Knowledge. FurtherReading: Unacknowledged Women Artists of Telangana. Whose History? Questions for Historians and Others (Towards a World of Equals Reclaiming a Past.Writing other Histories. Further Reading: Missing Pages from Modern Telangana History. Essential Reading: All the Units in the Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagarj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

Reference Books:

1. I .Sen, Amartya, "More than One Million Women are Missing." New York Review of Books 37.20 (20 December 1990). Print. 'We Were Making Hisoty' Life Stories ofWomen in the TelanganaPeople's Struggle. New Delhi: Kali for Women, 1989.
2. TriptiLahiri. “By the Numbers: Where Indian Women Work." Women's Studies Journal (14 November 2012) Available online at: http://blogs.wsj.com/India real time/2012/11/14/by-the-numbers-where-Indian-women-work/>
3. K.Satyanarayanaand Susie Tharu (Ed.) Steel Nibs Are Sprouting: New Dalit WritingFromSouthIndia, Dossier2,TeluguandKannadahttp://harpercollings.eo.in/BookDetail.asp?BookCode=3732

Course Structure of
BTech (Artificial Intelligence & Machine Learning)
(I, II, III & IV Years)

B.TECH (AI&ML) I YEAR I SEM 4 T+ 5P

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics I	3	1	0	4.0
2	BSC	Applied Physics	3	1	0	4.0
3	BSC	Applied Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSSMC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming for Problem Solving I	2	0	0	2.0
9	ESC	Programming for Problem Solving I Lab	0	0	3	1.5
Total						**19.5**

B.TECH (AI&ML) I YEAR II SEM 5T +3 P

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics II	3	1	0	4.0
2	BSC	Engineering Chemistry	3	1	0	4.0
3	BSC	Engineering Chemistry Lab	0	0	3	1.5
4	HSSMC	English	2	0	0	2.0
5	HSSMC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming for Problem Solving II	2	0	0	2.0
7	ESC	Programming for Problem Solving II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
Total						**18.5**

B.TECH (AI&ML) II YEAR I SEM 6T +3L+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	ESC	Computer Systems I	3	0	0	3
2	PCC	Data Structures	3	0	0	3
3	PCC	Python Programming	2	0	0	2
4	BSC	Discrete Mathematics	3	0	0	3
5	BSC	Probability and Statistics	3	0	0	3
6	PCC	Java Programming	2	1	0	3
7	PCC-Lab	Python Programming Lab	0	0	3	1.5
8	PCC-Lab	Data Structures & Java Lab	0	0	3	1.5
9	MC	Environmental Studies	2	0	0	0
Total						20

B.TECH (AI&ML) II YEAR II SEM 6T+2L+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Data Wrangling and Visualization	2	1	0	3
2	PCC	Design and Analysis of Algorithms	3	1	0	4
3	PCC	Fundamentals of Artificial Intelligence	2	1	0	3
4	PCC	Fundamentals of Software Engineering	3	0	0	3
5	PCC	Database Management Systems	3	0	0	3
6	HSSMCL	Soft Skills for Success Lab	0	0	2	1
7 7	PCC-Lab	Data Wrangling and Visualization Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

B.TECH (AI&ML) III YEAR I SEM (4T+4L) +1 MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Machine Learning	3	0	0	3
2	PCC	Computer Systems II	3	1	0	4
3	PCC	Web Technologies	3	0	0	3

4	OEC-I	1. English for Professionals 2. Entrepreneurship Development 3. Intellectual Property Rights	3	0	0	3
5	PCC-Lab	Computer Systems Lab	0	1	3	2.5
6	PCC-Lab	Web Technologies Lab	0	0	3	1.5
7	PCC-Lab	Machine Learning Lab	0	0	3	1.5
8	BSC-Lab	Quantitative Aptitude and Reasoning	0	0	3	1.5
9	MC	NSS/NSO	0	0	2	0
Total						20

B.TECH (AI&ML) III YEAR II SEM (5 T +3L)

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Automata Theory and Applications	3	1	0	4
2	PCC	Advanced Machine Learning	3	0	0	3
3	ESC	Computer Vision	3	0	0	3
4	PEC-1	1. R Programming 2. Mobile Application Programming 3. Internet of Things 4. Unified Modified Language	2	0	0	2
5	PEC-II	1. Information Retrieval Systems 2. Cloud Computing 3. Evolutionary Computing 4. Cryptography	3	0	0	3
6	HSS&MC	Verbal Ability & Skill Integrated Lab	0	0	4	2
7	PCC Lab	Data Mining Lab	0	0	3	1.5
8	PEC-1-Lab	1. R Programming Lab 2. Mobile Application Programming Lab 3. Internet of Things Lab 4. Unified Modified Language Lab	0	0	3	1.5
Total						20

B.TECH (AI&ML) IV YEAR I SEM (5 T +2 L) + Mini project

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Natural Language Processing	3	0	0	3
2	PCC	Deep Learning	3	1	0	4

3	PEC-III	1. Big Data (Pre req: DBMS) 2. Information Security (Prereq: Cryptography) 3. Computational Biology (Pre req: Machine Learning) 4. Optimization (Pre req: Basic Math courses)	3	1	0	4
4	PEC - IV	1. Reinforcement Learning & Game Theory 2. Blockchain Technology (Pre-req: Distributed Systems) 3. Cloud Computing (Pre-req: Distributed Systems) 4. Introduction to Robotics (Pre-req: Fundamentals of AI)	3	0	0	3
5	PEC-V	(Pre req for all course: Fundamentals of AI + Machine Learning) 1. Applications of AI in GIS & Remote Sensing 2. Applications of AI in Healthcare 3. Applications of AI in Banking 4. Application of AI in e-Governance	3	0	0	3
6	PCC Lab	Deep Learning and Natural Language Processing Lab	0	0	3	1.5
7	PEC-III LAB	1. Big Data Lab 2. Information Security Lab 3. Computational Biology Lab 4. Optimization Lab	0	0	3	1.5
8	PROJ	Mini Project / Summer Internship	0	0	4	2
Total						**22**

		B.TECH (AI&ML) IV YEAR II SEM	**(2T +3 L/P)**			
S.No	**Category**	**Course Name**	**Hours per week**			**Credits**
			L	**T**	**P**	
1	OEC-II	1. Technical and Business Communication Skills 2. Language and life skills 3. Digital Media Literacy	3	0	0	3

		4. Managerial Economics and Financial Analysis				
2	OEC-III	1. Negotiation Skills 2. Project Management 3. Value Engineering	3	0	0	3
3	PROJ	Seminar	0	0	4	2
4		Comprehensive Viva-Voce	0	0	0	2
5	PROJ	Project	0	0	20	10
		Total				**20**

Credits Break-up

S. No	B.TECH (AI&ML) CATEGORY	Credit Break up	
		As per AICTE	As per proposed curriculum
1	Humanities and Social Sciences including Management courses (HSS&MC)	12*	**7**
2	Basic Science courses (BSC)	25*	**26.5**
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. (ESC)	24*	**21**
4	Professional core courses (PCC)	48*	**62.5**
5	Professional Elective courses relevant to chosen specialization/branch (PEC)	18*	**18**
6	Open Electives (OEC)*(from HSS&MC)*	18*	**09**
7	Project work, seminar and internship in industry or elsewhere (PROJ)	15*	**16**
8	Mandatory Courses (MC) [Environmental Sciences, Induction training, Indian Constitution,Essence of Indian Traditional Knowledge]	(non-credit)	
9	Total credits	**160**	**160**

**Minor variation is allowed as per need of the respective disciplines*

Course code and definition:

Course code Definitions	Course code Definitions
L	**L Lecture**
T	**T Tutorial**
P	**P Practical**
BSC	**BSC Basic Science Courses**
ESC	**ESC Engineering Science Courses**
HSSMC	**HSMC Humanities and Social Sciences including Management courses**
Management courses	

PCC	**Professional core courses**
PEC	**Professional Elective courses**
OEC	**Open Elective courses**
LC	**Laboratory course**
MC	**MC Mandatory courses**
PROJ	**PROJ Project**

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per wee	0.5 credits
2 Hours Practical(Lab)/week	1 credit

Course Structure of
BTech (Artificial Intelligence)
(I, II, III & IV Years)

B.TECH (AI) I YEAR I SEM 4 T+ 5P

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics I	3	1	0	4.0
2	BSC	Applied Physics	3	1	0	4.0
3	BSC	Applied Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSS&MC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming for Problem Solving I	2	0	0	2.0
9	ESC	Programming for Problem Solving I Lab	0	0	3	1.5
Total						**19.5**

B.TECH (AI) I YEAR II SEM 5T +3 P

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics II	3	1	0	4.0
2	BSC	Engineering Chemistry	3	1	0	4.0
3	BSC	Engineering Chemistry Lab	0	0	3	1.5
4	HSSMC	English	2	0	0	2.0
5	HSSMC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming for Problem Solving II	2	0	0	2.0
7	ESC	Programming for Problem Solving II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
Total						18.5

B.TECH (AI) II YEAR I 6T +3L+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	ESC	Computer Systems I	3	0	0	3
2	PCC	Data Structures	3	0	0	3
3	PCC	Python Programming	2	0	0	2
4	BSC	Discrete Mathematics	3	0	0	3
5	BSC	Probability and Statistics	3	0	0	3
6	PCC	Java Programming	2	1	0	3
7	PCC-Lab	Python Programming Lab	0	0	3	1.5
8	PCC-Lab	Data Structures & Java Lab	0	0	3	1.5
9	MC	Environmental Studies	2	0	0	0
Total						20

B.TECH (AI) II YEAR II SEM 6T+2L+1MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Data Wrangling and Visualization	2	1	0	3
2	PCC	Design and Analysis of Algorithms	3	1	0	4
3	PCC	Fundamentals of Artificial Intelligence	2	1	0	3
4	PCC	Fundamentals of Software Engineering	3	0	0	3
5	PCC	Database Management Systems	3	0	0	3
6	HSSMCL	Soft Skills for Success Lab	0	0	2	1
7 7	PCC-Lab	Data Wrangling and Visualization Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

B.TECH (AI) III YEAR I SEM 4T+4L +1 MC

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Machine Learning	3	0	0	3
2	PCC	Computer Systems II	3	1	0	4
3	PCC	Web Technologies	3	0	0	3
4	OEC-I	4. English for Professionals 5. Entrepreneurship Development 6. Intellectual Property Rights	3	0	0	3
5	PCC-Lab	Computer Systems Lab	0	1	3	2.5
6	PCC-Lab	Web Technologies Lab	0	0	3	1.5
7	PCC-Lab	Machine Learning Lab	0	0	3	1.5
8	BSC-Lab	Quantitative Aptitude and Reasoning	0	0	3	1.5
9	MC	NSS/NSO	0	0	2	0
Total						20

B.TECH (AI) III YEAR II SEM 5 T +3L

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Automata Theory and Applications	3	1	0	4
2	PCC	Data Science	3	0	0	3
3	PCC	Computer Vision	3	0	0	3
4	PEC-1	1. R Programming 2. Mobile Application Programming 3. Internet of Things 4. Unified Modified Language	2	0	0	2
5	PEC-II	4. Information Retrieval Systems 5. Distributed Systems 6. Evolutionary Computing 4. Cryptography	3	0	0	3
6	HSSMC	Verbal Ability & Skill Integrated Lab	0	0	4	2
7	PCC Lab	Data Science Lab	0	0	3	1.5
8	PEC-1-Lab	5. R Programming Lab 6. Mobile Application Programming Lab 7. Internet of Things Lab 8. Unified Modified Language Lab	0	0	3	1.5
Total						20

B.TECH (AI) IV YEAR I SEM **(5 T +2 L) + Mini project**

S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	PCC	Natural Language Processing	3	0	0	3
2	PCC	Deep Learning	3	1	0	4
3	PEC-III	5. Big Data (Pre req: DBMS) 6. Information Security (Prereq: Cryptography) 7. Computational Biology (Prereq: Machine Learning) 8. Optimization (Pre-req: Basic Math courses)	3	1	0	4
4	PEC - IV	5. Reinforcement Learning & Game Theory 6. Blockchain Technology (Prereq: Distributed Systems) 7. Cloud Computing (Pre req: Distributed Systems) 8. Introduction to Robotics (Pre req: Fundamentals of AI)	3	0	0	3
5	PEC-V	(Pre req for all course: Fundamentals of AI + Machine Learning) 5. Applications of AI in GIS & Remote Sensing 6. Applications of AI in Healthcare 7. Applications of AI in Banking 8. Applications of AI in e-Governance	3	0	0	3
6	PCC Lab	Deep Learning and Natural Language Processing Lab	0	0	3	1.5
7	PEC-III LAB	5. Big Data Lab 6. Information Security Lab 7. Computational Biology Lab 8. Optimization Lab	0	0	3	1.5
8	PROJ	Mini Project / Summer Internship	0	0	4	2
Total						**22**

		B.TECH (AI) IV YEAR II SEM	(2T +3 L/P)			
S.No	Category	Course Name	Hours per week			Credits
			L	T	P	
1	OEC-II	5. Technical and Business Communication Skills 6. Language and Life Skills 7. Digital Media Literacy 8. Managerial Economics and Financial Analysis	3	0	0	3
2	OEC-III	4. Negotiation Skills 5. Project Management 6. Value Engineering	3	0	0	3
3	PROJ	Seminar	0	0	4	2
4		Comprehensive Viva-Voce	0	0	0	2
5	PROJ	Project	0	0	20	10
		Total				**20**

Credits Break-up

S. No	B.TECH (AI) CATEGORY	Credit Break up	
		As per AICTE	As per proposed curriculum
1	Humanities and Social Sciences including Management courses(HSS&MC)	12*	**7**
2	Basic Science courses (BSC)	25*	**26.5**
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. (ESC)	24*	**21**
4	Professional core courses (PCC)	48*	**62.5**
5	Professional Elective courses relevant to chosen specialization/branch (PEC)	18*	**18**
6	Open Electives (OEC)	18*	**09**
7	Project work, seminar and internship in industry or elsewhere (PROJ)	15*	**16**
8	Mandatory Courses (MC) [Environmental Sciences, Induction training, Indian Constitution,Essence of Indian Traditional Knowledge]	(non-credit)	
9	Total credits	**160**	**160**

**Minor variation is allowed as per need of the respective disciplines*

Definition of Credit

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

M.TECH (AI) I YEAR I SEM [5T+ 2L+1AC+1RM]

S. No	Category	Course Title	Hours Per Week			Credits
			L	T	P	
1	PCC-I	Algorithms for AI	3	0	0	3
2	PCC-II	Foundations of Machine Learning	3	0	0	3
3	PCC-III	Deep Learning and Neural Networks	3	0	0	3
4	PEC-I	1. Information Security 2. Digital Image Processing 3. Bio Inspired Algorithms 4. Knowledge Representation and Reasoning 5. Principles of Internet of Things 6. Applications of AI in e-governance (Industry oriented)	3	0	0	3
5	PEC-II	1. Block Chain Technology 2. Game Theory 3. Object Oriented Programming(Java) 4. Computer Systems 5. Social Network Analysis 6. Information Retrieval System	3	0	0	3
6	PCC	Research Methodology	2	0	0	2
7	AC	Audit Course 1	2	0	0	0
8	PCC I-Lab	Foundations of Machine Learning Lab	0	0	4	2
9	PCC II-Lab	Deep Learning and Neural Networks Lab	0	0	4	2
		Total	**19**	**0**	**8**	**21**

M.Tech (AI) I YEAR II SEM [5T+ 2L]

S. No	Category	Course Title	Hours Per Week			Credits
			L	T	P	
1	PCC-IV	Natural Language Processing	3	1	0	4
2	PCC-V	Data Wrangling and Visualization	3	1	0	4
3	PEC-III	1. Cloud Computing 2. Computer Vision 3. Computer based Optimization techniques 4. Web Mining 5. Foundations of Software Engineering 6. Sentiment Analysis	3	0	0	3
4	PEC-IV	1. Big Data 2. Mobile Applications & Development 3. Predictive Analytics with R	3	0	0	3

		4. NoSQL Databases 5. Design and Analysis of Algorithms 6. Web Technologies				
5	PEC IV Lab	1. Big Data Lab 2. Mobile Applications & Development Lab 3. Predictive Analytics with R Lab 4. NoSQL Databases Lab 5. Design and Analysis of Algorithms Lab 6. Web Technologies Lab	0	0	4	2
6	PCC-IV Lab	Natural Language Processing Lab	0	0	4	2
7	OEC	Communication Skill	3	0	0	3
		Total	**15**	**2**	**8**	**21**

M.Tech (AI) II YEAR I SEM

S. No	Category	Course Title	Hours Per Week			Credits
			L	T	P	
1		Dissertation	0	0	24	12
		Total	**0**	**0**	**24**	**12**

M.Tech (AI) II YEAR II SEM

S. No	Category	Course Title	Hours Per Week			Credits
			L	T	P	
2		Dissertation	0	0	28	14
		Total	**0**	**0**	**28**	**14**

b) <u>BoS, Minutes of the BoS in Chemical Engineering</u>

Minutes of Board of Studies Meeting

The Second Board of Studies meeting of Department of Chemical Engineering of Anurag University, Venkatapur (V), Ghatkesar (M), Medchal (Dist), Hyderabad was held on 18.03.2021 (Thursday) at 11.00 am through online mode via Google Meet to discuss the following agenda.

AGENDA

1. Welcome address by Chairperson.
2. To approve scheme & syllabi of B. Tech II, III and IV-years to suit the requirements of B. Tech (Honour/ Minor Engg.)
3. To approve the courses & syllabi of B. Tech Chemical Engineering with Honours degree.
4. To approve the courses & syllabi of B. Tech Minor degree to be offered by Chemical Engineering department to other branches of Engineering.
5. To approve PhD eligibility entrance test syllabus.

The following members were present:

1. Dr. M. Mukunda Vani, HOD, Chemical Engineering, AU, Chairperson of BOS.
2. Dr. Narasimha Mangadoddy, Professor, Dept. of Chemical Engineering, IITH, Member.
3. Dr. G. Prabhakar Reddy, Professor, OUCT, Hyderabad, Member.
4. Dr. A. Ramesh Babu, Assoc. Professor, BITS Pilani Hyderabad Campus, Member.
5. Dr. S. Sridhar, Senior Principal Scientist, CSIR-Indian Institute of Chemical Technology, Member.
6. Dr. Ravi K Gujjula, Chief General Manager –Technical, Andhra Pradesh State Skill Development Corporation, Member.
7. Dr. N. Anil, Assoc. Prof, Dept. of Chemical Engineering, AU, Member.
8. Dr. B. Venkataramana Reddy, Asst. Prof, Dept. of Chemical Engineering, AU, Member.
9. Mrs. M. Shireesha, Asst. Prof, Dept. of Chemical Engineering, AU, Member.
10. Dr. P. Nagarjuna Reddy, Managing Director, REVIN LABS Pvt Ltd, Alumni, Member.

The following resolutions were made:

S. No.	Suggested changes	Suggested by
1.	The subject Fluid and particle Mechanics and the lab in II year -I semester to be renamed as Fluid mechanics & Fluid Mechanics Lab respectively.	Dr. M. Narasimha & Dr. A. Ramesh.
2.	Few experiments were suggested to be added in the Chemical Technology Lab in II-year II semester in compliance with Chemical Technology course. They are: a. Cement Manufacture from Calcium carbonate b. Pulp & paper production from standard methods c. Preparation of a Polymer	Dr. A. Ramesh.
3.	For B. Tech honours course, 18-20 credits to be fulfilled by students. 50% of syllabus to be offered offline and the	All members

	remaining online.	
4.	The subject in honours program Technology of fuel cells & batteries to be renamed as Fuel cell technology and batteries.	Dr. M. Narasimha
5.	For B. Tech Minor course, 18-20 credits to be fulfilled by students. 50% of syllabus to be offered offline and the remaining online.	All members
6.	Introduction to Material science & engineering course should be taken as prerequisite before taking up any course for the minor degree programme.	Dr. M. Narasimha & Dr. A. Ramesh.
7.	In material Characterization course – syllabus to be modified where mechanical aspects can be added.	Dr. A. Ramesh.
8.	In the Entrepreneurship development course, the student should be taken for a visit to T-Hub as a part of the curriculum so that student can gain knowledge as how to set up her/his own enterprise.	Dr. Ravi K Gujjula
9.	Approved scheme & syllabi of B. Tech II, III and IV-years to suit the requirements of B. Tech (Honour/ Minor Engg.)	All members
10.	Approved the courses & syllabi of B. Tech Chemical Engineering with Honours degree.	All members
11.	Approved the courses & syllabi of B. Tech Minor degree to be offered by Chemical Engineering department to other branches of Engineering.	All members
12.	Approved PhD eligibility entrance test syllabus which is in line with the GATE syllabus.	All members

Department of Chemical Engineering

FOUR YEARS COURSE STRUCTURE
R20 REGULATIONS

B.Tech (Chem) I Year I Semester **5T+3L**

Sl.No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–I	3	1	-	4.0
2	BSC	Engineering Chemistry-I	3	1	-	4.0
3	HSS&MC	English	2	-	-	2.0
4	ESC	Python Programming-I	2	-	-	2.0
5	ESC	Engineering Graphics	1	-	3	2.5
6	HSSMC-Lab	English Language Skills Lab	-	-	2	1.0
7	BSC -Lab	Engineering Chemistry Lab	-	-	3	1.5
8	ESC -Lab	Python Programming Lab-I	-	-	3	1.5
Total						**18.5**

Department of Chemical Engineering
B.Tech (Chem) I Year II Semester **4T+5L**

Sl.No	Category	Course title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–II	3	1	-	4.0
2	BSC	Engineering Physics	3	1	-	4.0
3	ESC	Python Programming-II	2	-	-	2.0
4	ESC	Basic Electrical Engineering	3	-	-	3.0
5	BSC -Lab	Engineering Physics Lab	-	-	3	1.5
6	ESC -Lab	Python Programming lab-II	-	-	3	1.5
7	ESC -Lab	Basic Electrical Engineering Lab	-	-	2	1.0
8	ESC -Lab	Engineering Workshop	-	-	3	1.5
9	HSSMC-Lab	English Communication Skills Lab	-	-	2	1.0
	TOTAL					**19.5**

Department of Chemical Engineering

B.Tech (Chem) II Year I Semester **6T+2L +1 MC**

Sl. No	Category	Course title	Hours per week			Credits
			L	T	P	
1	ESC	Engineering Mechanics	3	-	-	3.0
2	BSC	Engineering Chemistry – II	2	-	-	2.0
3	PCC	Fluid Mechanics	3	-	-	3.0
4	PCC	Material & Energy Balance Computations	3	-	-	3.0
5	PCC	Mechanical Unit Operations	3	-	-	3.0
6	BSC	Probability and statistics	3	-	-	3.0
7	PCC-Lab	Fluid Mechanics Lab	-	-	3	1.5
8	PCC-Lab	Mechanical Unit Operations Lab	-	-	3	1.5
9	MC	Environmental Studies	2	-	-	0
Total						**20**

Department of Chemical Engineering

B.Tech (Chem) II Year II Semester **6T+3L**

Sl. No	Category	Course title	Hours per week			Credits
			L	T	P	
1	PCC	Process Heat Transfer	3	-	-	3.0
2	ESC	Chemical Engineering Thermodynamics-I	3	-	-	3.0
3	PCC	Instrumentation and Process Analytics	2	-	-	2.0
4	PCC	Chemical Technology	3	-	-	3.0
5	ESC	Material Science and Engineering	2	-	-	2.0
6	PEC-I	1. Technology of Pharmaceuticals and Fine Chemicals 2. Corrosion Engineering 3. Polymer Science and Engineering	3	-	-	3.0
7	HSSMC-Lab	Professional Skills Lab	-	-	2	1.0
8	PCC-Lab	Process Heat Transfer Lab	-	-	3	1.5
9	PCC-Lab	Chemical Technology Lab	-	-	3	1.5
Total						**20**

Department of Chemical Engineering

B.Tech (Chem) III Year I Semester **5T+3L +1 MC**

Sl. No	Category	Course title	Hours per week			Credits
			L	T	P	
1	PCC	Chemical Reaction Engineering- I	3	-	-	3.0
2	PCC	Mass Transfer Operations-I	3	-	-	3.0
3	PCC	Chemical Engineering Thermodynamics-II	3	-	-	3.0
4	HSSMC	Entrepreneurship Development	3	-	-	3.0
5	OEC-I	1. Project Management 2. Managerial Economics and Financial Analysis 3. Intellectual Property Rights	3	-	-	3.0

6	PCC-Lab	Computational Methods in Chemical Engineering Lab	1	-	2	2.0
7	HSSMC - Lab	Quantitative Aptitude and reasoning	-	-	3	1.5
8	HSSMC - Lab	Verbal Ability & Critical Reasoning	-	-	3	1.5
9	MC	Gender Sensitization	2	-	-	0
Total						**20**

Department of Chemical Engineering

B.Tech (Chem) III Year II Semester 6T+2L

Sl. No	Category	Course title	Hours per week			Credits
			L	T	P	
1	PCC	Chemical Reaction Engineering-II	3	-	-	3.0
2	PCC	Mass Transfer Operations –II	3	-	-	3.0
3	PCC	Plant Design & Economics	2	-	-	2.0
4	PCC	Bio Chemical Engineering	3	-	-	3.0
5	PEC-II	1. Industrial Safety and Hazard Management 2. Petroleum and Petrochemical Technology 3. Environmental Pollution and control	3	-	-	3.0
6	PEC-III	1. Nano science and Nano Technology 2. Process Intensification 3. Membrane Technology	3	-	-	3.0
7	PCC-Lab	Chemical Reaction Engineering Lab	-	-	3	1.5
8	PCC-Lab	Mass Transfer Operations Lab	-	-	3	1.5
Total						**20**

Department of Chemical Engineering

B.Tech (Chem) IV Year I Semester **6T+2L**

Sl. No	Category	Course title	Hours per week			Credits
			L	T	P	
1	PCC	Process Dynamics and Control	3	-	-	3.0
2	PCC	Process Modeling and simulation	3	-	-	3.0
3	PCC	Chemical Process Equipment Design	2	-	-	2.0
4	PCC	Artificial Intelligence for Chemical Engineering	3	-	-	3.0
5	PCC	Transport Phenomena	3	-	-	3.0
6	PEC-IV	1. Design and Analysis of Experiments 2. Computational Fluid Dynamics 3. Optimization of chemical Processes	3	-	-	3.0
7	PCC-Lab	Process Dynamics and Control Lab	-	-	3	1.5
8	PCC-Lab	Process Modeling & Simulation Lab	-	-	3	1.5
9	PROJ	Mini Project/ Summer Internship	--	--	--	2.0
Total						**22**

Department of Chemical Engineering

B.Tech (Chem) IV Year II Semester **2T+3PROJ**

Sl.No	Category	Course title	Hours per week			Credits
			L	T	P	
1	OEC-II	1. Renewable Energy Technology 2. Disaster Preparedness and Planning Management 3. Operational Research	3	-	-	3.0
2	OEC-III	1. Essential English and Employability Skills 2. Technical & Business communication 3. Digital media Literacy	3	-	-	3.0
3	PROJ	Project Work	--	--	20	10.0
4		Comprehensive Viva Voce	--	--	--	2.0
5	PROJ	Technical Seminar	-	-	4	2.0
Total						**20**

Professional Elective –I(PEC-I)	1. Technology of Pharmaceuticals and Fine Chemicals 2. Corrosion Engineering 3. Polymer Science and Engineering
Professional Elective –II (PEC-II)	1. Industrial Safety and Hazard Management 2. Petroleum and Petro Chemical Technology 3. Environmental Pollution and control
Professional Elective –III (PEC-III)	1. Nano science and Nano Technology 2. Process Intensification 3. Membrane Technology
Professional Elective –IV(PEC-IV)	1. Design and Analysis of Experiments 2. Computational Fluid Dynamics 3. Optimization of chemical Processes

Open Elective –I (OEC-II)	1. Project Management 2. Managerial Economics and Financial Analysis 3. Intellectual Property Rights
Open Elective –II (OEC-II)	1. Renewable Energy Technology 2. Disaster Preparedness and Planning Management 3. Operational Research
Open Elective –III (OEC-III)	1. Essential English and Employability Skills 2. Technical & Business communication 3. Digital media Literacy

Break Up of Credits

No.	Category	Code	Suggested Break Up of Credits	Allotted Breakup of Credits by AICTE	Allotted Breakup of Credits
1	Humanities and Social Sciences including Management courses	**HSS&MC**	12*	12	11

2	Basic Science courses	**BSC**	25*	27	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	**ESC**	24*	27	20
4	Professional core courses	**PCC**	48*	55	68
5	Professional Elective courses relevant to chosen specialization/branch	**PEC**	18*	12	12
6	Open Electives Course	**OEC**	18*	12	9
7	Project work, seminar and internship in industry or elsewhere	**PROJ**	15*	15	16
8	Mandatory Courses MC [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	**MC**	(non-credit)	(non-credit)	(non-credit)
9	Total credits		160	160	160

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Department of Chemical Engineering

B.Tech-CHEM II-Year - I-Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

ENGINEERING MECHANICS

COURSE OBJECTIVES: The objectives of this course are to

1. Enable the students to do the analysis of static objects by the concepts of force, moment and mechanical equilibrium.
2. Develop the student's knowledge to solve various problems on friction.
3. Enable the students to find the centroid and center of gravity of a given section.
4. Develop the students' knowledge to determine the area and mass moment of inertia of given section.
5. Enable the students to formulate a problem given from work-energy Principle.

UNIT - I:
Introduction to Engineering Mechanics: Basic concepts.
System of Forces: Coplanar, Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System.
Equilibrium of System of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems, Lame's Theorem.

UNIT – II:
Friction*:* Basic concepts, Types of Friction, Laws of Friction, Static and Dynamic Friction, Motion of Bodies, Wedge friction, ladder Friction, screw friction, applications.

UNIT - III:
Centroid: Centroids of simple figures (from basic principles) Centroids of Composite Figures.
Centre of Gravity: CG of simple bodies (from basic principles), CG of composite bodies, Pappus theorem.

UNIT- IV:
Area Moment of Inertia: Definition - Polar Moment of Inertia, Transfer Theorem, MI of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: MI of Masses, Transfer Formula for MMI, MMI of composite bodies.

UNIT - V:
Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion. Connected System - Fixed Axis Rotation and Plane Motion. Impulse momentum method.

COURSE OUTCOMES: At the end of this course, students will be able to:

1. Solve the resultant of forces which are acting on the systems and also able to apply the equilibrium conditions on a body.
2. Solve the problems based on friction.
3. Estimate the centroid and center of gravity of composite sections.
4. Determine the area and mass moment of inertia of simple and composite sections.
5. Calculate the distance travelled and time required for the particle in case of connected systems.

TEXT BOOKS:

1) Singer's Engineering Mechanics by K. Vijaya Kumar Reddy and J. Suresh Kumar.
2) Engineering Mechanics by S.S.Bhavikatti, J.G.Rajasekharappa.
3) Engineering Mechanics by Timoshenko & Young.

REFERENCE BOOKS:

1) Engineering Mechanics by Meriam and Kraize
2) Engineering Mechanics by K.L.Kumar / Tata McGraw Hill.
3) Engineering Mechanics by A. K. Tayal / Umesh Publications.
4) Engineering Mechanics by D. S. Kumar / S. K. Kataria & Sons.
5) Engineering Mechanics by Russell C. Hibbeler.

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	3	0	3

ENGINEERING CHEMISTRY –II

PREREQUISITES: Engineering Chemistry- I

COURSE OBJECTIVES:

1. To bring understanding to the conception of chemistry and to become a perfect engineer.
2. To impart the basic knowledge of types of polymers and their applications in different walks of life.
3. To acquire the knowledge of IUPAC nomenclature of simple organic compounds to interpret the reactivity of organic molecules.
4. To acquire the skills relevant to various chromatography techniques and to apply them for medical and other fields.
5. To acquire the knowledge of green chemistry, dyes and fuels which are essential for the industry.

UNIT-I Fundamentals of reaction mechanism

Basic concepts of functional groups, electro negativity, dipole moment, Types of Organic reactions.

Polar effects – Inductive effect, electromeric effect, mesomeric effect, Concept of reactive intermediates- carbanions, carbocations, carbenes and free radicals, Hyper conjugation, steric inhibition of resonance – examples.

UNIT- II Polymers

Polymerization Reactions – Basic concepts; Types of Polymerization – Addtion and Condensation Polymerizations, Plastics- Thermosetting and Thermoplastics – Differences, Molecular weights of polymer: Number average molecular weight, Weight average molecular weight, Preparation, Properties and Engineering uses of the Following: Polyethylene, PMMA, Bakelite, Epoxy resins and Silicone Resins, Rubber - Processing of Natural Rubber, Vulcanization. Elastomers- Neoprene, Butyl rubber and Polyurethane Rubber.

UNIT–III Fuels and Combustion

Fuels, classification – (solid, liquid, gaseous). Calorific value of fuel –HCV, LCV. Solid fuels – coal – analysis – proximate and ultimate analysis and their significance. Determination of calorific value by Bomb Calorimeter. Liquid fuels – petroleum, refining of petroleum, cracking, knocking, synthetic petrol –Fischer- Tropsch's process; Gaseous fuels – natural gas, LPG, CNG: composition and uses. Analysis of flue gas by Orsat's method. Combustion – problems, determination of calorific value by Junker's gas calorimeter.

UNIT– IV Chromatography

Fundamentals of chromatographic techniques.

Paper chromatography: Types of Paper chromatography, RF value.

Thin Layer Chromatography: Stationary phase, mobile phase, sample application, development techniques – evaluation and documentation, advantages and disadvantages. Gas Chromatography: Principle of Gas Chromatography, block diagram of gas chromatograph, Function of each component, stationary phase for column, mobile phase, chromatogram, applications of Gas Chromatography.

HPLC: Principles of high performance liquid chromatography, Block diagram of HPLC, Systems, functions of each component, stationary phases, eluting solvents, pumps, detectors, applications of HPLC.

UNIT-V Green Chemistry

Significance and determination of COD and BOD, Greenhouse effect and global warming, e-waste, radioactive pollution, Application of green chemistry and green technology.

Dyes: Colours and constitution, chromophore and auxochrome theory, modern theory of colour, classification of dyes based on their structures and method of applications. Preparation, properties and applications of Malachite green and Bismark brown colours.

COURSE OUTCOMES:

The course will enable the student to:

1. Interpret the reactivity of organic molecules with concepts of functional groups.
2. Apply the knowledge of polymer properties to their structure and conformation.
3. Apply the knowledge of calorific value for the chemical analysis of various fuels.
4. Explain the concept of new analytical techniques that use chromatography principle.
5. Analyze the concept of green chemistry and industrial applications of dyes.

TEXT BOOKS:

1. Organic Chemistry- Reactions and Reagents- O.P. Agrawal– Krishna Prakashan media(P) Ltd. – 2009.
2. Organic Reactions and their Mechanisms, II Edition – P. S. Kalsi– New age International Publishers– 2000.

REFERENCES:

1. Organic Chemistry Vol- I-IL. Finar, V Edition– Pearson Publication.
2. Text book of Organic Chemistry – P.L. Soni– Sultan Chand & Sons, New Delhi– 2003.
3. Engineering Chemistry – Prasanta Rath and others–Cengage Publication, New Delhi – 2018.

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	3	0	3

FLUID MECHANICS

PREREQUISITES: Engineering Physics

COURSE OBJECTIVES

1. To understand the basic concepts of fluid mechanics and their applications in Chemical Engineering.
2. To develop relationships among process or system variables using dimensional analysis.
3. To illustrate the basic laws for systems like Continuity equation, Equation of Motion, Equation of Energy etc.
4. To evaluate the flow of incompressible and compressible fluids for laminar and turbulent flow.
5. To study and understand the transportation of fluids and pump systems along with flow meters.

UNIT 1: Introduction and Fluid Flow Phenomena
Fluid statistics, Applications of fluid statistics, Properties of fluid, Classification of fluids, Newton's law of viscosity, Rheological classification of fluids, Newtonian and Non-Newtonian fluids, Turbulence, Reynolds number – its significance, Boundary layer theory, Manometers, Decanters, Centrifuge, Dimensional analysis, Buckingham π- theorem.

UNIT 2: Basic Laws for Systems
Continuity equation, Momentum balance equation, Bernoulli's equation, Introduction to Navier-Stoke's and Euler's equations, macroscopic balance.

UNIT 3:
Incompressible flow: In pipes and channels, laminar flow in pipes & channels, Hagen-Poiseuille's equation, turbulent flow in pipes & channels, Moody chart, Darcy Weisbach equation, Friction losses in expansion & contractions, Effects of fittings and valves.
Compressible flow: Processes of compressible flow, Isentropic flow through nozzles, adiabatic frictional flow and isothermal frictional flow.

UNIT 4: Flow past Immersed bodies
Concept of Drag, Drag coefficient, and drag coefficient with Reynolds number, flow through packed bed and fluidized bed, flow through bed of solids.
Introduction to Particles
Introduction to particles, their characterization, Particulate Phenomena – Brownian motion and phoresis, motion of particles through the fluid, particle settling velocity.
Fluidization: Types of Fluidization, Minimum Fluidization velocity, Pneumatic conveying and other industrial uses.

UNIT 5: Transportation and metering of Fluids: Pipes, fittings and valves, Classification of Pumps, Centrifugal pumps- Cavitation, NPSH, characteristic curves, positive displacement pumps, fans, blowers and compressors.
Fluid Meters: Volume flow measurement, full bore meters, area meters and local velocity measurement: Pitot tube, hot wire anemometers, mass flow meters.

COURSE OUTCOMES: Thestudent will be able to

1. Understand the fluid properties, their characteristics while static and during flow through ducts, pipes etc.
2. To develop the ability to formulate problems, identify the basic mechanisms.
3. To solve the problem by mathematical analysis or by application of experimental data.
4. To understand and use differential equations to determine pressure and velocity variations in internal and external flow.
5. Study and understand several machineries used to transport fluid and their performance.

TEXT BOOKS:

1. Unit Operations of Chemical Engineering, Mc-cabe, W.L. Smith, J.C. Harriott, Peter, Mc-graw Hill Higher Education Publication, New Delhi.
2. A Textbook of Fluid Mechanics and Hydraulic Machines, R K Bansal, 9^{th} edition, Laxmi Publications, New Delhi, 2004.

REFERENCES:

1. Transport Processes and unit operations, Christie J. Geankoplis, PHI.
2. Richardson Chemical Engineering, Volume-1, M. Coulson, J.F. Richardson, with J.R. Backhurst and J.H. Harker, Coulson, 6^{th} edition , Butterworth-Heinemann, 1999.

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B.Tech-CHEM II-Year - I-Semester **L T/P/D C**

3 0 3

MATERIAL AND ENERGY BALANCE COMPUTATIONS

PREREQUISITES: Engineering physics, Engineering Chemistry-I & II, Mathematics I&II

COURSE OBJECTIVES:

1. To give and apply principals of Material Energy Balance Computations in the project.
2. To understand and apply material and energy balance calculations in design.
3. Make Complex system simple by using principles of Material and Energy Balance Computations.
4. To learn modern estimation technique of Material and Energy Balance Computation to solve chemical problems.
5. To understand the aspects of recycle by –pass and purge and apply in chemical engineering in conservations.

UNIT-I

Stoichiometric relation: basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales Behavior of ideal gases: applications of ideal gas law to gaseous mixtures, gases in chemical reactions, include combustion processes.

UNIT-II

Vapor pressure: Liquefaction and liquid state, vaporization, boiling Point, effect of temperature on vapor pressure, Antoine equation, Vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law. Non-volatile solutes.

UNIT-III

Humidity and Saturation: Properties of air-water vapor mixtures, Absolute Humidity, molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts for engineering calculations.

UNIT-IV

Material balances: Tie substances, yield, conversion, limiting reactants, excess reactants, processes involving chemical reactions, Material balances with the help of stoichiometric equations, Material balance calculations for processes involving recycle, bypass and purge Material balances involving drying, dissolution and crystallization.

UNIT-V

Thermo physics: Energy, energy balances, heat capacity of gases, liquid and mixture solutions, Kopp's rule, latent heats, heat of fusion and Heat of vaporization, Trouton's rule, Kistiakowsky equation for non-Polar liquids, enthalpy and its evaluation Thermochemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchhoff's equation, enthalpy concentration change, calculation of theoretical actual flame temperature.

COURSE OUTCOMES: The student will be able to

1. Learn fundamental laws of Stoichiometry.
2. Calculate Vapor Pressures for Liquids using appropriate laws & critical Properties of ideal solution mixtures.
3. Calculate Properties for Air-Water system using Humidification principles.
4. Apply Material balances to Unit Operations and processes with and without chemical reactions.
5. Apply Energy balances to Unit Operations and processes with and without chemical reactions.

TEXT BOOKS:

1. Chemical Process Principles, Part-I, Material and Energy Balance by Hougen O A, Watson K.M and Ragatz R. A. John Wiley and sons, New York, 1963, 2nd Ed.

REFERENCES:

1. Basic Principles and Calculation in Chemical Engineering by D. H. Himmelblau, 5th Ed. PHI, 2001
2. Stoichiometry by B.I, Bhatt and S.M. Vora (3rd Ed.) Tata Mc Graw Hill Publishing Company, Ltd. New Delhi (1996)

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B.Tech-CHEM II-Year - I-Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

MECHANICAL UNIT OPERATIONS

PREREQUISITES: Mathematics I & II

COURSE OBJECTIVES: By studying this subject students will learn about

1. Characterization of solids
2. Size reduction equipments
3. Transportation of solid particulate mass
4. Techniques of solid – fluid separation
5. Agitation and mixing of liquids

UNIT-I

Properties, handling and mixing of particulate solids: Characterization of solid particles, Storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.

Transportation of solid particulate mass, belt, screw, apron conveyers, pneumatic conveying.

UNIT-II

Size reduction: Principles of comminution, size reduction equipment crushers, grinders, ultra-fine grinders, cutting machines, Equipment operation. Screening, Industrial screening equipment.

UNIT–III

Filtration, cake filters, Principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, and principles of clarification. Cross flow filtration, types of membranes.

UNIT-IV

Separations based on motion of particles through fluids, gravity settling processes and centrifugal settling processes, float and sink method, differential settling, coagulation, Flotation-separation of ores, flotation agents

UNIT -V

Agitation and mixing of liquids: Agitation of liquids, circulation velocities, power consumption in agitated vessels. Blending and mixing of liquids, suspension of solid particles. Crystallization: crystal geometry, crystal growth.

COURSE OUTCOMES: The student will be able to:

1. Understand about different types of size reduction processes
2. Describe the Transportation of solids.
3. Apply the basic methods of characterization of particles and bulk solids, e.g. average particle size, settling velocity.
4. Describe the operation of filter processes and types of filters used to perform solid-liquid separations, and calculate their power requirement
5. Design a mixed tank, calculate its power requirements and scale-up the design

TEXT BOOKS:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc Graw Hill 7th ed. 2004.

REFERENCES:

1. Chemical engineers hand book, J.H. Perry, 7th ed. Mc Graw Hill.
2. Walter Badger and Julius T. Bencharo, “Introduction to Chemical Engineering”. Mc Graw Hill, 2017.
3. Narayanan C.M. & Bhattacharya B.C. “Mechanical operations for chemical engineers”
   Khanna publishers

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B.Tech-CHEM II-Year - I-Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

PROBABILITY & STATISTICS

COURSE OBJECTIVES:

1. Understand chance cause and random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
2. In the discrete case, study the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
3. To perform polynomial curve fitting, general curve fitting and interpolation, various types of Skewness and kurtosis, Correlations.
4. The types of sampling, sampling distribution of means, sampling distribution of variance, Estimation of statistical parameters, testing of hypothesis of few unknown statistical parameters.
5. Understanding the experiments.

UNIT-I: Introduction to Probability, Addition theorem, Multiplication theorem (Two events only), Baye's theorem.
Random variables, Discrete and continuous random variable, Definitions of Probability Distribution function, Probability mass function, Probability density function and properties.
Definitions of Mathematical expectation, Variance of discrete and continuous random variable. Bivariate distributions and their properties, marginal and conditional distribution

UNIT-II:
Discrete Distributions: Bernoulli, Binomial, Poisson distributions (definition and problems) their mean, variance and moment generating function.
Continuous Distribution: Normal, exponential distributions (definition and problems) related properties.

UNIT-III:
Measures of Central tendency: Moments, Skewness and Kurtosis.
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.
Correlation and regression – Rank correlation

UNIT-IV:
Estimation: Concept of Point estimation and its properties (definition only), Concept of interval estimation with examples.
Test of Hypothesis: Null & Alternative Hypothesis, Critical region, Type I and Type II errors, level of significance, one tail, two-tail tests.
Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means

UNIT-V:
Small Sample tests: t-Test for single mean, difference of means, paired t-test, F-test.
Chi-square test for goodness of fit and independence of attributes.
ANOVA: Introduction, ANOVA for One way and Two way classification.

COURSE OUTCOMES: The student will able to:

1. Identify distribution in certain realistic situation. It is mainly used for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables involved in the probability models. It is quite useful for all branches of engineering.
2. Calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations. It is mainly useful for non-circuit branches of engineering.
3. To interpolate using curve fitting and identify the correlation between variables.
4. To estimate an unknown population parameter.
5. Design their experiment with the basic norms and test their design efficiency. It is useful to all the branches of engineering.

TEXT BOOKS:

1. Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press.
2. Probability and Statistics for Engineers by Richard A Johnson, Pearson Education.

REFERENCES:

1. Introduction to Probability by Charles M Grinstead, J Laurie Snell, American Mathematical Society.
2. Miller and John E. Freund, Probability & Statistics for Engineers, Prentice Hall of India.
3. Montgomery: Design and Analysis of Experiments, Wiley

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B.Tech-CHEM II-Year - I-Semester

L	T/P/D	C
0	3	1.5

FLUID MECHANICS LAB

COURSE OBJECTIVES:

1. To gain practical knowledge on the measurement of fluid flow and their characteristics at different operating conditions.
2. To determine experimentally the flow characteristics of fluids and also to determine the efficiency of the flow measuring devices and fluid transport machineries.
3. To investigate the discharge coefficients for orifice and venturi meters.
4. To examine the type and nature of flow using Reynold's apparatus.
5. To evaluate the friction losses in smooth and bend pipes.

Atleast TEN experiments out of the following TWELVE experiments should be performed.

1. Experiments on Reynolds Apparatus for determination of flow regime.
2. Determination of coefficient of discharge for orifice meter.
3. Determination of coefficient of discharge for Venturi meter.
4. Determination of coefficient of discharge for V-notch.
5. Determination of efficiency of a centrifugal pump.
6. Calibration of Rotameter.
7. Frictional losses in straight pipes and construction of fanning friction factor vs Reynolds number plot.
8. Frictional losses in bend pipes and construction of fanning friction factor vs Reynolds number plot.
9. Determine absolute viscosity of glycerol-water mixture.
10. To determine the pressure drop across the packed column.
11. Experiment on fluidization techniques and determination of
   (a) Minimum fluidization velocity;
   (b) Pressure drop profile
12. Experiment is to verify Bernoulli's theorem.

LIST OF EQUIPMENTS/MACHINES REQUIRED:

1. Reynolds apparatus
2. Orifice meter
3. Venturi meter
4. V-notch apparatus
5. Centrifugal pump
6. Rotameter
7. Set of straight pipes
8. Set of fittings in pipes
9. Cannon viscometer
10. Packed column apparatus
11. Fluidized column
12. Bernoulli's apparatus

COURSE OUTCOMES:

Students will be able to

1. Understand concepts on nature of fluids, pressure concepts and measurement of pressure by various experimental methods and by mathematical relations and enhancement of problem solving skills.
2. Understand clear concepts on flow of incompressible fluids in conduits and thin layers and friction factor variations with velocity and friction losses using Bernoulli's equations which will be demonstrated experimentally.
3. Determine viscosity using Cannon Fenske viscometer.
4. Determine terminal velocity of particles in a packed column.
5. Understand principles and working of various types of pumps, transportation and metering of fluids using various experimental techniques.

TEXTBOOK:

1. "Unit Operations in Chemical Engineering", W.L. Mccabe and J.C. Smith, 7^{th} Edition, McGraw Hill Publishing Co., 2004.

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0 3 1.5

MECHANICAL UNIT OPERATIONS LAB

COURSE OBJECTIVES: Students will able to

1. Develop a sound working knowledge on different types of crushing equipment's
2. Explain the laws of crushing using any size reduction equipment
3. Explain solid liquid separations
4. Explain particle sizes
5. Determine the density of materials

To enable the students to develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

(At least TEN experiments out of the following FOURTEEN experiments should be performed)

LIST OF EXPERIMENTS:

1. To determine the time of grinding in a ball mill for producing a product with 80 % passing a given screen.
Major equipment - Ball mill Apparatus, Sieve shaker, Different sizes of sieves, weighing balance.
2. To verify the laws of crushing using any size reduction equipment like crushing rolls or vibrating mills and to find out the working index of the material.
Major equipment – Jaw Crusher, Sieve shaker, Different sizes of sieves, Weighing Balance, Energy meter
3. To find the effectiveness of hand screening of a given sample by a given screen.
Major equipment - Vibrating Sieve shaker, Different sizes of sieves, Weighing Balance
4. To separate a mixture of oil into two fractions using froth flotation technique.
Major equipment - Froth flotation cell
5. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions.
Major equipment- Sedimentation apparatus
6. To determine the specific cake resistance and filter medium resistance of slurry in plate and frame filter press.
Major equipment - Plate and Frame filter press.
7. Verification of Stoke's law.
Major equipment – Stoke's law apparatus.
8. To take a representative sample from a bulk by two methods, Cone& Quartering and to find out the average size {volume-surface mean diameter} of the samples.
9. To find the size analysis of a given fine sample using beaker decantation method.
10. To verify the laws of crushing using any size reduction equipment like roll crusher find out the working index of the material.
– Roll Crusher, Sieve shaker, Different sizes of sieves, Weighing Balance, Energy meter.
11. To separate a mixture of particles by jigging
Major Equipment – Mineral Jig

12. To analyze a given powder for its particle size distribution. / Cumulative and Differential methods of particle size distributions

13. To calculate separation efficiency of particles in a mixture using cyclone separator.
    Major Equipment – Cyclone separator

14. To determine the bulk, tapped and true density along with the flow ability and porosity of a given fine sample

COURSE OUTCOMES: students will able to

1. Gain the practical knowledge and hands on various separation techniques like filtration, sedimentation, screening, froth flotation, and beaker decantation and size reduction operations.
2. Explain the energy for different size reduction equipment's.
3. Determine the efficiency of screens
4. Determine the viscosity of fluid using settling velocity method
5. Determine the average particle sizes

TEXT BOOK:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc Graw Hill 7th ed. 2004.

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B.Tech-CHEM II-Year – I-Semester	**L**	**T/P/D**	**C**
	2	**0**	**0**

ENVIRONMENTAL STUDIES

PREREQUISITES: Engineering Chemistry

COURSE OBJECTIVES:

1. To introduce the knowledge about Environment.
2. To introduce students to the concepts of pollution, Biodiversity
3. To develop an awareness about global Environmental problems.
4. To learn to protect environment and awareness on legal issues
5. To learn about importance of sustainable development and role of IT in environment.

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Ecosystems: Concept of an ecosystem – Classification, structure and function of different ecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids.

Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – II

Natural Resources: Renewable and non-renewable – Natural resources and associated problems: Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest and tribal people: Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources: Equitable use of resources for sustainable lifestyles.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of different kinds of pollution (Air, Water, Soil, Marine, Noise, Thermal, Nuclear, e –Waste)
Carbon Capture & Sequestration – different storage sources, major disadvantages, environmental effects
Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

UNIT – VI

Waste management technology: Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

Waste water and sewage treatment technology: primary, secondary and tertiary treatments. Bioremediation, Phyto-remediation, ZLD (zero liquid discharge), membrane technology. Application of GIS and GPS system in environmental science.

Environmental policy, Rules and regulations. EIA (Environmental Impact Assessment) & EMP (ENVIRONMENTAL Management Plan) – Environment Protection Act. - Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act - Wildlife Protection Act –Forest Conservation Act.-Public awareness. Global environmental problems and global efforts.

UNIT – V

Towards sustainable future: concept of sustainable development, threats of sustainability, population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources. Urban sprawl, sustainable cities and sustainable communities, human health. Role of IT in environment, environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

COURSE OUTCOMES:

1. Understand fundamental physical and biological principles that govern natural processes.
2. Understand fundamental concepts from the social sciences and humanities underlying environmental thought and governance.
3. Integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems
4. Communicate integrated perspectives on complex environmental problems in the form of written and oral argument to both professional and lay audiences.

5. Design and conduct independent research that contributes to environmental thought and/or problem solving.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha, University Press Private Limited, Reprinted in 2005.
2. Environmental Studies: From Crisis to Cure by R.Rajagopalan, Oxford University Press, 2nd Edition, 2005

REFERENCES:

1. Environmental Science: Towards a Sustainable Future by Richard T.Wright. PHL Learning Private Ltd .New Delhi, 2008
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela. PHI Learning Pvt. Ltd. 4th edition, 2008

ANURAG UNIVERSITY
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B.Tech-CHEM II-Year - II-Semester	L	T/P/D	C
	3	0	3

PROCESS HEAT TRANSFER

PREREQUISITE: Material and Energy Balance Computations, Engineering Physics

COURSE OBJECTIVES:

1. To learn about the basic concepts and laws of the three modes of heat transfer
2. To Determine heat transfer coefficients for forced and natural convection & concept of fouling
3. To analyze the heat transfer processes involved in boiling and condensation
4. To Analyze the heat radiation in detail
5. To perform basic calculations of common heat exchangers and evaporators

UNIT I:
Nature of heat flow, conduction, convection, natural and forced convection, radiation.
Heat transfer by conduction in Solids
Fourier's law , thermal conductivity, steady state conduction in plane wall & composite walls, compound resistances in series, heat flow through a cylinder, conduction in spheres, thermal contact resistance, plane wall: variable conductivity
Unsteady state heat conduction
Equation for one-dimensional conduction, Semi-infinite solid.

Unit- II:
Principles of heat flow in fluids
Typical heat exchange equipment, countercurrent and parallel current flows, energy balances, rate of heat transfer, overall heat transfer coefficient, , LMTD, variable overall coefficient, multi-pass exchangers, individual heat transfer coefficients, resistance form of overall coefficient, fouling factors, classification of individual heat transfer
coefficients, magnitudes of heat transfer coefficients, effective coefficients for unsteady-state heat transfer.
Natural convection
Natural convection to air from vertical shapes and horizontal planes, effect of natural convection in laminar-flow heat transfer,

Unit- III:
Heat Transfer to Fluids without Phase change
Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in laminar flow, heat transfer by forced convection in turbulent flow, the transfer of heat by turbulent eddies and analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids in forced convection outside tubes.
Heat transfer to fluids with phase change
Heat transfer from condensing vapors, heat transfer to boiling liquids.
Unit- IV:
Radiation heat transfer Introduction, properties and definitions, black body radiation, real surfaces and the gray body, absorption of radiation by opaque solids, radiation between

surfaces, radiation shielding, radiation to semi-transparent materials, combined heat transfer by conduction, convection and radiation

Unit- V: Heat exchange equipment
General design of heat exchange equipment, shell and tube heat exchangers, condensers, boilers and extended surface equipment, heat transfer in agitated vessels, scraped surface heat exchangers, heat transfer in packed beds,
Evaporators
Evaporators, performance of tubular evaporators, capacity and economy, multiple effect evaporators, Methods of feeding, vapour recompression.

COURSE OUTCOMES: Students will be able to
1. Apply the basic concepts and laws of the three modes of heat transfer
2. Determine heat transfer coefficients for forced and natural convection & concept of fouling
3. Analyze the heat transfer processes involved in boiling and condensation
4. Analyze the heat transfer through radiation in detail
5. Perform basic calculations of common heat exchangers and evaporators

TEXT BOOKS:
1. Unit Operations of Chemical Engineering, 7th ed., W.L. McCabe, J.C. Smith and P. Harriot, McGraw-Hill, New York, 2004

REFERENCES:

1. Heat transfer, 4th edition, J. P. Holman , McGraw-hill, New York,1976.
2. Heat transfer: Principles and Applications. B.K. Dutta, PHI Learning, India, 2004
3. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997

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B.Tech-CHEM - II-Year II-Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

CHEMICAL ENGINEERING THERMODYNAMICS-I

PREREQUISITES: Material & Energy Balance Computations, Engineering Physics

COURSE OBJECTIVES

1. Explain the concepts of internal energy, heat, and work and energy conversion.
2. Use equations of state, correlations and tables for real fluids.
3. Reiterate the laws of thermodynamics, and understand the practical implications of these laws in engineering design.
4. Calculate the efficiencies of expansion and compression for flow processes
5. Analyze processes involving power production, refrigeration, and liquefaction.

UNIT I

Introduction: The scope of thermodynamics, Dimensions and units, temperature and Zeroth Law of Thermodynamics, Force, volume, pressure, work, heat, Energy classifications- energy in transit, point and path properties, thermodynamic state and state functions, reversible and irreversible processes, equilibrium, The phase rule.

UNIT-II

The first law and other basic concepts: Joules Experiments; The first law of thermodynamics and Internal Energy; Energy balance for closed systems; enthalpy; constant-V and constant- P processes; heat capacity; Mass and energy balance for open systems.

Volumetric properties of pure fluids: The PVT behaviour of pure substances; virial equations of state; the ideal gas; applications of the virial equations; Cubic equations of state; generalized correlations for gases; generalized correlations for liquids.

UNIT-III

The second law of thermodynamics: Statements of the second law; heat engines; thermodynamic temperatures scales - thermodynamic temperature and the ideal gas scale; Entropy; Entropy changes of an ideal gas; mathematical statement of the second law; Entropy balance for open systems; calculation of ideal work and lost work; the third law of thermodynamics; entropy from the microscopic view point.

UNIT-IV

Thermodynamic properties of fluids: Property relations for homogeneous phases; residual properties; two phase systems; thermodynamic diagrams; tables of thermodynamic properties; generalized property correlation for gases.

Application of thermodynamics to flow processes: Duct flow of compressible fluids - pipe flow, nozzles, throttling process; turbines; compression processes – compressors and pumps;

UNIT-V

Production of power from heat: The steam power plant-the Rankine cycle; Internal combustion Engines- the otto engine, the diesel engine, the gas-turbine engine; Jet engines.

Refrigeration and liquefaction: The Carnot refrigerator; the vapor compression cycle; the comparison of refrigeration cycles; the choice of refrigerant; absorption refrigeration; the heat pump; liquefaction processes.

COURSE OUTCOMES: The student will be able to:

1. Identify, formulate and solve engineering problems in classical thermodynamics.
2. Apply mass and energy balances to closed and open systems and study the PVT behavior of pure substances.
3. Apply the laws of thermodynamics and estimate the heat and work requirements for Industrial Processes.
4. Evaluate thermodynamic properties of ideal and real mixtures and the efficiency of flow processes.
5. Analyze liquefaction, refrigeration and different power cycles.

TEXT BOOKS:

1. Smith, J.M., Van Ness, H.C and Abbott, M.M., MT SWIHART, "Introduction to Chemical Engineering Thermodynamics ", 8^{th} ed, Tata McGraw Hill., 2018.

REFERENCES:

1. M J Moran, H P Shapiro, D Boettner and M B Bailey, Principles of engineering Thermodynamics, 8^{th} Ed, Wiley.
2. Kyle, B.G., "Chemical and Process Thermodynamics", 3rd ed. "Pearson, Prentice Hall of India Pvt. Ltd., 1999.
3. K.V.Narayanan, Chemical Engineering Thermodynamics, Prentice Hall of India Pvt Ltd., 2009
4. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles, Part II ", Thermodynamics, John Wiley, 1970.
5. Dodge, B.F., " Chemical Engineering Thermodynamics ", McGraw-Hill, 1960

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B.Tech-CHEM II-Year - II-Semester	**L**	**T/P/D**	**C**
	2	**0**	**2**

INSTRUMENTATION& PROCESS ANALYTICS

PREREQUISITES: Engineering Physics, Engineering Chemistry

COURSE OBJECTIVES:

1. Utilization and importance of measuring different variable in process industry using relative equipment.
2. Emphasis on the knowledge of fundamentals and working principles of temperature sensing devices.
3. Analyze the relation between pressure, vacuum, and head and those relationships helps in measuring required variables in industry.
4. Organize the composition analysis of different kinds of compounds in pharmacy, Chemical and metallurgical industries.
5. Evaluation of the Liquid levels and type of flow meters used in chemical Industries.

UNIT -I
Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers.

UNIT-II
Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells and response of thermocouples. Thermal coefficient of resistance, industrial resistance thermometer bulbs and circuits, radiation receiving elements, types of pyrometer: radiation pyrometer, photoelectric and optical pyrometers.

UNIT-III
Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, Density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels, measurement of interface level, density measurement, and level of dry materials, Head flow meters, area flow meters, open channel meters

UNIT-IV
Composition analysis, spectroscopic analysis by absorption, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer, Recording instruments, indicating and signaling instruments, transmission of instrument readings, control center, instrumentation diagram, process analysis.

UNIT –V

Process Analytics: BOD, COD, In-Line Turbidity Measurement, Sulfur Analyzers, Process Mass Spectrometers, In-Line pH Measurement, Fluoride Detection, Chlorine Detection, In-Line Dissolved Oxygen Measurement, In-Line Conductivity Measurement

COURSE OUTCOMES: Students will be able to:

1. Comprehend of measuring instruments & its utilization based on element characteristics.
2. Develop the thermoelectricity and utilization of pyrometers.
3. Analyze Composition analysis instruments like gas chromatography etc.
4. Identify indicating elements for Pressure in liquids like corrosive liquids.
5. Evaluate the functioning of process analytics, role of control centre, instrumentation diagrams and its utilization.

TEXT BOOK:

1. Industrial Instrumentation by Donald P.Eckman, Wiley eastern, 1950.

REFERENCES:

1. Principles of industrial instrumentation by Patra Nabis, TMH 2010.
2. Instruments for measurements and control by Holbrock W.C. Van Nostrand East West.
3. Hand book Instrumentation, Considine, McGraw Hill, 1982.
4. Instrumentation for Process measurement and Control, Norman A. Anderson, 3rd Edition, CRC press, 1997.
5. Industrial instrumentation Principles and Design by Tattamangalam R.Padmanabhan, 2000.

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	L	T/P/D	C
B.Tech-CHEM II-Year - II-Semester	**3**	**0**	**3**

CHEMICAL TECHNOLOGY

PREREQUISITES: Engineering Chemistry-I & II, Mechanical Unit Operations

COURSE OBJECTIVES: The students will learn about

1. Inorganic Industries
2. Fertilizer industries
3. Organic Chemical Industries
4. Petrochemicals
5. Polymer Industries

The application of various unit process and unit operations involved in various chemical process industries.

UNIT- I

Inorganic Industries

Chlor-Alkali Industry-Manufacture of Soda ash, caustic soda and chlorine, Sulfur and sulfuric acid, Cement-Portland cement and Special cement.

Unit – II

Fertilizer industries

Nitrogen Industries: manufacturing and uses: Ammonia, Urea and Nitric acid.
Phosphorous Industries: manufacturing and uses of Phosphoric acid and Calcium Phosphate
Potash industries: Production of NPK fertilizers, potassium sulphate, potassium chloride

Unit – III

Organic Chemical Industries

Oils: Definition, constitution, extraction of vegetable oils, refining and hydrogenation of oils.
Soaps and Detergent, Carbohydrate- Sugar and Starch: Manufacture of cane sugar
Pulp and Paper Industry: Methods of pulping production of sulphates and sulphite pulp. Recovery of chemicals from black liquor

Unit – IV

Petrochemicals: Manufacture and uses of Formaldehyde, Acrylonitrile, Vinyl Acetate, ethanolamines and Aromatics.

Unit – V:

Polymer Industries: Introduction, Fibre-manufacturing of Nylon66, Plastic-manufacturing of Polyethylene, Polycondensation-production of Phenol formaldehyde, Elastomer-manufacturing of Rubber and Cellulosic – Rayon.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to:

1. Understand inorganic and organic chemical technologies.
2. Understand the synthesis methods of nitrogen industries
3. Understand engineering problems in chemical processes.
4. Study different methods and processes used in cement manufacture.
5. Understand the manufacturing processes of various petrochemicals.

TEXT BOOKS:

1. Shreve's Chemical Process Industries edited by Austin, McGraw-Hill.5th ed.1985.
2. Dryden's outlines of Chemical Technology, edited by M.Gopal Rao and M.Sittig, 2^{nd} ed. 1973.

REFERENCES:

1. Industrial Chemistry by B.K.Sharma
2. Hand book of industrial chemistry Vol 1&II K.H.Davis & F.S. Berner, edited by S.C. Bhatia, CBS publishers.

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B.Tech-CHEM II-Year - II-Semester

L	T/P/D	C
2	0	2

MATERIAL SCIENCE & ENGINEERING

PREREQUISITES: Engineering Chemistry-I

COURSE OBJECTIVES:
The objective of the course will be to give the students

1. An introduction on how to apply advanced sciences to various material systems
2. Categorize and understand different principles related to materials and systems relevant to Chemical Engineering in particular.
3. Importance of phase diagrams for studying properties of materials
4. The intent of the course will be to relate the underlying molecular structure of the materials to their physical and chemical properties, and their processing and performance characteristics.
5. Identify problems related to materials

UNIT-I
Introduction to materials, bonding between atoms: metallic bonding, ionic bonding, covalent bonding, Van der Waals bond, Role of materials selection in design, structure-property relationships
Miller indices of directions and planes, packing of atoms inside solids, close-packed structures,

UNIT-II
Crystal Imperfections: Imperfections in solids: vacancies, equilibrium concentration of vacancies, interstitial and substitutional impurities in solids, dislocations, types and characteristics of dislocations, interfacial defects, stacking faults.
Strength of Materials: Yield strength, tensile strength, elastic modulus and ductility of materials, stress strain behavior of metals, ceramics and polymers, creep behavior and fatigue

UNIT-III
Basic thermodynamic functions; phase diagrams and phase transformation: Primary and binary systems-general types with examples; tie line & lever rules, non-equilibrium cooling. Phase transformations in Fe-Fe_3C steels, Time-Temperature-Transformation (TTT) curves for eutectoid steels and plain carbon steels; effect of alloying elements on properties of steels; types of steels.

UNIT-IV
Semi-crystalline materials: Classification, structure and configuration of ceramics, polymers, copolymers, liquid crystals and amphiphiles
Non-crystalline/amorphous materials: Silicates, glass transition temperature, viscoelasticity

Polymer composites (FRP) Fiber reinforced composite, Polymer Nano-composite materials: Nanocomposites, role of reinforcement-matrix interface strength on composite behavior, material related to catalyst such as zeolites, silica etc. and other selected materials

UNIT-V

Corrosion & Degradation of material**s**

Introduction to experimental techniques: XRD, etc. for material characterization highlighting links between molecular structure and macroscopic properties, tensile test, GPC, Microscopy, SEM.

COURSE OUTCOMES:

1. Analyze & apply advanced science and engineering principles to materials systems.
2. Categorize the scientific and engineering principles underlying the major elements of the field related to materials & systems appropriate to the field.
3. Analyze and apply concepts of Phase diagrams for studying properties of materials
4. Able to apply and study the microstructure, properties, processing and performance of materials
5. Able to formulate plans to solve problems related to materials.

TEXT BOOKS:

1. William D. Callister, David G. Rethwisch Materials Science and Engineering: An Introduction, Wiley Publisher.

2. Raghavan Materials Science and Engineering: A First Course, 5th Edition Prentice Hall India, 2004.

REFERENCES:

1. R. A. L Jones, Soft Condensed Matter, Oxford University Press, 2002.

2. S. Upadhyaya & A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007.

3. B. S. Mitchell an Introduction to Materials Engineering and Science for Chemical and Materials Engineers, John Wiley & Sons, 2004.

4. Callister, Material Science and Engineering adopted by R Bala Subramaniam, 2ed.,2019.

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B.Tech-CHEM II-Year - II-Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

TECHNOLOGY OF PHARMACEUTICALS AND FINE CHEMICALS

PREREQUISITES: Engineering Chemistry-I

COURSE OBJECTIVES

Students will learn about

1. Grading of chemicals which play a very important role in understanding the standards and impurities present in different chemicals by limit test
2. Process manufacturing of few pharmaceutical drugs and fine chemicals,
3. Formulations of different pharmaceutical dosage forms like tablets and capsules.
4. Different methodologies in extraction and sterilization.
5. Importance of pharma packaging.

Unit I:
A brief outline of grades of chemicals, sources of impurities in chemicals.
Limit test, principles of limit test for arsenic, lead, iron, chloride and sulfate in Pharmaceuticals.

Unit II:
Outlines of Preparation, properties, uses and testing of the following Pharmaceuticals - sulfacetamide, paracetamol, riboflavin, nicotinamide, Penicillin, Asprin, Cephalosporins – Erythromycin-Prednisolone. Outlines of Preparation, properties, uses and testing of the following fine chemicals - Methyl orange, fluorescence, procaine hydrochloride, paramino salicylic acid, isonicatinic acid hydrazide, Pthallic Anhydride.

Unit III:
Brief on different drug delivery systems (tablets, capsules, injections, topical applications etc). Tablet making and coating, granulation equipment, packaging and preparation of capsules, extraction of crude drugs.

Unit IV:
Sterilization: Introduction, methods of sterilization, heat (dry and moist), heating with bactericide, filtration, gaseous sterilization and radiation sterilization, suitable examples to be discussed.

Unit V:
Introduction to Packaging, Classification of Packaging, Essential Requirements, Functions of Packaging, Importance / significance of Pharma Packaging, Properties of Ideal Package, Packaging formats in Pharma Industry, Packaging recycling symbols, FDA Definitions, Introduction to Packaging materials, Classification, New Trends in the pharmaceutical packaging, Various materials and pharma Packaging,

COURSE OUTCOMES: The Student will be able to:

1. Identify impurities in different chemicals and set them according to standards.
2. Transforming raw materials into useful pharmaceutical and fine chemical products with commercial interest through systematic use of engineering concepts and methods.
3. Formulate and develop, use of excipients in tablets, capsules and coating techniques.
4. Get exposed to extraction and sterilization techniques in pharmaceuticals.
5. Classify various materials used in Pharma packaging industry.

TEXT BOOKS:

1. Bently's TEXT BOOK of Pharmaceutics by H A Rawlins, B Tindell and Box, 8th ed. OU Press, London, 1977.
2. Remington's Pharmaceutical Science, Mac publishing company, 13th ed. 1965.

REFERENCES:

1. Text Book of Pharmaceutical Chemistry by Bently and driver. Oxford University press, London, 8th ed. 1960.

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B.Tech-CHEM II-Year - II-Semester **L T/P/D C**

3 0

3

CORROSION ENGINEERING

PREREQUISITES: Engineering Chemistry-I

COURSE OBJECTIVES:

1. To introduce the principles of corrosion, material selection, and metallurgical aspects.
2. To introduce different types of corrosion and factors affecting them.
3. To introduce different methods of corrosion testing procedures.
4. To learn different protection measures against corrosion.
5. To enable students to understand the thermodynamics involved in corrosion.

UNIT – I

Introduction: Corrosion principles, Types of Corrosion, Acid Theory, Dry chemical corrosion, Wet theory or Electrochemical Theory, Electro- chemical aspects of Corrosion, -environmental effects, Pilling Bedworth Rule, Metallurgical aspects- corrosion rate expressions- methods of estimation of corrosion rates, Passivity.

UNIT –II

Types of corrosion: Forms of corrosion, uniform attack, galvanic corrosion, Examples of galvanic corrosion, Factors affecting galvanic corrosion, Crevice corrosion, Types of Crevice corrosion, pitting Corrosion: Principle and Theory, inter —granular corrosion, Knife line attack, selective leaching: Dezincification and Graphitization, Cavitation damage, Fretting Corrosion.

UNIT – III

Erosion- corrosion and some case studies, Factors affecting erosion- corrosion, stress corrosion cracking and Factors affecting stress corrosion.

Corrosion Testing procedures: Introduction, Purpose of Testing, Steps involved in Corrosion testing, Standard expression for corrosion rate, NACE test, Slow stain rate test, Linear Polarization, Paint test, Seawater test, In vivo corrosion test (Field test).

UNIT – IV

Protection against Corrosion: Material selection, alteration of environment, Use of inhibitors, Protection by proper Designing, Modification of the properties of the metal, Cathodic Protection and Anodic Protection Units, Use of protective coatings -organic and inorganic coatings, Methods of application of metallic coatings, cladding. Introduction to FRP’s(Fibre reinforced plastics), Properties and applications of FRP’s.

UNIT–V:

Modern Theory: Principle, Thermodynamics: Free energy, Cell Potential, SHE and EMF series, Application of Thermodynamics to corrosion, Pourbaix Diagram. Electrode Kinetics: Exchange current density, Activation Polarization, Concentration Polarization, Combined Polarization, Mixed electrodes, Passivity with modern aspects.

Predicting corrosion behavior: Effect of oxidizers, Velocity effects, galvanic coupling, Alloy evaluation. Corrosion prevention: Anodic Protection and Noble-Metal Alloying.

COURSE OUTCOMES: The student will be able to

1. Understand electrochemical fundamentals.
2. Understand different types of corrosion.
3. Understand different corrosion testing procedures.
4. Understand corrosion preventing methods.
5. Apply thermodynamic principles to corrosion.

TEXT BOOKS:

1. Corrosion Engineering, 3rd ed., M.G. Fontana, Tata Mc Graw Hill, 2005.

REFERENCES:

1. Corrosion and Corrosion Control, H.H Uhlig, Wiley, 3rd edition, 2011.
2. Handbook of Corrosion Engineering, Pierre Roberge, Mc Graw- Hill, New York, 2000

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	3	**0**	**3**

POLYMER SCIENCE & ENGINEERING

PREREQUISITES: Engineering Chemistry-I & II

COURSE OBJECTIVES:

1. Explain basic polymerization techniques
2. Use polymerization techniques for producing a polymer product
3. Characterize and Test the polymers
4. Demonstrate Polymer Rheology
5. Apply suitable processing techniques and explore advanced polymers

UNIT-I:

Introduction; Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubbery-ness, polymerization methods: addition and condensation; their kinetics, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, techniques for copolymerization-bulk, solution, suspension, emulsion and interfacial.

UNIT-II:

Synthesis & Properties:

Thermoplastics: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers. Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluoropolymers Thermosetting polymers: PF, MF, UF, Epoxy, Unsaturated polyester, Alkyds. Natural and synthetic rubbers: Recovery of NR hydrocarbon from latex, SBR, Nitrile, CR, CSM, EPDM, IIR, BR, Silicone, TPE.

Polymerization reactors types and mode of operation, Polymerization reactor design, control of polymerization, Post polymerization unit operations and unit processes

UNIT-III

Polymer Characterization and Testing:

Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights, polymer crystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques. Impact, flexural tensile testing methods of polymers, Mechanical Properties of Polymers, ASTM and ISO methods for testing of polymers.

UNIT-IV

Polymer Rheology:

Flow of Newtonian and non-Newtonian fluids, different flow equations, dependence of shear modulus on temperature, molecular/segmental deformations at different zones and transitions. Measurements of rheological parameters by capillary rotating, parallel plate, cone-plate rheometer. control of rheological characteristics through compounding, rubber curing in parallel plate viscometer.

UNIT-5

Polymer Processing:

Polymer processing: Extrusion process, Twin and Single Screw extrusion, Blow moulding, injection moulding, Wet and Dry spinning processes, thermo set moulding. Processing of polymer nanocomposites.

Speciality Polymers:

Polymer alloys, polymer eutectics, plastic-plastic, rubber-plastic and rubber-rubber blends. High Performance and Specialty Polymers, Polymer additives, compounding. Fillers, plasticizers, lubricants, colorants, UV stabilizers, fire retardants and antioxidants.

COURSE OUTCOMES: The student will be able to

1. Understand basic polymerization techniques
2. Apply polymerization technique for a polymer product
3. Characterize and Test the polymers
4. Analyse Rheology of Polymers
5. Select suitable processing techniques and explore advanced polymers

TEXTBOOKS:

1. Fried J R, Polymer Science and Technology, Prentice Hall of India Pvt. Ltd., New Delhi, Eastern Economy Edition, 2000.
2. R. Sinha, Outlines of Polymer Technology: Manufacture of Polymers, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
3. Kumar A, and Gupta S K, Polymer Fundamentals of Polymer Science and Engineering, Marcel Dekker, Inc, New York, 1997.

REFERENCES:

1. Premamoy Ghosh, Polymer Science and Technology, Tata McGraw Hill Publishing Company, New Delhi, 3rd Edition, 2010.
2. George Odian, Principles of Polymerization, John Wiley & Sons, Inc., 2004

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B.Tech-CHEM II-Year - II-Semester	**L**	**T/P/D**	**C**
	0	**2**	**1.0**

PROFESSIONAL SKILLS LAB

Introduction:

The world needs skilful employees who can contribute towards organizational growth. The professionals are expected to be confident and maintain amicable relations with clients and customers. With this backdrop, this course helps the students understand the importance of various aspects of professional life.

The course aims at making the students familiar with the corporate world and grooms them accordingly. This course is designed to improvise communication principles, interpersonal communication and public speaking of learners.

COURSE OBJECTIVES:

1. To prepare the students to understand and acquire different personality traits
2. To mould the students for global challenges and international careers
3. To excel the students in areas of self - management and ethics at workplace.

EXCERCISE- I

Self – Improvement:

Self Esteem - SWOT Analysis – Attitude - Image Matters

EXCERCISE – II

Communication Essentials:

Communication Basics - Barriers to Communication - Listening Skills - Communication Styles - Fitting in and Getting Along - Communicating Electronically

EXCERCISE – III

Work Skills:

Self - Management Tools - Efficient Work Habits - Our Diverse Society - Understanding Other Cultures - Fairness in the Workplace - Right and Wrong in the Workplace

EXCERCISE – IV

Leadership Skills:

What Makes a Leader - Empowering and influencing others - Leading change and Innovation

EXCERCISE - V

Career Planning:

Analyse your interest and qualifications - Networking and other sources of Job Leads - Job Search Documents - the Job Interview - Planning your Career - Networking - It never stops

Minimum Requirement of infra structural facilities for Professional Skills Lab:

A Spacious room with movable chairs, a Public Address System etc.

COURSE OUTCOMES:

1. Apply the learning from the class in day-to-day life
2. Manage and Implement their expertise in personal and professional life
3. Evaluate their learning every day and enhance the requisite skills

REFERENCES:

1. Carneige, Dale. How to win friends & Influence People. Maanu Graphics Publishers.
2. Covey, Stephen. Seven Habits of Highly Effective People. New York: Simon and Schuster, Inc., 1989.
3. Peale, Norman. V. The Power of Positive Thinking. New York: Simon and Schuster, 2002.
4. Sharma, Robin. The Monk Who Sold His Ferrari. Jaico.
5. Wallace, Masters. Personal Development for Life and Work. CENGAGE Learning.

ANURAG UNIVERSITY
Department of Chemical Engineering

B.Tech-CHEM II-Year - II-Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

PROCESS HEAT TRANSFER LAB

COURSE OBJECTIVES:

1. To calculate of the thermal conductivity.
2. To Calculate of heat transfer coefficient for natural convection.& Forced Convection
3. To determine of emissivity of a test plate.
4. To Determine Stefen Boltzmann constant
5. To Determine overall heat transfer coefficient in heat exchanger

(At least TEN experiments out of TWELVE should be performed)

1. Determination of total thermal resistance and thermal conductivity of composite wall
   Major equipment-Composite wall Assembly
2. Determination of thermal conductivity of metal rod.
   Major equipment-Thermal conductivity apparatus
3. Determination of natural convection heat transfer coefficient for a vertical tube.
   Major equipment-Natural convection heat transfer apparatus.
4. Determination of critical heat flux point for pool boiling of water.
   Major equipment-Pool boiling apparatus
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe.
   Major equipment-Forced convection heat transfer apparatus
6. Determination of overall heat transfer coefficient in double pipe heat exchanger.
   Major equipment-Double pipe heat exchanger apparatus
7. Study of the temperature distribution along the length of a pin-fin under natural and forced convections.
   Major equipment-Pin-fin apparatus
8. Determination the heat transfer through concentric spheres.
   Major equipment: concentric sphere Apparatus.
9. Determination of Stefan-Boltzmann constant.
   Major equipment-Stefan-Boltzmann apparatus
10. Determination of emissivity of a given plate at various temperatures.
    Major equipment-Emissivity determination apparatus.
11. Determination of Capacity and Economy by Single Effect Evaporator
    Major Equipment- Evaporator.
12. Determine the heat transfer coefficient in the agitated vessel system.
    Major Equipment: Agitated Vessel Apparatus

COURSE OUTCOMES: The student will be able to:

1. Calculate the thermal conductivity.
2. Calculate heat transfer coefficient for natural convection.& Forced convection
3. Determine of emissivity of a test plate.
3. Determine Stefen Boltzmann constant.
4. Determine overall heat transfer coefficient in heat exchanger.

TEXT BOOKS:

1. Unit Operations of Chemical Engineering, 7th ed., W.L. McCabe, J.C. Smith and P. Harriot, McGraw-Hill, New York, 2004

REFERENCES:

1. Heat transfer, 4th edition, J. P. Holman , McGraw-hill, New York,1976.
2. Heat transfer: Principles and Applications. B.K. Dutta, PHI Learning, India, 2004
3. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997

ANURAG UNIVERSITY
Department of Chemical Engineering

B.Tech-CHEM II-Year - II-Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

CHEMICAL TECHNOLOGY LAB

PREREQUISITES: Engineering Chemistry-I & II

COURSE OBJECTIVES:

3. To learn analytical experimental methods.
4. To understand principles and concepts.
5. To plan experiments and operate sophisticated instruments.
6. To analyse and interpret experimental data.
7. To handle experiment with all safety measures needed

(At least TEN experiments out of FIFTEEN should be performed)

LIST OF EXPERIMENTS:

1. Estimation of Ferrous ion (II) using standard potassium dichromate solution.
2. Estimation of Copper (II) using standard sodium thiosulphate.
3. Estimation of Borax solution using Hcl.
4. Estimation of dissolved oxygen in water.
5. Estimation of Calcium ions in water.
6. Solubility tests in vegetable oils.
7. Estimation of Formaldehyde in formalin solution.
8. Estimation of Glucose.
9. Preparation of Nitro-benzene.
10. Preparation of Meta dinitro benzene.
11. Preparation of Acetanilide.
12. Determination of λ_{max} of solution & verify Beer's law by finding out the concentration of unknown solution.
13. Synthesis of Aspirin.
14. Preparation of pulp and paper by standard methods.
15. Cement manufacture from calcium carbonate.

COURSE OUTCOMES: The Student will be able to:

1. Explain and select instrumental techniques for analysis.
2. Plan experiments and operate several specific instruments.
3. Analyse and interpret the experimental data.
4. Develop and apply preparation methodologies for various products
5. Understand the importance of safety and hazard management during chemical operations.

TEXT BOOKS:

1. Harris C. H., “Quantitative chemical analysis”, 7th Ed., W. H. Freeman, New York, 2006.
2. Willard H. H., and Meritt, L. L., “Instrumental methods of Analysis”, 7th Ed., ACS Publications, 1989.

REFERENCES:

2. Skoog A. D., Holler, F. J., Stanley, R. C., “Principles of Instrumental Analysis”, 7th Ed., Brookes Cole, 1997.
3. S. K. Bhasin and Sudha Rani, “Laboratory manual in engineering chemistry”, Dhanpathrai Pub. Company, 2009.

COURSE STRUCTURE

B. Tech Chemical Engineering with Honors in GREEN TECHNOLOGY AND SUSTAINABILITY ENGINEERING

ANURAG UNIVERSITY
BRANCH: CHEM B. TECH-2020

COURSE STRUCTURE

S. NO.	COURSE TITLE	L	T	PW	YEAR	CREDITS
1	Fuel Cell Technology and Batteries	3	0	0	III-I	3.0
2	Project Work	0	0	12	III-II	6.0
	Total	**03**	**00**	**12**		**9.0**

S. No.	Course Title	Source	No. of Weeks	Credits	Links	Institution	Discipline
1(cluster1)	Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts	NPTEL	12	3	https://nptel.ac.in/courses/127/105/127105018/	IIT-Kharagpur	Civil Engineering
	Sustainable Engineering Concepts and Life Cycle Analysis	NPTEL	8	2	https://nptel.ac.in/courses/105/105/105105157/	IIT-Kharagpur	Civil Engineering
2	Waste to Energy Conversation	NPTEL	8	2	https://nptel.ac.in/courses/103/107/103107125/	IIT-Roorkee	Chemical Engineering
3	Technologies for Clean and Renewable Energy Production	NPTEL	8	2	https://nptel.ac.in/courses/103/107/103107157/	III-Roorkee	Chemical Engineering
4(cluster 2)	Advanced Green Manufacturing Systems	NPTEL	12	3	https://nptel.ac.in/courses/110/104/110104119/	IIT-Kanpur	Management

	Sustainability Through Green Manufacturing Systems: An Applied Approach	NPTEL	8	2	https://nptel.ac.in/courses/112/104/112104225/	IIT-Kanpur	Mechanical Engineering
	Sustainable Materials and Green Buildings	NPTEL	12	3	https://nptel.ac.in/courses/105/102/105102195/	IIT-Delhi	Civil Engineering
5	Organic Farming for Sustainable Agricultural Production	NPTEL	8	2	https://nptel.ac.in/courses/126/105/126105014/	IIT-Kharagpur	Department of Agricultural and Food Engineering
6	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	NPTEL	8	2	https://nptel.ac.in/courses/103/103/103103206/	IIT-Guwahati	Chemical Engineering
7	Energy Resources Economics and Environment	NPTEL	12	3	https://nptel.ac.in/courses/109/101/109101171/#	IIT-Bombay	Department of Energy Science and Engineering
8(cluster 3)	Strategies for Sustainable Design	NPTEL	8	2	https://nptel.ac.in/courses/124/106/124106157/#	IIT-Hyderabad	Department of Design & Department of Climate change
	System Design for Sustainability	NPTEL	12	3	https://nptel.ac.in/courses/107/103/107103081/#	IIT Guwahati	Department of Design Engineering
9	Energy Resources and conversion processes	NPTEL	15	4	https://onlinecourses.swayam2.ac.in/nou20_cs09/preview	Indira Gandhi National Open University	Computer science and engineering

Note:

1. The student should opt any one course given in the clusters of subjects. i. e, she /he cannot choose more than one from the given cluster and claim for credits.
2. It is mandatory for the student to acquire 18-20 additional credits to get the Honor degree as per AICTE guidelines.
3. 50% courses will be offered and delivered by the Dept. Remaining courses shall be offered in online mode. Project work is included in the offline courses

ANURAG UNIVERSITY

B.Tech-CHEM III-Year - I-Semester **L T/P/D C**
3 0 3

FUEL CELL TECHNOLOGY AND BATTERIES

Unit-I: Overview of Fuel cells: what is a fuel cell, brief history, classification, how does it work, why do we need fuel cells, Fuel cell basic chemistry and thermodynamics, heat of reaction, theoretical electrical work and potential, theoretical fuel cell efficiency.

Unit-II: Fuels for Fuel Cells: Hydrogen, Hydrocarbon fuels, effect of impurities such as CO, S and others. Fuel cell electrochemistry: electrode kinetics, types of voltage losses, polarization curve, fuel cell efficiency, Tafel equation, exchange currents.

Unit-III: Fuel cell process design: Main PEM fuel cell components, materials, properties and processes: membrane, electrode, gas diffusion layer, bi-polar plates, Fuel cell operation conditions: pressure, temperature, flow rates, humidity. Fuel processing: Direct and in-direct internal reforming, reformation of hydrocarbons by steam, CO_2 and partial oxidation, Direct electro-catalytic oxidation of hydrocarbons, carbon decomposition, Sulphur tolerance and removal, Using renewable fuels for SOFCs.

Unit-IV: Batteries: Principles of operation, electrochemical principles and reactions battery electrolytes factors affecting battery performance. Primary batteries: introduction, Zinc-carbon batteries, Magnesium and Aluminum batteries, Lithium Primary batteries and Alkaline-Manganese batteries.

Unit-V: Secondary batteries: introduction, Lead-Acid batteries, Iron electrode batteries, industrial and aerospace Nickel-cadmium batteries and Lithium – Ion batteries and applications of batteries.

TEXT BOOKS:

1. Hoogers., Fuel Cell Technology Hand Book, CRC Press, 2003.
2. Karl Kordesch & Gunter Simader, Fuel Cells and Their Applications, VCH Publishers,
3. NY, 2001.
4. F. Barbir, PEM Fuel Cells: theory and Practice, 2nd ed, Elsevier/Academic Press, 2013.
5. Linden, D.; Reddy, T.B , Handbook of Batteries, McGraw-Hill, 2002
6. Ronald Dell, David Anthony James Rand, Understanding Batteries, Royal Society of Chemistry, 2001

REFERENCES:

1. Subhash C. Singal and Kevin Kendall, High Temperature Fuel Cells: Fundamentals, Design and Applications, 2003.
2. O'Hayre, R. P., S. Cha, W. Colella, F. B. Prinz, Fuel Cell Fundamentals, Wiley, NY 2006.

COURSE STRUCTURE

B. Tech Chemical Engineering with Minors in MATERIAL SCIENCE AND ENGINEERING

ANURAG UNIVERSITY
BRANCH: B. TECH CHEM -2020

COURSE STRUCTURE

S. NO.	COURSE TITLE	L	T	P	YEAR	CREDITS
1	Material Characterization	3	1	0	II-II	4.0
2	Introduction to Composites	3	1	0	III-I	4.0
3	Material Science and Engineering Lab	0	0	3	III-II	1.5
	Total	**06**	**02**	**3**		**9.5**

Sr. No.	Course Title	Source	No. of Weeks	Credits	Links	Discipline	Institute
1. (Cluster -I)	Introduction to Material Science and Engineering	NPTEL	12	3	https://nptel.ac.in/courses/113/102/113102080/	Metallurgy and Material Science	IIT Delhi
	Basics of Materials Engineering	NPTEL	12	3	https://swayam.gov.in/nd1_noc20_me78/preview	Mechanical Engineering	IIT Madras
	Materials Science and Engineering	NPTEL	8	2	https://onlinecourses.nptel.ac.in/noc20_mm09/	Metallurgy and Material science & Mining Engineering	IIT Roorkee
2	Physics of Materials	NPTEL	40 lectures	--	https://nptel.ac.in/courses/113/106/113106040/	Metallurgy and Material Science	IIT Madras

3	Fundamentals of Material Processing -I	NPTEL	8	2	https://nptel.ac.in/courses/113/104/113104073/	Metallurgy and Material Science	IIT Kanpur
4	Corrosion Part-I	NPTEL	8	2	https://nptel.ac.in/courses/113/104/113104082/	Metallurgy and Material Science	IIT Kanpur
5 (Cluster -II)	Nanotechnology, Science & Applications	NPTEL	8	2	https://nptel.ac.in/courses/113/106/113106093/	Metallurgy and Material Science	IIT Madras
	Structural analysis of Nano-materials	NPTEL	4	1	https://nptel.ac.in/courses/113/107/113107081/	Metallurgy and Material Science	IIT Roorkee
6	Advanced Materials & Processes	NPTEL	12	3	https://nptel.ac.in/courses/113/105/113105081/	Metallurgy and Material Science	IIT Kharagpur
7	Electrochemical technology in pollution control	NPTEL	8	2	https://nptel.ac.in/courses/103/108/103108162/	Chemical Engineering	IISc Bangalore
8	Fundamentals of Electronic materials and devices	NPTEL	8	2	https://nptel.ac.in/courses/113/106/113106065/	Metallurgy and Material Science	IIT Madras
9	Phase transformations and Heat treatment	NPTEL	31 lectures	--	https://nptel.ac.in/courses/113/101/113101003/	Metallurgy and Material Science	IIT Bombay
10 (Cluster - III)	Science & Technology of Polymers	NPTEL	48 hours	--	https://nptel.ac.in/courses/113/105/113105028/	Metallurgy and Material Science	IIT Kharagpur
	Polymers: Concepts, Properties, Uses and Sustainability	NPTEL	12	3	https://swayam.gov.in/nd1_noc20_ch41/preview	Chemical Engineering	IIT Madras
11	Fuels, Refractory and Furnaces	NPTEL	42 hours	--	https://nptel.ac.in/courses/113/104/113104008/	Metallurgy and Material Science	IIT Kanpur
12	Dealing with	NPTEL	12	3	https://nptel.ac.in/courses/113/	Metallurgy	IIT

	Materials Data: Collection, Analysis and Interpretation				101/113101096/	and Material Science	Bombay
13	Solar Photovoltaics-Principles, Technologies & Materials	NPTEL	8	2	https://nptel.ac.in/courses/113/104/113104084/	Physics	IIT Roorkee
14	Dynamic Behaviour of Materials	NPTEL	12	3	https://swayam.gov.in/nd1_noc20_me89/preview	Mechanical Engineering	IIT Guwahati
15	Surface Engineering of Nanomaterials	NPTEL	8	2	https://onlinecourses.nptel.ac.in/noc20_mm10/	Metallurgy and Material Science	IIT Roorkee
16	Carbon Materials and Manufacturing	NPTEL	12	3	https://nptel.ac.in/courses/113/106/113106099/	Metallurgy and Material Science	IIT Mandi
17	Properties of Materials (Nature and Properties of Materials : III)	NPTEL	8	2	https://onlinecourses.nptel.ac.in/noc20_mm13/	Metallurgy and Material Science	IIT Kanpur
18	Diffusion in Multicomponent Solids	NPTEL	12	3	https://onlinecourses.nptel.ac.in/noc20_me28/	Metallurgy and Material Science	IIT Kanpur
19	Non - Metallic Materials	NPTEL	12	3	https://onlinecourses.nptel.ac.in/noc21_mm14/preview	Metallurgy and Material science & Mining Engineering	IIT Kharagpur

Note:

1. The student should opt any one course given in the clusters of subjects. i.e, she /he cannot choose more than one from the given cluster and claim for credits.
2. It is mandatory to complete one course given in the cluster-I as a pre-requisite before going for any other course. If completed in their regular curriculum it can be omitted.
3. It is mandatory for the student to acquire 18-20 additional credits to get the Honor degree as per AICTE guidelines.
4. 50% courses will be offered and delivered by the Dept. Remaining courses shall be offered in online mode. Project work is included in the offline courses

ANURAG UNIVERSITY

B.Tech-CHEM II-Year - II-Semester **L T/P/D C**

3 1 4

Course Name: Materials Characterization

Syllabus

Unit I
Introduction to materials and Techniques, Chemical bonding, fundamentals of crystallography, reciprocal lattice, X ray diffraction, diffraction theory, atomic scattering factor, integrated intensity of diffracted beams, temperature factor, line broadening.

Unit II
Techniques: Laue, powder & rotating crystal technique; mode of bonding, crystal types, density of packing, atomic stacking, inter-atomic voids, coordination polyhedron, Pauling's rules, symmetry elements, space & point groups, group theoretical formulation. Phase identification, indexing and lattice parameter determination, Analytical line profile fitting using various models.

Unit III

Neutron diffraction; Reflection High energy electron Diffraction (RHEED), Low energy Electron Diffraction (LEED), Introduction to Microscopes, Optical microscopy (OM), Transmission Electron Microscopy (TEM); Basic Electron scattering, Concepts of resolution, TEM instruments, Various imaging modes, Analysis of micrographs, Electron Energy Loss Spectroscopy.

Unit IV
Scanning Electron Microscopy, Rutherford backscattering spectrometry, Atomic Force Microscopy, Scanning Probe Microscopy. UV-VIS spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy.

Unit V
Thermal analysis tools, Thermometry and dilatometry, calorimetry, differential scanning calorimetry (DSC), DTA, Temperature modulated calorimetry, Thermomechanical analysis, DMA and DETA, Thermogravimetry.

Textbooks and Reference:
1. Materials Characterization Techniques, S Zhang, L. Li and Ashok Kumar, CRC Press (2008)
2. Elements of X-Ray Diffraction, B. D. Culity (Addison Wesley)
3. Physical Methods for Metal Characterization, Pej Flewitt (Institute of Physics Pub.)

ANURAG UNIVERSITY

B.Tech-CHEM III-Year - I-Semester **L T/P/D C**

3 1 4

Course Name: Introduction to Composites

Syllabus

Unit I

Introduction, terminology, engineering properties, Basics of composite materials, Different type of Fibers

Unit II

Matrix materials, Short fiber composites, Theories of Stress transfer, Orthotropic lamina

Unit III

Concept of Tensor, General Anisotropic material, Specially Orthotropic material under plane stress, Stress- Strain transformation

Unit IV

Strain displacement relations, Relations for stress and strain along thickness of laminate, Composite laminates and Failure initiation in composite laminates

Unit V

Quasi-isotropic laminates, Maximum Stress and Strain theory, Application of Composites

Textbook:

1. Analysis & Performance of Fiber Composites: Bhagwan D. Agarwal & Lawrence J. Broutman.

c) Minutes of the BoS in Civil Engineering

Minute of the 3rd Board of Studies Meeting

Held on 27th March 2021 virtually

Minutes of the 3rd Board of Studies (BoS) meeting in Civil Engineering was held virtually on Saturday, 27th March 2021 at 3:00 PM in the conference hall of C-block. The following members were present.

S. No	Name of the Members	Position
1	Dr. K. R. C. Reddy, Professor, AU.	Chairman
2	Dr. B. Narender, Assoc. Professor & HOD, AU.	Member
3	Dr. R. Pradeep Kumar, Professor, IIIT Hyd.	Member
4	Dr. K. Srinivasa Raju, Professor BITS Pilani- Hyd.	Member
5	Dr. P. Rajasekhar, Professor, OU, Hyd.	Member
6	Mr. Ravikanth Chittiprolu, Entrepreneur, Hyd.	Member
7	Dr. P. Pradeep Kumar, Assoc. Professor, AU	Member
8	Dr. K. Madhusudan Reddy, Assoc. Professor, AU	Member
9	Mr. K. Saibaba, Assoc. Professor, AU	Member
10	Dr. K. J. N. Sai Nitesh, Asst. Professor, AU	Member
11	Dr. Radhika K S, Asst. Professor, AU	Member
12	Dr. Sambit Kumar Beura, Asst. Professor, AU	Member
13	Dr. Hemanth Kr. Chinthapalli, Asst. Professor, AU	Member
14	Mr. Naveen Kr. Chaturvedi, Asst. Professor, AU	Member
15	Mr. Basavaraj Ashok B Patil, Asst. Professor, AU	Member
16	Mr. D. Rahul, Alumni, 2014 Batch	Member

The chairman has welcomed all the members andpresented the outline of the agenda of the meeting. As per the agenda item wise the draft copies were presented for the discussion and their comments were noted and the minutes of the meeting are presented below.

Item I: B. Tech. Programme Course Structure:

1. The BOS members have expressed satisfaction with draft copy of the Course Structure with a suggestion to changes of names of few courses.
   Resolution: Names of few courses have been done as per the suggestion.

2. The members have suggested to shifting of the Technical Seminar from IV year to III year
   Resolution: The decision is left to the Central committee of the University.

Item II: B. Tech. II Year Syllabus:

1. The BOS members have expressed satisfaction with draft copy of the syllabus of II Year Courses with minor corrections at few places
2. **Resolution:** The suggested changes have been incorporated and finalized the syllabus.

Item III: B. Tech. with Honors/Minor:

1. The members have satisfied with the basket of courses that have been listed for the award of the additional degree.

Item IV: M. Tech. Programme Course Structure:

1. The BOS members have accepted the draft copy of the course structure as it is, however they suggested to take up the departmental courses under the open electives
   Resolution: The decision is left to the Central committee of the University.

Item V: Ph. D. Admission Test Syllabus:

1. The members have agreed to use the GATE syllabus for the admission Test, but the score obtained by a candidate in the admission test may not be used for preparing the merit list after the interview. They suggested to prepare the merit list only based on the interview performance.
2. **Resolution:** The decision is left to the Central committee of the University.

Item VI :New PG Post Graduation Programme:

1. It has come to the discussion of expert committee that it is proposed to start new post-graduation programme in Construction Technology and Management and transportation Engineering as they are most sort of programmes in the present industry requirement.

2. **Resolution:** As CTM progrmme has been introduces in the department in 2015 and discontinued in the 2017 because of not availability of PhD faculty. Now there is possibility of getting PhD faculty in CTM, hence it’s strongly proposed to restart the M.Tech programme in Construction Technology and Management. The M.Tech in Transportation Engineering also can be started as per present need of industry and as PhD faculty is available in the Department.

Civil Engineering
FOUR YEARS COURSE STRUCTURE
R20 REGULATIONS

B.TECH (CIVIL) I YEAR I SEM (1st semester)
5T+3L

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	BSC	Mathematics–I	3	1	0	4
2	HSS&MC	English	2	0	0	2
3	BSC	Engineering Chemistry	3	1	0	4
4	ESC	Programming for Problem Solving - I	2	0	0	2
5	ESC	Engineering Graphics	1	0	3	2.5
6	BSC	Engineering Chemistry Laboratory	0	0	3	1.5
7	HSS&MC	English Language Skills Laboratory	0	0	2	1
8	ESC	Programming for Problem Solving-I Laboratory	0	0	3	1.5
TOTAL						**18.5**

B.TECH (CIVIL) I YEAR II SEM (2^{nd} semester)
4T+4L

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	BSC	Mathematics–II	3	1	0	4
2	BSC	Engineering Physics	3	1	0	4
3	ESC	Programming for Problem Solving - II	2	0	0	2
4	ESC	Engineering Mechanics	3	1	0	4
5	BSC	Engineering Physics Laboratory	0	0	3	1.5
6	ESC	Engineering Workshop	0	0	3	1.5
7	ESC	Programming for Problem Solving -II Laboratory	0	0	3	1.5
8	HSS&MC	English Communication Skills Lab	0	0	2	1
TOTAL						**19.5**

B.TECH (CIVIL) II YEAR I SEM (3rd semester)
6T+2L+1MC

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	BSC	Mathematics-III	3	0	0	3
2	PCC	Strength of Materials-I	3	0	0	3
3	PCC	Surveying and Geomatics	3	0	0	3
4	PCC	Fluid Mechanics	3	0	0	3
5	PCC	Construction Materials and Planning	3	0	0	3
6	ESC	Engineering Geology	2	1	0	3
7	PCC	Strength of Materials Laboratory	0	0	2	1
8	PCC	Surveying and Geomatics Laboratory	0	0	2	1
9	MC	Environmental Studies	3	0	0	0
TOTAL						**20**

B.TECH (CIVIL) II YEAR II SEM (4th semester)
5T+3L+1PROJ

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	PCC	Strength of Materials-II	3	1	0	4
2	PCC	Concrete Technology	3	0	0	3
3	PCC	Hydraulic Engineering	3	0	0	3
4	PCC	Geotechnical Engineering	3	0	0	3
5	ESC	Basic Electrical Engineering	3	0	0	3
6	PCC	Concrete Technology Laboratory	0	0	2	1
7	PCC	Fluid Mechanics and Hydraulic Machinery Laboratory	0	0	2	1
8	PCC	Geotechnical Engineering Laboratory	0	0	2	1
9	PROJ	Project Design and Innovation*	0	0	2	1
TOTAL						**20**

*Activity oriented non-lab course (No laboratory required)

B.TECH (CIVIL) III YEAR I SEM (5th semester) 5T+3L+1MC

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	PCC	Design of Reinforced Concrete Structures	3	1	0	4
2	PCC	Structural Analysis	3	0	0	3
3	PCC	Transportation Engineering	3	0	0	3
4	PCC	Hydrology and Water Resources Engineering	3	0	0	3
5	OEC	**Open Elective-I** 1. English for Professionals 2. Essential English and Employability Skills 3. Entrepreneurship Development	3	0	0	3
6	PCC	Transportation Engineering Laboratory	0	0	2	1
7	ESC	Computer Aided Drafting of Building	0	0	3	1.5
8	BSC	Quantitative Aptitude and Reasoning Laboratory	0	0	3	1.5
9	MC	NSS and Sports	0	0	3	0
		TOTAL				**20**

B.TECH (CIVIL) III YEAR II SEM (6th semester) 5T+3L+1MC

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	PCC	Design of Steel Structures	3	1	0	4
2	PCC	Environmental Engineering	3	0	0	3
3	PEC	**Professional Elective-I** 1. Advanced Structural Analysis 2. Irrigation Engineering 3. Foundation Engineering	3	0	0	3
4	PEC	**Professional Elective-II** 1. Traffic Engineering 2. Elements of Earthquake Engineering 3. Rehabilitation and Retrofitting of Structures	3	0	0	3
5	PEC	**Professional Elective-III** 1. Ground Improvement Techniques 2. Pavement Analysis and Design 3. Disaster Preparedness and Planning	3	0	0	3
6	PCC	Environmental Engineering Laboratory	0	0	2	1
7	PCC	Structural Analysis and Design Laboratory	0	0	3	1.5
8	HSS&MC	Verbal Ability and Critical Reasoning	0	0	3	1.5
9	MC	Gender Sensitization	3	0	0	0
		TOTAL				**20**

B.TECH (CIVIL) IV YEAR I SEM (7th semester) 6T+2L+1PROJ

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	PCC	Estimation and Costing	3	0	0	3
2	ESC	Remote Sensing and GIS	3	0	0	3
3	HSS&MC	Engineering Economics	3	0	0	3
4	PEC	**Professional Elective-IV** 1. Advanced Structural Design 2. Air Pollution and Control 3. Railways and Airport Engineering	3	0	0	3
5	PEC	**Professional Elective-V** 1. Prestressed Concrete Structures 2. Solid Waste Management 3. Water Distribution Systems	3	0	0	3
6	PEC	**Professional Elective-VI** 1. Earth Retaining Structures 2. Ground Water Development and Mgmt. 3. Industrial Waste Water and Management	3	0	0	3
7	ESC	Remote Sensing and GIS Laboratory	0	0	2	1
8	ESC	Computer Applications in Civil Engineering Lab	0	0	2	1
9	PROJ	Mini project/ Summer Internship	0	0	4	2
TOTAL						**22**

B.TECH (CIVIL) IV YEAR II SEM (8th semester) 2T+ 3PROJ

S. No.	Category	Course Title	Hours per week			Credits
			L	T	P/D	
1	OEC	**Open Elective-II** 1. Technical and Business Communication Skills 2. Intellectual Property Rights 3. Introduction to Artificial Intelligent	3	0	0	3
2	OEC	**Open Elective-III** 1. Negotiation Skills 2. Project Management 3. Introduction to Machine Learning	3	0	0	3
3	PROJ	Seminar	0	0	0	2
4	PROJ	Comprehensive Viva	0	0	0	2
5	PROJ	Project Work	0	0	20	10
TOTAL						**20**

B. Tech. CIVIL ENGINEERING

CREDITS DISTRIBUTION

S. No.	Category	Credits as per AICTE / as per model curriculum	Adopted
1	Humanities and Social Sciences including Management Courses	12/12	8.5
2	Basic Science Courses	25/26	23.5
3	Engineering Science Courses including workshop, drawing, basics of electrical/mechanical/computer etc.	24/29	27.5
4	Professional Core Courses	48/47	56.5
5	Professional Elective Courses relevant to chosen specialization/branch	18/23	18
6	Open Electives from other technical and /or emerging subjects	18/11	9
7	Project work, seminar and internship in industry or elsewhere	15/15	17
8	Mandatory Courses	non credit	non credit
	Total	160	160

B. Tech. Civil II Year -I Sem.

	L	T	P/D	C
	3	**0**	**0**	**3**

MATHEMATICS-III

NUMERICAL METHODS & PARTIAL DIFFERENTIAL EQUATIONS

(Common to Mechanical & Civil)

Prerequisite- Nil

Course Objectives:

- Determine the approximate solutions of algebraic and transcendental equations using iterative methods and interpolate the values for the given data.
- Concept of Numerical differentiation to find the higher order derivatives for the tabulated values and finding integration of given data points with various step sizes by using numerical methods and also determine the solution of linear first order initial value problems using single and multi step methods.
- An understanding of Fourier series for continuous and discontinues functions and its applications to the solutions of partial differential equations.
- Formation of PDE's and solution of linear and non-linear PDE's using various methods.
- Classification of PDE's and solving One Dimensional Heat and Wave equations.

Course Outcomes:

6. Solve the algebraic and transcendental equations using numerical methods and also finding the polynomial using given set of tabulated values and estimation of the functional value within the data by Interpolation.
7. Apply the method of Numerical Differentiation and Integration for engineering problems and solve the first order initial value problems using Taylor's, Euler and Runge-Kutta methods.
8. Express any periodic function in term of sines and cosines and solve engineering problems.
9. Using concepts of partial differential equations to solve linear and non-linear problems.
10. Solve Heat conduction and wave equation by using method of separation of variables and identity the consistent solution.

UNIT-I: Solution of Non- linear Equations

Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – Newton-Raphson Method.

Interpolation: Introduction, Finite differences (Forward and Backward differences), Newton's forward and backward difference interpolation formulae, Lagrange's Interpolation formula.

UNIT-II:
Numerical Differentiation: Numerical differentiation using interpolation formulae.

Numerical integration: Newton-cotes Quadrature Formula, Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.
Numerical solution of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations, Euler and modified Euler's methods, Runge-Kutta Method.

UNIT-III: Fourier Series

Determination of Fourier coefficients, Fourier series, Even and Odd functions, Fourier series in an arbitrary interval, Half-Range Fourier sine and cosine series.

UNIT-IV: Partial differential equations of First Order

Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange's) equation and nonlinear (Standard types) equations, Charpit's Method.

UNIT-V:Partial differential equations of Second Order

Method of separation of Variables for second order equations.Classification of general second order partial differential equations.Applications of Partial Differential Equations, One dimensional wave equation, Heat equation.

Textbooks/References:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
3. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Steven Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 4th Edition, McGraw-Hill Education; 3 edition, 2018.
5. B. S. Grewal, Numerical Methods In Engineering & Science, Khanna Publishers.

B. Tech. Civil II Year -I Sem.	**L**	**T**	**P/D**	**C**
	3	**0**	**0**	**3**

STRENGTH OF MATERIALS-I

Prerequisite- Engineering Mechanics, Mathematics

Course Objectives:

- To relate mechanical properties of a material with its behavior under various load types.
- To provide the concepts of finding shear force and bending moment for different types of beams under various loads.
- To assess the bending stresses and shear stresses variations across various cross sections of a beams.
- To determine the deflections of beams under various types of loads.
- To determine the stresses and deformations in circular shafts due to torsion and in different types of springs.

Course Outcomes:
On successful completion of this course, it is expected that the students will be able to,

- Understand the meaning of basic terminology involved in estimation of strength of various materials.
- Analyze the various beams under different types of loads to draw shear force and bending moment diagrams.
- Determine the bending and shear stress distribution in various beam cross section.
- Know the different methods of finding deflections in beams under different types of loads
- Know the theories involved to find stresses and deformations in the torsion of circular shafts and different types of springs.

UNIT-I
Simple Stresses And Strains: Elasticity and plasticity-Types of stresses and strains-Hooke's law-stress-strain diagram for mild steel-working stress-factor of safety-Lateral strain, Poisson's ratio and volumetric strain-Elastic moduli and the relationship between them-Bars of varying section-composite bars-Temperature stresses.

UNIT-II
Shear Force and Bending Moment: Definition of beam-Types of beams-concept of shear force and bending moment-S.F and B.M diagrams for cantilever, simply supported with and without overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads-point of contra flexure-Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT-III
Flexural Stresses: Theory of simple bending-Assumptions-Derivation of bending equation: M/I=f/y=E/R-Neutral axis-Determination of bending stresses-section modulus of rectangular and circular sections (solid and hollow), I, T, and Channel sections and-Design of simple beams.
Shear Stresses: Derivation of formula - Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T.

UNIT-IV

Deflection of Beams: Bending into a circular arc - slope, deflection and radius of curvature-Differential equation for the elastic line of a beam-Double integration and Macaulay's methods-Determination of slope and deflection for cantilever and simply supported beams, subjected to point loads, U.D.L, Uniformly varying loads-Mohr's theorems - Moment Area Method, Conjugate Beam Method, application to simple cases.

UNIT-V

Torsion of Circular Section: Theory of pure torsion–derivation of torsion equations- $T/J = q/r = N\theta/L$ – assumptions made in the theory of pure torsion – torsional moment of resistance– polar section modulus – power transmitted by shafts – combined bending and torsion and end thrust – design of shafts according to theories of failure.

Springs: Introduction–type of springs–carriage/leaf springs, helical springs-deflection of close and open coiled helical springs under axial pull and axial couple - springs in series and parallel.

TEXT BOOKS

1. Strength of Materials by S Ramamrutham, Dhanpat Rai Publishing Company (P) Limited,-2011.
2. Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, Eleventh Edition-2015.

REFERENCE BOOKS

1. Strength of Materials-A Practical Approach by D S Prakash Rao,University Press
2. Strength of Materials by Pytel A H and Singer F L, Harper Collins, New Delhi
3. Strength of Materials by G.H.Ryder, Published by Macmillan and Co. Ltd, Third Edition in SI Units

NPTEL

https://nptel.ac.in/courses/112107146/

B.Tech. Civil II Year -I Sem.	**L**	**T**	**P/D**	**C**
	3	**0**	**0**	**3**

SURVEYING AND GEOMATICS

Course Objectives:

- To understand principles and classification of surveying.
- To understand principles and functioning of basic survey equipment such as chain, prismatic compass, levels.
- To impart the knowledge of calculating the areas and volumes and contours and their usage.
- Determine latitudes, departures, and coordinates of control points and balancing errors in a traverse.
- Use appropriate software for calculations and mapping, reduce data for application in a geographic information system.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
- Translate the knowledge gained for the implementation of Civil infrastructure facilities
- Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry, Remote Sensing, andGeographic Information System (GIS*)*.
- Able to understand and relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Remote Sensing Understand
- Able to apply Global Positioning System (GPS), Photogrammetry, and Geographic Information System (GIS).

UNIT-I

Introduction to Surveying: Principles of surveying, objectives of surveying and classifications of surveying,Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines and Plane table surveying.

Levelling: Principles of levelling- booking and reducing levels; differential, reciprocal levelling, profile levelling, and cross-sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, use; areas and volumes.

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation -network- Signals. Baseline - choices - instruments and accessories - an extension of baselines -corrections - Satellite station - reduction to centre - Intervisibility of height and distances -Trigonometric levelling - Axis single corrections.

UNIT-II

Modern Field Survey Systems:-Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors, and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT-III

Photogrammetry Surveying*:* Introduction, Basic concepts, perspective geometry of aerial photograph, relief, and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes

UNIT-IV

Remote Sensing: Introduction –Electromagnetic Spectrum, the interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing

UNIT-V

Geographic Information System (GIS): Introduction, GIS definition, and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Types of data representation: Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer-based GIS, Feature-based GIS mapping.

TEXTBOOKS

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS, and Remote Sensing, Pearson India, 2006.
2. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.
3. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
4. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.

REFERENCE BOOKS

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS, and Remote Sensing, Pearson India, 2006.
2. Surveying, Vol-I, II Venkatraman, Published by Macmillan and Co. Ltd, Third Edition in SI Units

NPTEL

1. https://nptel.ac.in/courses/112107142/

B.Tech. Civil II Year -I Sem

L	T	P/D	C
3	0	0	3

FLUID MECHANICS

Prerequisite- Mathematics, Engineering Mechanics

Course Objectives:

- To know the various types of fluids and their Properties.
- To formulate and analyze fluid measurement and Buoyancy forces.
- To summarize various fluid flows and to study equations of fluid motion.
- To understand the dynamics of fluids. Dimensional analysis, similitude studies, and model laws.
- To impart the knowledge of boundary layer theory and flow in pipes

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Identify the fluid properties and relationship among them.
- Apply the mathematical equations in fluid mechanics and analyzing those by using fundamental fluid statics.
- Identify various types of fluid flows and determine discharge using Bernoulli's equation.
- Able to analyze hydraulic phenomena using Dynamics and model laws with the help of dimensional principles.
- Able to summarize the concept of Boundary layer theory and analyze the flow of fluid in pipelines.

UNIT- 1

Basic Concepts and Definitions

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT- 2

Fluid Statics

Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure, and force: horizontal, vertical, and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT- 3

Fluid Kinematics

Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; one, two, and three-dimensional flows; Streamline, path line, streak line, and stream tube; stream function, velocity potential function. One-, two- and three-dimensional continuity equations in Cartesian coordinates, flow net analysis.

UNIT- 4

Fluid Dynamics

Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturi meter, orifice meter, and pitot tube; Momentum principle; Forces exerted by the fluid flow on pipe bend; Vortex Flow – Free and Forced.

Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number, and Euler Number; Buckingham's π-Theorem.

UNIT-5

Laminar Flow

Laminar flow through circular pipes, Stoke's law, Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, Causes of turbulence, the effect of turbulent flow in pipes. universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes. Boundary-Layer theory -Assumption and concept of boundary layer theory. Definition of Boundary-layer thickness, displacement, momentum & energy thickness.

Flow-through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, and total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, and pipes in parallel.

TEXTBOOKS

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth, Standard Book House, 22^{th} edition -2021
2. A Text-Book of Fluid Mechanics and Hydraulic Machines by R. K. Bansal, Laxmi Publications, 2019

REFERENCE BOOKS

1. Fluid Mechanics, Hydraulics and Hydraulic Machines by K.R. Aurora, Standard Publishers, 2020

2. Theory and Applications of Fluid Mechanics by K. Subramanya, Tata McGraw Hill,2016

NPTEL

1. https://nptel.ac.in/courses/112105171
2. https://nptel.ac.in/courses/112/104/112104118/

B.Tech. Civil II Year -I Sem	L	T	P/D	C
	3	0	0	3

CONSTRUCTION MATERIALS AND PLANNING

Course Objectives:

- To study the basic behavior of various building materials, properties, and their applications.
- To provide an idea about different masonry work and their applications used in structures.
- Know the functional design of various elements such as arches, lintels, floors.
- Know the functional design of various elements of stairs, doors, and windows, and Building services.
- To emphasize planning and Building by-laws and foundation methods and types and smart building materials.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Understanding about different materials used in civil engineering applications
- Understanding about different Masonry construction.
- Know about various systems of plumbing, fire protection, etc.
- Know about various design parameters and standard dimensions of doors, windows, and building services.
- Understanding Building planning and building by-laws and foundations in soil and smart building materials.

UNIT-I

Introduction to Engineering Materials: Cement – Introduction to cement, different grades, IS specifications and OPC and PPC Cements Chemical composition, properties such as setting, strength, fineness, and hydration.

Aggregates types, M- Sand, Mechanical properties.

Concrete - Constituents, proportioning, properties in the fresh and hardened state, characteristic strength.

Characteristics, manufacturing process, and types of Glass, Plastic, Steel. Timber: Characteristics, seasoning, and defects of timber; Paints: Characteristics and types. Bitumen – Source, composition, characterization, various forms.

UNIT-II

(a)Stone Masonry: Cutting and dressing, selection of stones, types of stone masonry, and principles of construction joints in masonry, lifting heavy stones, **Plastering and pointing:** Different types of plasters and plastering process, defects in plastering

(b)Brick Masonry: Qualities of good bricks, classification of bricks, Tests on bricks as perIS codes, terms used in brickwork, commonly used types of bonds in brickwork, principles of construction, Reinforced brickwork, brick noggin, parapets, copings, sills and corbels, a brief introduction to cavity walls, load-bearing and partition walls, Masonry construction using cement concrete blocks and clay blocks, precast elements like poles, cover, jallies, steps, etc.

UNIT-III
Arches and lintels: Chajjas and canopies, precastlintel, and arches.
Damp proofing: Causes and effects of dampness, various methods of damp proofing,new techniques of damp proofing.
Roofs and Floors: General principles, types, and method of construction, Synthetic and ceramic tiles. Flat and pitched roofs, roof coverings, Thermal insulation, Acoustics

UNIT-IV
Stairs: Types of stairs, functional design of stairs.
Doors and windows: Purpose and materials of construction and types.
Building Services: Plumbing services: Water distribution, Sanitary lines & fittings;
Ventilations: Functional requirements, system of ventilations;
Air conditioning: Essentials and type;
Fire protection: - Classification of fire, general causes of fire, detection of fire, methods for fire control, Analysis for structural components for fire resistance (wood, steel, concrete, and masonry), fire safety norms.
Formwork: Types of Formwork, types of materials used in formwork, shoring, underpinning, and scaffolding, Types of Scaffoldings, Scaffolding Erection & dismantling, Scaffolding Inspection

UNIT-V
Functional Planning of buildings: Sustainability and concept of Green building, General aspects to consider for planning, classification building, bye-laws and regulations, Selection of the site for building construction, Principles of planning, Orientation of building and its relation to the outside environment, Components of buildings, Foundation and its functional requirements, Characteristics of soil, types of foundations.
Smart building Materials: Energy conservation in buildings- use of recycled materials, regional materials, and industrial waste products as means of sustainable development. Green Building Materials

TEXTBOOKS
1. S. P. Arora and S. P. Bindra, ‘A Textbook on Building Construction’, Edition 2010Dhanpat Roy Publications, New Delhi.
2. Rangwala, ‘Engineering Materials’, Charotar Publications.43rd Edition, 2017

REFERENCE BOOKS
1. Basics of Civil Engineering by Subhash Chander, Jain brothers Publications.
2. Building by-laws by State and Central Governments and Municipal Corporations.
3. National Building Code of India 2003, Indian Standards Institution.
4. Building Construction by B. C. Punmia, Ashok Kr. Jain and Arun Kr. Jain, Laxmi Publications Pvt. Ltd, New Delhi.

NPTEL: https://nptel.ac.in/courses/105/102/105102088/

B.Tech. Civil II Year -I Sem.	**L**	**T**	**P/D**	**C**
	2	**1**	**0**	**3**

ENGINEERING GEOLOGY

Course Objectives:

- To know the Origin, occurrence, of rocks and physical, optical properties minerals, and weathering.
- To know the Classification, Textures, structures, physical properties of various rocks.
- To know the Structural Geology, Stratigraphic principles, Geological Time Scale andRock Mechanics.
- To know the causes of Geological Hazards and considerations for stable civil Structures.
- To know the Role of Geology and geophysics and their implications on civil structures and site selection for dams, reservoirs, tunnels.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Rocks and minerals Genesis and Methods of study, weathering Concept and rock cycle
- Classification, Textures, structures, physical properties of strong and weak rock rocks
- The effect of folds, Faults, Joints, and unconformities on civil structures and GTS
- Geological hazards - measures, precautions, and geological considerations for civil constructions.
- Application of Geological, Geophysical and Groundwater methods for creating professional civil engineers

UNIT-I

Introduction and Concepts of Geology

Geology and Engineering Geology; important branches of geology; Physical Geology**:** – Weathering (agents, affects and products) and erosion, Effect of alteration and weathering.; Stages of rivers and various landforms, Coastal deposits; Granite weathering; **Bowens Reaction principle:** Magmticcystallisationand Origin and composition of minerals and rocks, Importance of quartz; **Mineralogy:** Mineral Definition, Families; Physical and Optical properties of **Rock-forming minerals:** Quartz, Flint, Jasper, Agate, Feldspar, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, and Calcite. **Ore forming minerals:** Psilomalane, Chromite, Galena, Graphite, Bauxite, and barite Pyrite, haematite, Magnetite, Pyrolusite Instruments – XRD, XRF, SEM, ICPMS**;** National and State geological organizations.

UNIT-II

Petrology- Definition of rock and petrology; Texture, Structure, Geological classification of rocks; Rock cycle, Classification and Physical properties of rocks; Rock masses, strength and Quality, excavation and stone aggregates, Igneous, Sedimentary, and metamorphic rocks textures and structures; **Igneous petrology**- Magma and lava (Volcanoes) products, Magma types and composition. Plutonic, Hypabyssaland volcanic rocks; Detailed study Granite, Gabbro, Dolerite, Basalt Rhyolite, Pegmatite, Tors, Engineering aspects of granite and basalt; **Sedimentary petrology:** Mode of formation, Mineralogical Composition. A detailed study of Conglomerate, Breccia, Sandstone, Mudstone, and Shale, Limestone, laterite; **Metamorphic petrology:** Agents and types of metamorphism, metamorphic grades, Mineralogical composition, Schistosity, Foliation. A detailed study of Gneiss, Schist, Slate, Phyllite with engineering consideration.

UNIT-III

Structural Geology

Stratigraphy: Stratigraphic principles; Structural geology; Indian Stratigraphy, Geological Time scale, Dip, and strike. Outcrop, Inliers and outliers; **Structural Classification, and** importance: Folds, Faults, Joints, and fractures Unconformities and their recognition in the field; Ductile (plastic) and Brittle Rock Deformation-Compression, Tension and shear. **Rock Mechanics and Rocks Strength**- Stress and strain in rocks, engineering characteristics of rocks masses; Rock failure theories, Bearing capacity and shear strength of rocks; Strength of Igneous rocks.

UNIT-IV

Geological Hazards

Landslides: Concept of landslides, Types, Causes and effect, Rock Instability and Slope movement and Role of lithology, mineralogy, weathering, groundwater in landslides and preventive measures; Landslides Zonation Maps; Rock Bolting and Rock anchoring, Retaining wall, Slope treatment; **Earthquake:** Causes and effects, Shield areas and seismic belts, Seismic waves (P, S, L, and Raleigh), Richter scale, Layered structure of the earth, Seismic Zones of India; Earth Quake resistant civil structures; **Floods and Droughts:** Natural and Urban floods and droughts, causes, effects, and remedies; **Geological considerations** for selecting dam and reservoir site, the significance of faults on the dam site and grouting; **Ground Subsidence:** Causes and effects; Role of mining and groundwater fluctuation in ground subsidence.

Unit-V

Geophysical -Groundwater studies and Tunnels

Geophysical studies: Principles and concepts of Geophysical methods- Gravity, Magnetic, Electrical, Seismic, Radio, and Geothermal. Special importance and study of Electrical resistivity and Seismic refraction Studies. **Groundwater**: Groundwater Table, Aquifers and springs; Cone of depression, Water bearing capacity of pervious and impervious rocks; Groundwater effects on civil structures and measures; Groundwater movement, controls, and exploration; **Geological considerations** of Tunnels (Lithology, Mineralogy, Structure, and Groundwater); Analysis of Dams, tunnels and reservoirs Failure in the past and Case histories; Water tightness and life of reservoirs; **Tunnels**: Types and effects; Modern methods of tunneling; over break and lining in tunnels;

TEXTBOOKS

1. Engineering andGeneral Geology: Parbin Singh, 8th Edition (2010), S K Katariaand Sons.
2. Text Book of Engineering Geology: N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.

REFERENCE BOOKS

1. Geology for Geotechnical Engineers: J.C.Harvey, Cambridge University Press (1982).
2. Engineering Geology: D.Venkat Reddy, Second Edition (2016), Vikas Publishing House Pvt Ltd,
3. Engineering Geology: S.K.Duggal, H.D. Panday, N.Raval, McGraw Hill Education (India) Pvt., (2014)

NPTEL

https://nptel.ac.in/courses/105105106/

B. Tech. Civil II Year -I Sem.

L	T	P/D	C
0	0	2	1

SOLID MECHANICS LABORATORY

Prerequisite- Solid Mechanics

Course Objectives:

- To study behaviour of material under various types of stresses.
- To observe and understand basics of equilibrium conditions.
- To observe the behaviour of deformable bodies.
- To apply the Maxwell's Reciprocal Theorem and Principal of Superposition

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Understand the behavior of Mild steel material in elastic, plastic and elasto-plastic states before breaking or failure.
- Determine the load-deflection characteristics of beams, springs and shafts.
- Understand the concept of Principal of superposition of loads
- Apply the Maxwell's Reciprocal Theorem.

LIST OF EXPERIMENTS

1. Determination of Tensile strength of Mild Steel.
2. Determining Young's Modulus of Elasticity (E) of Material of Cantilever Beam by Deflection test.
3. Determining Young's Modulus of Elasticity (E) of Material of Simply Supported Beam by Deflection test.
4. Determining hardness of material by using
5. Brinell Hardness Test
6. Rockwell Hardness Test
7. Determination of Modulus of rigidity of a material by Torsion Test.
8. Determination of Modulus of Rigidity of the Helical Spring.
9. Compression Test on Brick and Concrete.
10. Determination of Toughness by Charpy and Izod Impact Test
11. Direct Shear Test.
12. Verification of Maxwell's Reciprocal Theorem.
13. Demonstration on use of electrical resistance gauges.

B.Tech. Civil II Year -I Sem.

	L	T	P/D	C
	0	**0**	**2**	**1**

SURVEYING AND GEOMATICS LABORATORY

Course Objectives:

- To understand the practical applications of Surveying Instruments
- To know the field measurements and Observations.
- To understand the different methods involved in survey fieldwork
- Work with survey observations, and perform calculations
- Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station, or survey-grade GNSS instruments.

Course Outcomes:

- Understand the usage and functioning of various basic survey instruments
- Understand the innovative methods of surveying the given field.
- Understand, interpret, and prepare a plan, profile, and cross-section drawings
- Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities
- Use appropriate software for calculations and mapping

List of Experiments

1. Determination of the distance between two inaccessible points with compass
2. Leveling –Differential Leveling, longitudinal and cross-sectioning, and plotting
3. Measurement of horizontal and vertical angles using a theodolite
4. Trigonometric leveling using a theodolite.
5. Determination of area and Determination of remote height using total station
6. Gradient, diff, height between two inaccessible points using total station and Contouring using total station
7. Finding Distance and Linear Measurement Using GPS or DGPS
8. Preparation of base map using topo sheet and find out the changes in satellite image using Arc GIS
9. Georeferencing of topo sheet using ArcGIS
10. Georeferencing of satellite image using Arc GIS
11. Digitization of point, line, and polygon features using ArcGIS

B. Tech. Civil II Year -II Sem.	L	T	P/D	C
	3	1	0	4

STRENGTH OF MATERIALS-II

Prerequisite- Solid Mechanics

Course Objectives:

- To impart the knowledge of direct and bending stresses in columns, retaining walls, Dams, Chimneys.
- To impart the knowledge of analysis of principal stresses and strains on inclined plane under combinations of stresses.
- To impart the knowledge on analysis of unsymmetrical bending of beams to find stresses and deformations and to assess the stresses and deformations in thin cylinders.
- The theory involved in the various columns with various end conditions. To impart the knowledge of analysing trusses.
- To analyse and determine the shear force and bending moment in statically indeterminate beams under different types of loads.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Understand the behaviour of columns under various loads.
- Analyse various situations involving structural members subjected to combined stresses. by application of Mohr’s circle of stress; locate the shear center of thin wall beams.
- Solve the problems to find stresses and deflections in beams subjected to unsymmetrical bending.
- Understand the behaviour of columns and struts and the theories involved. To understand the methods of analyzing trusses.
- Know the analysis of indeterminate beams and curved beams.

UNIT-I

Direct and Bending Stresses: Stresses under the combined action of direct axial load and bending moment - core of a section – determination of stresses in the case of chimneys, retaining walls and dams - conditions for stability - stresses due to direct loading and bending moment about both axis.

Cylinders: Thin Cylinders: Derivation of formula for longitudinal and circumferential stresses– hoop, longitudinal and volumetric strains – change in diameter and volume of thin cylinders – spherical shells. **Thick Cylinders:** Introduction- Stresses in thick cylindrical shell-Problems

UNIT-II

Principal Stresses and Strains: Introduction-stresses on an inclined section of a bar under axial loading-compound stresses-normal and tangential stresses on an inclined plane for biaxial stresses - two perpendicular normal stresses accompanied by a state of simple shear-Mohr’s circle of stresses-principal stresses and strains-analytical and graphical solutions.

UNIT-III

MOVING LOADS and INFLUENCE LINES: Introduction maximum SF and BM at a given section and absolute maximum shear force and bending moment due to single concentrated load ,uniformly distributed load longer than the span, uniformly distributed load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length - Definition of influence line for shear force and bending moment – load position for maximum shear force and maximum bending Moment at a section - Point loads, uniformly distributed load longer than the span, uniformly distributed load shorter than the span-Influence lines for forces in members of Pratt and Warren trusses - Equivalent uniformly distributed load -Focal length.

UNIT-IV

Columns and Struts: Introduction–types of columns–short, medium and long columns -axially loaded compression members - crushing load – Euler's theorem for long columns – assumptions – derivation of Euler's critical load formulae for various end conditions - equivalent length of columns- slenderness ratio – Euler's critical stress - limitations of Euler's theory – Rankine formula - long columns subjected to eccentric loading – Secant formula – empirical formulae - straight line formula - Prof Perry's formula.

UNIT-V

Fixed beams: Fixed beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – shear force and bending moment diagrams - deflection of fixed beams - effect of sinking of support - effect of rotation of support.

Continuous beams: Introduction -Clapeyron's theorem of three moments- analysis of continuous beams with constant moment of inertia with one or both ends fixed – continuous beams with overhang, continuous beams with different moment of inertia for different spans - Effects of sinking of supports - shear force and bending moment diagrams.

Analysis of pin jointed structures: Introduction- Method of joints- Method of sections for trusses.

TEXT BOOKS

1. Strength of Materials by S Ramamrutham, DhanpatRai Publishing Company (P) Limited,-2011.
2. Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, Eleventh Edition-2015.

REFERENCE BOOKS

1. Strength of Materials-A Practical Approach by D S Prakash Rao,University Press
2. Strength of Materials by Pytel A H and Singer F L, Harper Collins, New Delhi
3. Strength of Materials by G.H. Ryder, Published by Macmillan and Co. Ltd, Third Edition in SI Units
4. Strength of Materials by R. K .Bansal, Laxmi Publications Ltd.-2016.

NPTEL

1. https://nptel.ac.in/courses/112107146/
2. https://nptel.ac.in/courses/105105108/ 3. https://nptel.ac.in/courses/112101095/

B.Tech.Civil IIYear-II Sem **L T P/D C**

3 0 0 3

CONCRETE TECHNOLOGY

CourseObjectives:

- Toimparttheknowledgeofthematerialsrequiredformakingtheconcrete.
- Toknowtheconstituents andproperties ofthefreshconcrete.
- Toknowtheconstituentsand propertiesofthehardened concrete.
- Toimpartknowledgeaboutthespecialconcretesandtheirpropertiesbyusingdifferentchemicaland mineral admixtures.
- Toprovidetheknowledgeofvariousmethodsofmixdesignofconcrete.

CourseOutcomes:

- Understandthedifferenttypesand propertiesofmaterialsrequiredformakingconcrete.
- Understandthe constituentsandpropertiesofFreshconcrete.
- UnderstandtheconstituentsandpropertiesofHardenedconcrete.
- Understandingtheeffectofthespecialconcretesandtheirpropertiesbyusingdifferentchemicaland mineral admixtures.
- Understandingandanalyzingthe variousmethodsofmixdesignofconcrete.

UNIT-I

Concrete Making Materials: Cement: Portland cement–chemical composition–Hydrationof Cement, Structure of hydrated cement, Bogue"s compounds, Hydration, Gel formation,Differentgradesofcement.Typesofcement,–DifferenttestoncementasperIndianstandards
Water: Qualityof mixingwater.

Aggregates: Classification of aggregate–Particle shape and texture–Bond, strength and othermechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption andmoisture content of aggregate – Bulking of sand – Deleterious substance in aggregate –Soundness of aggregate– Alkali aggregate reaction – Thermal properties – Sieve analysis –Fineness modulus – Grading curves – Grading of fine and coarse Aggregates – Gap gradedaggregate– Maximum aggregatesize.

Mineralandchemicaladmixtures

UNIT-II

Constituents & Properties of Fresh Concrete: Water / Cement ratio– Abram‟s Law – Gelspaceratio-Propertiesoffreshconcrete-Workability–Factorsaffectingworkability– Measurement of workability by different tests – Setting time of concrete – Effect of time andtemperature on workability – Segregation and bleeding – Mixing and vibration of concrete –Stepsin themanufacture ofconcrete.

UNIT-III

Constituents & Properties of Hardened Concrete: Nature of strength of concrete– Maturityconcept–Strength intensionand Compression– Factorsaffecting strength– Relationshipbetweendifferent strengths-Curing.

Tests on Hardened Concrete: Compression tests–Tension tests–Factors affecting thestrength –Flexuretest–Splittingtensiletest–Pull-out test.

NDT: Codal provisions–Ultrasonic Pulse Velocity–Rebound Hammer Tests–Core cuttingtest.
Properties of Hardened Concrete: Modulus of elasticity–Dynamic modulus of elasticity–Poisson‟s ratio – Creep of concrete – Factors influencing creep – Relation between creep andtime – Nature of creep – Effects of creep – Shrinkage – types of shrinkage. Influence oftemperatureand Permeabilityonconcrete.

UNIT-IV

Special Concretes: Lightweight concrete–Cellular concrete – No-fines concrete – High-densityconcrete–Fiber-reinforcedconcrete-Polymerconcrete–Typesof Polymerconcrete –High-performanceconcrete–Self-compactingconcrete,Prepackedaggregateconcrete,Massconcrete-Under waterconcrete,Ferro cement.
Admixtures: Types of Admixtures- properties and compatibility with concrete.– dosage-effect.

UNIT-V

MixDesign: Factorsinthechoiceofmixproportions–Durabilityofconcrete–QualityControl of concrete – Statistical methods – Acceptance criteria – Variables influencing theconcrete proportioning mixes and their effecton the concrete strength. Proportioning ofconcrete mixes by various methods – BIS method of mix design-ACI method of mix design - Britishmethod

TEXTBOOKS

1. M.S.ShettyandAKJain„ConcreteTechnology-TheoryandPractice,S.ChandandCo.2018

2. A.M.NevilleandJ.J.Brooks,ConcreteTechnology,PrenticeHall,2010.

REFERENCEBOOKS

1. A.R.Santhakumar,“ConcreteTechnology”, OxfordUniversityPress India
2. P.K.MehtaandJ.M.PauloMonteiro,ConcreteMicrostructurePropertiesandMaterials,4/e, McGraw-Hill Professional.
3. M.L.Gambhir,ConcreteTechnology,5/e,TataMcGraw-HillEducation.

INDIAN STANDARD CODES

1. IS 269:1989 - Specification for Ordinary, Rapid Hardening and Low Heat Portland Cement.
2. IS 8112:2013 - Indian Standard Ordinary Portland Cement 43 Grade Specification.
3. IS 12269:1987 - Indian Standard Specification for 53 Grade Ordinary Portland Cement.
4. IS 455:1989 - Indian Standard Specification for Portland Blast furnace Slag Cement.
5. IS 1489(Part 1):1991- Specification for Portland pozzolana cement Part 1 Fly ash based.
6. IS 1489(Part 2):1991- Specification for Portland-pozzolana cement: Part 2 Calcined clay based.
7. IS 383:1970 - Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.
8. IS 456:2000 -Indian Standard Code of Practice for Plain and Reinforced Concrete.
9. IS 516:1959(Reaffirmed2004) - Indian Standard Methods of Tests for Strength of Concrete.
10. IS 650 :1991- Specification for standard sand for testing of cement.
11. IS 1727: 1967- Methods of Test for Pozzolanic materials.
12. IS 10262: 2019- Concrete Mix Proportioning – Guidelines.
13. IS 13311(Part 1): 1992- Non-Destructive Testing of Concrete, Methods of Test, Ultrasonic Pulse Velocity.
14. IS 13311(Part 2): 1992- Non-Destructive Testing of Concrete, Methods of Test- Rebound Hammer.

NPTEL:https://nptel.ac.in/courses/105/102/105102012/

B. Tech. Civil- II Year II Sem.

L	T	P/D	C
3	**0**	**0**	**3**

HYDRAULIC ENGINEERING

Prerequisite- Fluid Mechanics

Course Objectives:

- To develop the knowledge of types of flows and their relationships in an open channel.
- To determine the characteristics of non-uniform and gradually varied flow.
- To identify characteristics of hydraulic jump in various fluid channels.
- To introduce the theory and design principles of turbines, jets and their working efficiencies.
- To introduce the theory and design principles of pumps and their working efficiencies.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Able to design various economical sections in open channels.
- Able to analyze the characteristics of the flows and profiles in the flows.
- Able to analyze and apply the hydraulic jump in fluid channels.
- Analyze the types, working principles, and velocity triangles of various turbines and impact of jets on vanes.
- Able to discuss the types, characteristics, and working principles of pumps.

UNIT-1

Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

Uniform Flow-Continuity Equation, Energy Equation, and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Most economical section of the channel. Computation of Uniform flow, Normal depth.

UNIT-2

Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Broad Crested Weir. Measurement of Velocity- Current meter.

Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by direct Step method,

UNIT-3

Hydraulic Jump- Theory of hydraulic jump, Elements, and characteristics of hydraulic jump in a rectangular Channel, length and height of a jump, location of a jump, Types, applications, and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

UNIT-4

Hydraulic Turbines: Elements of hydroelectric power plants - heads and efficiencies of turbines - classification of turbines: Pelton wheel, Francis turbine, Kaplan turbine - work done, efficiency, velocity diagram, working proportions, and design - draft tube theory – surge tank.

Performance of Turbines: Performance under the unit head–under specific conditions– expressions for specific speeds, performance characteristic curves.

UNIT-5

Centrifugal Pumps: parts of centrifugal pumps - working of centrifugal pump–types – work done – head of a pump - minimum starting speed – losses and efficiencies - specific speed - multi-stage pumps - pumps in parallel - performance of pumps characteristic curves - Net Positive Suction Head (NPSH) - Cavitation. Impact of jet on vanes with special reference to turbines and Pumps.
Hydropower Engineering: types of hydropower plants–definition of the load factor, utilization factor, capacity factor – components of hydropower plants

TEXTBOOKS

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth, Standard Book House, 22th edition, 15 March 2021.
2. A Text-Book of Fluid Mechanics and Hydraulic Machines by R. K. Bansal, Laxmi Publications, 2021.

REFERENCE BOOKS

1. Fluid Mechanics, Hydraulics and Hydraulic Machines by K.R. Arora, Standard Publishers, 7th December 2020,
2. Theory and Applications of Fluid Mechanics by K. Subramanya, Tata McGraw Hill,2016.

NPTEL

1. https://nptel.ac.in/courses/105103097/
2. https://nptel.ac.in/courses/105103096

B.Tech. Civil II Year -II Sem

L	T	P/D	C
3	**0**	**0**	**3**

GEOTECHNICAL ENGINEERING

Prerequisite- Engineering Geology,
Engineering Mechanics

Course Objectives:

- To impart knowledge on Characterize and classify soils
- To provide the basic knowledge of soil formation and the properties of various soils.
- To provide knowledge about compaction and consolidation characteristics of soil
- To provide the knowledge on stress distribution in soils
- To provide the knowledge on shear strength in soils

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Understand the classifications and various engineering properties of soil.
- Understand the soil formation, the effect of permeability and seepage on soils.
- Determine compaction and consolidation effect on soils
- Calculate stress distributions in soils.
- Determine strength characteristics of soil and its effect on different soils

UNIT-I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass volume relationship – Relative density. Index Properties of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – I.S. Classification of soils.

UNIT-II

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law-permeability Factors affecting – laboratory determination of coefficient of permeability – Permeability of layered soils – Insitu permeability tests (Pumping in and pumping out test). Effective Stress Seepage Through Soils: Total, neutral and effective stresses – principle of effective stress - quicksand condition – Seepage through soils – Flow nets: Characteristics and Uses.

UNIT-III

Compaction: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties. – Field compaction Equipment – compaction quality control.

Consolidation: Types of compressibility – immediate settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log p curves – normal consolidation soil, over consolidated soil and under consolidated soil – pre-consolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation : square root time and logarithm of time fitting methods.

UNIT-IV

Stress Distribution in Soils: Boussinesq's and Westergard's theories for point loads, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and new mark's influence chart for irregular areas.

UNIT-V

Shear Strength of Soils: Importance of shear strength - Mohr – Coulomb Failure theories- Types of laboratory strength tests – strength tests based on drainage conditions- strength envelops – Shear strength of sands – Dilatancy Critical void ratio – Liquefaction- shear strength of clays.

TEXT BOOK

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers New Delhi-2009.
2. Principles of Geotechnical Engineering by B.M.Das, Cengage Learning-2013.

REFERENCE BOOKS

1. Soil Mechanics by T.W.Lambe and Whitman,McGraw Hill Publishing Company,Newyork.
2. Geotechnical Engineering by Manoj Dutta and Gulati S K, Tata McGrawhillPublishers,New Delhi,2015.
3. Geotechnical Engineering by C. Venkataramaiah, New Age International, 2006.

NPTEL

https://nptel.ac.in/courses/105103097/

Code books:

IS 2720 Method of Test for soils.

B.Tech, Civil, II Year II Semester **L T/P/D C**

3 1 3

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objectives:

- To impart knowledge of basic electrical equipment
- To introduce the concept of electrical circuits and its components.
- To acquaint the students with principles of operation of Transformers, Electrical machines
- To learn the characteristics of diode and how to make use of diode in different applications
- To explain the operation and characteristics of transistors in different modes

Course Outcomes:

At the end of the course, students will be the able to

- Analyze basic electric circuits with DC excitation.
- Determine the losses and efficiency of single transformers.
- Compare the difference between the performance and applications of three phase and single phase Induction motor.
- *Apply the diode concepts in different applications*
- *Understand the operating principles of major electronic devices*

UNIT-I:

ELECTRICAL CIRCUITS: Basic definitions, types of elements, ohms law, Kirchhoff' laws, resistive networks, inductive networks, capacitive networks, series, parallel circuits and star –delta transformations.

UNIT-II:

DC MACHINES: DC generators: Construction, basic principle, EMF equation, types of dc generators, losses & efficiency, applications. DC Motors: Basic principle, types of dc motors, torque equation, necessity of starters,3-point starter, characteristics, speed control of dc shunt motor, losses & efficiency, applications.

UNIT-III:

AC MACHINES: Transformers: Principle of operation of 1-phase Transformers, construction, OC & SC tests, losses, efficiency & regulation, applications. Induction machines: Principle of operation of 3-phase Induction machines, torque-slip characteristics. Losses and efficiency and applications.

UNIT-IV:

DIODE AND TRANSISTOR: Diode: p-n junction diode, symbol, V-I characteristics, Diode Application, Rectifier-Half wave, Full wave and Bridge rectifier. Transistor: PNP and NPN junction transistor, Transistor as an amplifier.

UNIT-V:

CATHODE RAY OSCILLOSCOPE: Principles of CRT (Cathode Ray Tube), Deflection, sensitivity, Electroscopic and Magnetic deflection, Application of CRO-voltage, Current and frequency measurements.

Text Books:

1. Principles of Electrical and Electronics Engineering -V.K.Mehta, 2nd edition, S.Chand & Co, 2008.

2. Introduction to Electrical Engineering - Kothari and Nagarath, 2nd edition, TMH Publications.

3. Fundamentals of Electrical Engineering and Electronics - J.B. Gupta, S.K. Kataria & sons Publications, 2002.

Reference Books:

1. Basic Electrical Engineering - Kothari and Nagarath, TMH Publications, 2nd edition

2. Electrical and Electronics Technology - Hughes – Pearson education

B.Tech. Civil II Year -II Sem

L	T	P/D	C
0	0	2	1

FLUID MECHANICS AND HYDRAULIC MACHINARY LABORATORY

Prerequisite- Fluid Mechanics

Course Objectives:

- To provide practical knowledge in the verification of principles of fluid flow.
- To impart knowledge in measuring discharge and velocity of fluid flow.
- To understand the measurement of flow through open channels and pipes.
- Implementing Bernoulli's equation and application of Bernoulli's theorem in estimating various losses in a pipe.
- To study the characteristics of Hydraulic machines (Pumps and Turbines).

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Verify Bernoulli's theorem and its applications.
- Determine the discharge coefficient and velocity for various flow measuring devices.
- Determine the coefficient of discharge through open channels and pipes.
- Apply Bernoulli's equation in estimating various head losses in pipes.
- Examine and determine the characteristics of Hydraulic machines.

List of Experiments:

1. Verification of Bernoulli's equation.
2. Determine the Coefficient discharge of the Venturi meter and Orifice meter
3. Determination of coefficient of discharge for given orifice and mouthpiece
4. Estimation of various head losses in the pipe due to major losses. (Friction Factor)
5. Estimation of various head losses in the pipe due to minor losses.
6. Determination of coefficient of discharge for given notches (Triangular/Rectangular)
7. Determination of coefficient of Impact of Jet on given Vane
8. Determination of hydraulic jump.
9. Determination of Performance characteristics Pelton wheel.
10. Determination of Performance characteristics Francis turbine
11. Determination of Performance characteristics of a single-stage centrifugal pump.
12. Determination of Performance characteristics of a multi-stage centrifugal pump.
13. Determination of Performance characteristics of a reciprocating pump.

Laboratory Manual:

1. "Fluid Mechanics Laboratory Manual", prepared by the faculty of the Department of Civil Engineering.

Reference Books:

1. N. Kumara Swamy, "Fluid Mechanics and Machinery Laboratory Manual", Charotar Publishing House Pvt., Ltd., 1stedn., 2008.

2. Sarbjit Singh, "Experiments in Fluid Mechanics", PHI Learning Private Limited, New Delhi, 2009.

B. Tech. Civil- II Year II Sem	L	T	P/D	C
	0	0	2	1

CONCRETE TECHNOLOGY LABORATORY

Perquisite: Concrete Technology

Course Objectives:

- To provide the knowledge of various tests conducted on cement, aggregates, and concrete.
- To provide the knowledge of materials based on IS code provisions.
- To know the properties of fresh concrete.
- To know about the procedure about how to determine the physical properties and mechanical properties of hardened concrete.
- To provide knowledge about concrete mix design and guidelines and application of NDT tests on concrete.

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Able to determine the physical properties of cement, aggregates, and concrete.
- Understands the knowledge of materials based on IS code provisions.
- Understand about physical and mechanical properties of fresh concrete.
- Able to perform the test, and also to determine the physical properties and mechanical properties of hardened concrete.
- Able to design mix for various grades of concrete practices and gain practical application of NDT tests on concrete.

LIST OF EXPERIMENTS

I. Tests on Cement:

1. Fineness and normal consistency of cement
2. Initial setting time and final setting time of cement
3. The specific gravity of cement
4. Compressive strength of cement

II. Tests on Aggregate:

1. Fineness modulus of fine and coarse aggregate
2. Specific gravity and bulk density of fine and coarse aggregate
3. Bulking of sand

III. Tests on Concrete:

1. Workability tests on concrete by slump and Vee-bee
2. Young’s modulus and compressive strength of concrete
3. Split tensile strength of concrete
4. Flexural strength of plain concrete

B.Tech. Civil II Year -II Sem

	L	T	P/D	C
	0	**0**	**2**	**1**

GEOTECHNICAL ENGINEERING LABORATORY

Prerequisite- Geotechnical Engineering

Course Objectives:
- To impart the knowledge on how to classify the soils
- To impart the knowledge of field tests involved in knowing the soil properties
- To impart knowledge on permeability characteristics of soils
- To impart knowledge on strength characteristics of soils
- To impart knowledge on how consolidation behaviour of soils

Course Outcomes:
On successful completion of this course, it is expected that the students will be able to,
- Classify soils based on grainsize and Atterberg limits.
- Classify the field tests and lab tests conducted on soils.
- Determinethe permeability of soils.
- Understand strength characteristics of soils.
- Determine consolidation of soils.

List of Experiments
1. Determination of specific gravity of soil pyconometer
2. Attenberg Limits (Liquid Limit, Plastic Limit)
3. Field density by core cutter method and sand replacement method
4. Grain size distribution by sieve analysis
5. Differential free swell index
6. Permeability of soil by constant and variable head test methods
7. Standard Proctor's compaction tests
8. Unconfined compression tests
9. Triaxial compression test
10. Direct shear test
11. Vane shear test
12. Determination of coefficient of consolidation (Square root time fitting method)

NPTEL
https://nptel.ac.in/courses/105103097/

CODES
IS 2720 Method of Test for soils?

B.Tech. Civil- II Year II Sem

	L	T	P/D	C
	0	**0**	**2**	**1**

PROJECT DESIGN INNOVATION

Course Outcomes:

- To provide a platform to showcase innovative idea
- To get a chance to mold an idea into a physical model
- To provide a chance to search the literature and make comprehensive report on the new idea.
- To provide a platform to improve the presentation skill
- To convert the idea into realistic project

Course Outcomes:

On successful completion of this course, it is expected that the students will be able to,

- Show an innovative idea in the form of a model
- Convert an idea into a physical model
- Prepare a comprehensive report on a designed model
- Improve the presentation skill in the form of seminar
- Convert the innovative idea into realistic model and do the further project/research

M. Tech. Structural Engineering

COURSE STRUCTURE AND SYLLABUS

I - SEMESTER

Sr. No.	Course Code	Course Name	Teaching Scheme			Credits
			L	T	P/D	
1.		Advanced Structural Analysis	3	0	0	3
2.		Theory of Elasticity	3	0	0	3
3.		Structural Dynamics	3	0	0	3
4.		**Professional Elective 1** 1. Water Retaining Structures 2. Advanced Foundation Design 3. Design of Masonry Structures 4. Advanced Concrete Technology	3	0	0	3
5.		**Open Elective** 1. Business Analytics 2. Industrial Safety 3. Machine Learning 4. Cost Management 5. Computer Oriented Numerical Methods 6.Waste to energy	3	0	0	3
6.		Research Methodology	2	0	0	2
7.		Advanced Concrete Technology Instrumentation Laboratory	0	0	4	2
8.		Virtual Smart Structures and Dynamics Laboratory	0	0	4	2
Total			**17**	**0**	**8**	**21**

II - SEMESTER

Sr. No.	Course Code	Course Name	Teaching Scheme L	T	P/D	Credits
1		Finite Element Method	3	1	0	4
2		Earthquake Resistant Design of Structures	3	1	0	4
3		**Professional Elective 2** 1. Stability of Structures 2. Retrofitting and Rehabilitation Structures 3. High Rise Structures 4. Soil Structure Interaction	3	0	0	3
4		**Professional Elective 3** 1. Theory of Plates 2. Bridge Engineering 3. Industrial Structures 4. Composite Structures	3	0	0	3
5		**Professional Elective 4** 1. Prestressed Concrete 2. Structural Health Monitoring 3. Nonlinear Structural Analysis 4. Design of Substructures	3	0	0	3
6		Audit Course	2	0	0	0
7		CAD Laboratory	0	0	4	2
8		Seminar	0	0	4	2
Total			**17**	**2**	**8**	**21**

III - SEMESTER

Sr. No.	Course Code	Course Name	Teaching Scheme L	T	P/D	Credits
1		Dissertation Phase – I	0	0	24	12
Total			**0**	**0**	**24**	**12**

IV - SEMESTER

Sr. No.	Course Code	Course Name	Teaching Scheme			Credits
			L	**T**	**P/D**	
1		Dissertation Phase – II	0	0	28	14
Total			**0**	**0**	**28**	**14**

List of Open Electives Courses

S. No.	Course Name	Name of Department
1	Business Analytics	MBA
2	Industrial Safety	Mechanical Engineering
3	Machine Learning	Computer Science Engineering
4	Cost Management of Engineering Projects	MBA
5	Waste to energy	Electrical Engineering
6	Computer Oriented Numerical Methods	Mathematics

List of Audit Courses

S. No.	Course Name	Name of Department
1	English for Professional	English
2	Technical Writing and Communication Skills	English

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED STRUCTURAL ANALYSIS

Course Objectives: To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

Course Outcomes: The learner will be able to analyze different indeterminate structures using Matrix methods.

UNIT - I

Introduction to matrix methods of analysis - statical indeterminacy and kinematical indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and torsional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT - II

Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method.

UNIT - III

Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and garde frame by flexibility method using system approach by flexibility methods and gables frames by Gable System Approach.

UNIT - IV.

Analysis of plane truss - continuous beams with and without settlement - plane frame including sides sway, grids and gable frames by stiffness methods, single bay – two storey, two bay single – storey.

Unit-V

Special analysis procedures - static condensation and sub structuring - initial and thermal stresses

TEXT BOOKS

1. Matrix Analysis of Frames structures by William Weaver J.R and James M. Gere,CBS publications, 2nd edition, 2004
2. Advanced Structural Analysis by Ashok. K. Jain, Nem ChandBrothers, 3rd edition, 2015

REFERENCE

1. Advanced Structural Analysis by Devadas Menon, Narosa, 2009.
2. Structural Analysis by R. C. Hibbler, Pearson, 2015.
3. Text Book of Finite Element Analysis by P. Seshu, PHI, 2003.
4. Basic Structural Analysis by C.S. Reddy, Tata Mc-Grawhill
5. Matrix method of S.A by Pandit & Gupta

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY OF ELASTICITY

Course Objectives: To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

Course outcomes: The learner will be able to solve problems of elasticity and be able to apply numerical methods to solve continuum problems.

Prequistes: Strength of Materials, Mathematics

UNIT-I

Introduction: Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis – Two dimensional co-ordinate system-differential equations of equilibrium - boundary conditions – Strain Displacement Relations - compatibility equations –Airy's stress function

UNIT - II

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams – Simple Supported and Cantilever Beam.

UNIT - III

Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions Edge Dislocation - general solution of two-dimensional problem in polar coordinates - application to Plates with Circular Holes-solid and hollow – Rotating Disk.

Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section.

UNIT - IV

Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface- determination of principal stresses Stress Invariants - max shear stresses Stress Tensor – Strain Tensor- Homogeneous deformation - principal axes of strain-rotation.

General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem Strain Energy.

UNIT - V

Torsion of Circular Shafts - Torsion of Straight Prismatic Bars– Saint Venant’s Method - torsion of prismatic bars - bars with circular and elliptical cross sections – thin walled sections-Prandtl’s membrane analogy - torsion of a bar of narrow rectangular bars - solution of torsional problems by energy method - torsion of shafts, tubes , bars etc. – Introduction and Applications of Elastic Solutions in Geomechanics.

TEXT BOOKS

1. Theory of Elasticity by Timoshenko, Mc-Graw hill Publications, 2017.
2. Advanced Mechanics of solids by L.S.Srinath, Tata Mc-GrawHill, 2017.

REFERENCES:

1. Theory of Elasticity by Y.C. Fung, Dover publications, Newyork, 2008.
2. Advanced Mechanics of Materials by Arthur P. Boresi, John Willey publishers, 2010
3. Continuum Mechanics by P.N. ChandraMouli, Yes Dee Publishers, 2004
4. Theory of Elasticity by Sadhu singh, KhannaPublishers, 2018.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

STRUCTURAL DYNAMICS

Course Objectives: To impart knowledge on the fundamental of structural dynamics and their applications.

Course Outcomes: The learner will be able to understand the equation of motion, dynamics response of single, and multi degree-of freedom systems.

UNIT - I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth

UNIT - II

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems: Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral, Numerical evaluation of dynamic response- Central Difference Method and Newmark's Method, Concept of response spectrum.

UNIT - III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes – Modal Analysis- Mode super position procedure for damped forced vibrations

UNIT - IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basicprocedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT - V

Deterministic Earthquake Response of Systems – Rigid Foundation, Types of Earthquake Excitation
– Response to Rigid – Soil Excitation, Lumped SDOF elastic systems – Lumped SDOF elastic system – Distributed Parameter Elastic Systems – SRSS, CQC combination of modal responses.

TEXT BOOKS:

1. Anil. K. Chopra, Dynamics of Structures, Pearson Education India, 2007.
2. Pankaj Agarwal and Manish Shrikhande," Earthquake Resistant Design of Structures", PHI, 2006.

REFERENCES :

1. Ray W. Clough, Joseph Penzin, Dynamics of Structures, CBS Publishing, 2015.
2. Mario Paz,"Structural Dynamics: Theory And Computation", CBS Publishing, 2004.

W.T. Thomson,Theory of vibrations ,CBS Publishers And Distributors Pvt Ltd, 2002.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

WATER RETAINING STRUCTURES

Professional Elective-I

Course Objective

To understand the planning, behavior, analysis and design of water retaining structures

Course Outcomes At the completion of this course, the student shall acquire knowledge and ability to

CO1. design and detailing of circular GSR and underground tank,

CO2. design and detailing of rectangular GSR and underground tank,

CO3. design and detailing of Elevated Service Reservoir of various capacities and column configurations,

CO4. design and detailing of various units of water treatment plant such as clarrifloculator, Aeration fountain, chemical house etc,

CO5. design and detailing of Approach Bridge, Jack well.

Unit-I

Analysis of circular water tanks with various boundary conditions at base slab, variation of hoop tension, moment and deflection of wall with various H/T ratios, deep and shallow tanks. Analysis of tanks using beam on elastic foundation analogy

Unit-II

Analysis of rectangular water tanks with various boundary conditions at base slab, variation of moments with respect to height/span ratio.,

Unit-III

Design (un-cracked and cracked design) of water tank sections subjected to moment, Moment and compression, moment and tension.

Unit-IV

Earthquake Analysis of water tanks on ground and over head tanks (SDOF and MDOF model)

Unit-V

Analysis and design of jack well, approach bridge and WTP (clarifloculator, FM, aeration fountain, chemical house, flash mixer etc.) units etc. Analysis and design of ESR (container and staging)

Reference Books/Material

1. Jaiswal, O. R., Rai, D. C., & Jain, S. K. (2007). Review of seismic codes on liquidcontaining tanks. Earthquake Spectra, 23(1), 239-260.
2. BIS IS 1893-2(2014) Criteria for Earthquake Resistant Design of Structures – Part 2: Liquid retaining tanks, Bureau of Indian Standards, New Delhi, India, (2014).
3. BIS IS 1168 (2011)Criteria for design of RCC staging for overhead water tanks, Bureau of Indian Standards, New Delhi, India, (2011)
4. Anchor, R. D. (1981). Design of liquid-retaining concrete structures. Halsted Press.
5. IS 3370(Part-I). (2009). Concrete structures for storage of liquids - code of practice.
6. IS 3370(Part-II). (2009). Concrete structures for storage of liquids - code of practice.
7. IS 3370(Part-III). (1967). Code of practice for concrete structures for the storage of liquids.
8. IS 3370(Part-IV). (1967). Code of practice for concrete structures for the storage of liquids. Design –Tables.
9. IS BIS IS 13920 (2016). Ductile design and detailing of reinforced concrete structures subjected to seismic forces – code of practice (first revision), Bureau of Indian Standards, New Delhi, India.
10. Ghali, A. (2014). Circular storage tanks and silos. CRC Press.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED FOUNDATION ENGINEERING

Professional Elective-I

Course Objective:
To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

Course Outcome:
Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

Unit-I

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

Unit-II

Shallow Foundations: **Bearing Capacity:-** Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

Unit-III

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands- Schmertmann and Burland & Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, CodalProvisions.

Unit-IV

Deep Foundations: **Single Pile:** Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral

Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions, Analysis of foundation on soft soil.

Unit-V

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

***Introduction to Reliability-Based Design**: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering(2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning(2008)

REFERENCE BOOKS

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc.(1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john Wiley & sons inc(1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall(2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering,Wiley Publications (2003).

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

DESIGN OF MASONRY STRUCTURES
Professional Elective-I

Course Objectives: To enable the student to understand the fundamental Concepts of

1. Masonry materials and its mechanical properties.
2. Analysis and the behavior of structural masonry
3. Shear and flexural behavior of Reinforced and unreinforced masonry
4. Summarize construction practices, seismic behavior, specifications, for Design of masonry
5. Seismic evaluation and Retrofit of Masonry.

Course Outcomes: At the end of the course, students will be able to

1. Select appropriate masonry unit and mortar mixes for masonry construction.
2. Distinguish from a wide range of materials for their suitability to arrive at feasible and optimal solutions for masonry constructions.
3. Apply knowledge of structural masonry for advanced research and construction procedures.
4. Justify the design of masonry buildings for sustainable development.
5. Repair and strengthen the existing masonry structures for seismic loads

UNIT - I:

Introduction - Masonry construction - National and International perspective –Historical development, Modern masonry, Principles of masonry design, Masonry standards: IS 1905 and others. Material Properties - Masonry units: clay and concrete blocks, Mortar, grout and reinforcement, Bonding patterns, Shrinkage and differential movements.

UNIT - II:

Masonry in Compression - Prism strength, Eccentric loading, Kern distance. Masonry under Lateral loads - In-plane and out-of-plane loads, Analysis of perforated shear walls, Lateral force distribution -flexible and rigid diaphragms.

UNIT - III:

Behaviour of Masonry - Shear and flexure - Combined bending and axial loads -Reinforced and unreinforced masonry - Cyclic loading and ductility of shearwalls for seismic design – Infill masonry.

UNIT - IV:

Structural design of Masonry - Working and Ultimate strength design - In-plane and out-of-plane design criteria for load-bearing and infills, connecting elements and ties - Consideration of seismic loads - Code provisions.

UNIT - V:

Seismic evaluation and Retrofit of Masonry - In-situ and non-destructive tests for masonry -properties - Repair and strengthening of existing masonry -structures for seismic loads.

TEXTBOOKS:

1. P. Dayaratnam and P. Sarah, "Brick and Reinforced Brick Structures",Oxford& IBH Publishing Co, 2017.

2. R. G. Drysdale, A. H. Hamid and L. R. Baker, "Masonry Structures:Behaviour & Design", Prentice Hall Hendry,1994.

REFERENCES:

1. A.W. Hendry, B.P. Sinha and S. R. Davis, "Design of MasonryStructures", E & FN Spon, UK, 1997.
2. S. Sahlin, "Structural Masonry", Prentice Hall, Englewood Cliffs, NJ,1971.
3. R.S. Schneider and W.L. Dickey, "Reinforced Masonry Design",Prentice Hall, 3rd edition, 1994.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

ADVANCED CONCRETE TECHNOLOGY

Professional Elective-I

Course Objectives: Study the different types of admixtures, mix design, properties and applications of special concretes.

Course Outcomes: Design concrete mixes by various methods. Familiarize with the types of admixtures, and applications of special concretes.

UNIT – I

Cement chemistry-Portland cement and its constituent phases-High temperature chemistry-The chemistry of Portland cement manufacture-Hydration of calcium silicate phases-Hydrated aluminates, ferrite and sulphate phases- Hydration of cement.

Admixtures: Classification of admixtures - Chemical and mineral admixtures - Influence of various admixtures on properties of concrete and their applications

UNIT –II

Mix Design of Concrete as per IS 10262-2019, ACI Method and DOE Method

Durability Properties - Permeability – chemical attack – Sulphate attack – Carbonation - Quality of water – marine conditions – Thermal properties of concrete – fire resistance – methods of making durable concrete

UNIT –III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design of HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete. High Performance Concrete- Requirements and properties of High-Performance Concrete- Design Considerations.

UNIT –IV

Concrete - Understanding the quasi-brittle nature of concrete - Failure of concrete under low stress - Micro— cracking, crack propagation - stress concentration at openings –Destructive, semi-destructive & Non-destructive testing methodology - Rebound hammer test – Ultrasonic

Pulse Velocity (UPV) Test - Penetration resistance test - Pull-out Test - Pull-off Method - Break-off test - Cover Measurement

UNIT - V

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete – Reactive Powder concrete – Blended Concrete-RMC-Requirements and Guidelines – Advantages and Applications. Light weight concrete. Concrete mix design: Quality Control – Quality assurance – Quality audit.

TEXTBOOKS

1. A.M. Neville Properties of Concrete , ELBS publications, Fifth edition, 2012.
2. Shetty M.S., “Concrete Technology”, S.Chand and Company Ltd. Delhi, Seventh edition, 2013.

REFERNCES

1. Gambhir.M.L., “Concrete Technology”, Tata McGraw Hill, Publishing Co. Ltd NewDelhi, 2013.
2. Santhakumar .A.R.,” Concrete Technology”, Oxford University Press, NewDelhi2006.
3. Rajat Siddique Special Structural concretes, Galgotia Publications.
4. N.Krishna Raju Design of Concrete Mixes , CBS Publications, 5/e edition, 2018
5. P.K. Mehta Concrete: Micro Structure, Properties and Materials, Tata Mc-Graw Hill Publishing House Pvt. Ltd, fourth edition.

ANURAG UNIVERSITY

M.Tech. (Structural Engineering)

BUSINESS ANALYTICS

Open Elective

Course Objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.

Course Outcomes:

1. Students will demonstrate knowledge of dataanalytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support businessdecision-making.
4. Students will demonstrate the ability to translate data into clear, actionableinsights.

Unit1

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of BusinessAnalytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple LinearRegression.

Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Textbooks:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress 2015.
2. Business Analytics by James Evans, personsEducation.2010.

ANURAG UNIVERSITY

M.Tech. (Structural Engineering)

INDUSTRIAL SAFETY

Open Elective

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical

hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment andmethods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internalcombustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their generalcauses.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept andimportance

TEXTBOOKS

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.

REFERENCES

1. Pump-hydraulic Compressors, Audels, Mcgrew HillPublication.
   Foundation Engineering Handbook, Winterkorn, Hans, Chapman & HallLondon.

ANURAG UNIVERSITY

M.Tech. (Structural Engineering)

MACHINE LEARNING

Open Elective

Prerequisites: Data Structures, Knowledge on Statistical Methods

Course Objectives:

1. This course explains machine learning techniques such as decision tree learning, Bayesian learningetc.
2. To understand computational learningtheory.
3. To study the pattern comparisontechniques.

Course Outcomes:

1. Understand the concepts of computational intelligence like machinelearning
2. Ability to get the skill to apply machine learning techniques to address the realtime problems in differentareas
3. Understand the Neural Networks and its usage in machine learningapplication.

UNIT – I

Introduction - Well-posed learning problems, designing a learning system Perspectives and issues in machine learning

Concept learning and the general to specific ordering – Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.

Decision Tree Learning – Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision TreeLearning.

UNIT – II

Artificial Neural Networks Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm. Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition **Evaluation Hypotheses** – Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

UNIT – III

Bayesian learning - Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle, Bayes Optimal Classifier, Gibs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EMAlgorithm.

Computational Learning Theory – Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning.

Instance-Based Learning – Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

UNIT – IV

Pattern Comparison Techniques, Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization

Pattern Classification: Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing

UNIT – V

Analytical Learning – Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize theHypothesis.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – HwangJuang.

REFERENCE BOOK:

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

ANURAG UNIVERSITY

M.Tech. (Structural Engineering)

COST MANAGEMENT OF ENGINEERING PROJECTS

Open Elective

Unit-I:

Introduction and Overview of the Strategic Cost Management Process. Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents.

Unit-III

Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-IV:

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

Unit-V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TEXTBOOKS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting

REFERENCES:

1. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher

N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

ANURAG UNIVERSITY
M.Tech. (Structural Engineering)

COMPUTER ORIENTED NUMERICAL METHODS

Open Elective

Unit - I:

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and Eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

UNIT - II:

Interpolation: Linear Interpolation – Higher order Interpolation – Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation –piece-wise and spline Interpolation.

Unit - III

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulae using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Applications to Simply Supported Beams, Columns and RectangularPlates.

UNIT - IV

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculation of Slopes andDeflections.

UNIT - V

Ordinary Differential Equation: Euler's method – Backward Euler method – Midpoint method – single step method, Taylor's series method- Boundary value problems.

TEXT BOOKS:

1. Numerical methods for scientific and engineering computations. M.K. Jain-S.R.K. Iyengar – R.K. Jain Willey EasternLimited
2. Numerical Methods for Engineering Problems, N. Krishna Raju, KU Muthu, Mac-Millan publishers

REFERENCES:

1. Introductory Numerical Methods by S.S. Shastry, PHI Learning Pvt.Ltd.
2. Applied numerical analysis by – Curtis I. Gerala- Addission Wasley – publishedcampus.
3. Numerical methods for Engineers Stevan C. Chopra, Raymond P. Canal Mc. Graw Hill Book Company.
4. C Language and Numerical methods by C. Xavier – New age internationalpublisher.
5. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers, NewDelhi.

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M.Tech. (Structural Engineering)

WASTE TO ENERGY

Open Elective

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme inIndia.

TEXBOOKS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.

REFERENCES:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

RESEARCH METHODOLOGY

Course Objectives

1 Motivate to choose research as career
2 Formulate the research problem, prepare the research design
3 Identify various sources for literature review and data collection report writing
4 Equip with good methods to analyse the collected data

Course Outcomes

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyse problem by statistical techniques: ANOVA, F-test, Chi-square

UNIT - I

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. **Defining the Research Problem**: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

UNIT - II

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet.

Literature Review: Need of Review, Guidelines for Review, Record of Research Review.

UNIT - III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Steps in sample design, types of sample designs, Use of Standards and Codes.

UNIT - IV

Data Collection: Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software.

Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student’s t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT - V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

TEXT BOOKS:

1. C.R Kothari, Research Methodology, Methods & Technique‖; New Age International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers‖, MJP Publishers, 2011

REFERENCE:

1. Y.P. Agarwal, Statistical Methods: Concepts, Application and Computation‖, Sterling Publications Pvt. Ltd., New Delhi, 2004
2. G.B. Reddy, Intellectual Property Rights and the Law 5th Ed. 2005 Gogia Law Agency
3. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications, Macmillan India Ltd, 2006

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M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE TECHNOLOGY AND INSTRUMENTATION LAB

Course Objective: to understand the test procedure and behavior of the concrete and RC beams

Course Outcome: the student will be able to design concrete mix which will satisfy the fresh and hardened concrete properties, and study the behavior of structural elements.

Experiments to be conducted:

1. Workability of fresh concrete
   a) slump core
   b) Compaction Factor
   c) Vee Bee Test
2. To design the mix for High Strength Concrete and determine fresh and hardened properties of High Strength Concrete.
3. Mix proportion on fly-ash based concrete for compressive strength.
4. Mix proportion on Geo-polymer concrete for compressive strength.
5. Cube compressive strength of fly-ash and geo polymer concrete. Split tensile strength and modulus of rupture for fly-ash concrete/geo-polymer concrete.
6. Marsh cone test.
7. Permeability and Air entrainment of concrete
8. NDT tests on hardened concrete
   a) Rebound hammer
   b) UPV hammer
9. Accelerated curing of concrete
10. Design and Testing of self compacting concrete of standard grade (M30 or M40)
    a) V- Funnel
    b) L -Box
    c) U -Box
    d) J -Ring

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VIRTUAL SMART STRUCTURES AND DYNAMICS LAB

Course Outcomes

After the completion of the course, the student will be able to:

1. Understand the behaviour of structures subjected to dynamic loadings

2. Understand the dynamic characteristics of structures instrumented with sensors.

3. Visualize shear lag effect and Rebar Corrosion

4. Draw response spectrum curve for given condition

5. Measure displacements using Photogrammetry

List of Experiments:

Simulation based:

1. Free Vibration of S.D.O.F System

2. Forced Vibration of S.D.O.F System

3. Impulse Response of S.D.O.F System

4. Concept of Response Spectrum

5. Vibration of M.D.O.F System

6. Behaviour of Rigid Blocks

7. Torsional Response of Building

8. Continuous Systems

9. Vibration Control

10. Modes of Vibration of Simply Supported Beam Under Flexure

11. Modes of Vibration of Simply Supported Plate

12. Damage Detection and Qualitative Quantification Using Electro-Mechanical Impedance (EMI)

Technique

13. Dynamics of Bandra Worli Sea Link Bridge

14. Piezoelectric Energy Harvesting and Structural Health Monitoring Using Thin Surface Bonded PZT

Patches.

15. Shear Lag Effect in Electro-Mechanical Impedance (EMI) Technique

16. Rebar Corrosion Detection and Assessment Using Electro-Mechanical Impedance (EMI) Technique.

Simulation based:

17. Vibration Characteristics of Aluminium Cantilever Beam Using Piezoelectric Sensors

18. Identification of High Frequency Axial Modes of Beam in "Free-Free" Condition Using Electro-

Mechanical Impedance (EMI) Technique

19. Forced Excitation of Steel Beam Using Portable Shaker

20. Photogrammetry for Displacement Measurement

e-resources:

1. http://sd-iiith.vlabs.ac.in/Introduction.html (For Experiments 1 to 9)

2. http://vssd-iitd.vlabs.ac.in/home.html (For Experiments 10 to 20)

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M. Tech – I Year – II Sem. (Structural Engg.)

FINITE ELEMENT METHOD

Course Objectives: To impart knowledge about various finite element techniques and development of finite element code.

Course Outcome: The learner will be able to solve continuum problems using finite element analysis.

UNIT - I

Introduction: Concepts of FEM - steps involved - merits and demerits – energy principles Discretization - Raleigh - Ritz method of functionalapproximation.
Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT - II

One dimensional FEM : Stiffness matrix for beam and bar elements - shape functions for 1-D elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT - III

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis - formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements.
Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.
Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

UNIT - IV

Introduction to Finite Element Analysis of Plates: Basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT - V

Heat Transfer- Introduction, Steady state Heat Transfer, 1D Steady state Condition -2D steady state condition-Triangular element.
Dynamic Analysis-Introduction, Formulation-Element Mass matrices of bar element, truss element, CST element, Axi-symetric element, Evaluation of Eigen value-Eigen Vector.
Non– linearfinite analysis –Introduction- Types – Analysis of Material and Geometric Nonlinearity.

TEXT BOOKS:

1. T. R. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice –Hall of India Private Limited,New Delhi, 2009.
2. David V. Hutton, Fundamentals of Finite Element Analysis, McGraw Hill Education (India) Private Limited, Delhi, 2014.

REFERENCES

1. Daryl L, Logan, "A first course in the Finite Element Method", Third Edition, Thomson Brook, Canada Limited, 2007.
2. R. D. Cook, R.D" Concepts and Applications of Finite Element Analysis", John Wiley and sons, 1981.
3. O. C. Zienkiewicz. And R. L. Taylor, "The Finite Element Method", Vol.1, McGraw Hill Company Limited, London, 1989.
4. Reddy, J. N, An Introduction to the Finite Element Method, McGraw Hill, New York, 1993.
5. Bathe, K. J, (2006). Finite Element Procedures, Prentice Hall of India, New Delhi.

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M. Tech – I Year – II Sem. (Structural Engg.)

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Course Objectives:

To impart knowledge on the seismology and behavior of buildings during earthquakes.

Course Outcomes:
The learner will be able to analyse and design buildings to resist seismic forces

UNIT-I
Earthquake Ground Motion: Engineering seismology, Seismic zoning map of India, Strong motion studies in India, Strong motion characteristics, Evaluation of seismic design parameters, Theory of seismic pickup.

UNIT-II
Concepts of Earthquake Resistant Design of RCC Structures: Basic elements of earthquake resistant design, Identification of seismic damages in RCC buildings, Effect of structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture.

UNIT-III
Seismic Analysis and Modelling of RCC Structures: Code based procedure for determination of design lateral loads, Infill walls, Seismic analysis procedure as per IS 1893 code, Equivalent static force method, Response spectrum method, Time history analysis, Mathematical modelling of multi-storey RCC buildings.

UNIT-IV
Earthquake Resistant Design of RCC Structures: Ductility considerations, Earthquake resistant design of multi-storey RCC buildings and shear walls based on IS 13920 code, Capacity based design.

UNIT-V

Earthquake Resistant Design of Masonry Structures: Identification of damages and non-damages in masonry buildings, Elastic properties of structural masonry, Lateral load analysis of masonry buildings, Seismic analysis and design of one-storey and two-storey masonry buildings.Case studies of past earthquakes in India.

TEXT BOOKS

1. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2009.
2. S K Duggal, Earthquake Resistant Design of Structures, Oxford University Press, 2007.

REFERENCES

1. Bruce A Bolt, Earthquakes, W H Freeman and Company, New York, 2004.
2. C. A. Brebbia, Earthquake Resistant Engineering Structures, WIT Press, 2011.
3. Mohiuddin Ali Khan, Earthquake-Resistant Structures: Design, Build and Retrofit, Elsevier Science & Technology, 2012.

4. Paulay, T and Priestley, M.J.N., Seismic Design of Reinforced Concrete and Masonry buildings, John Wiley and Sons, 1992.

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M. Tech – I Year – II Sem. (Structural Engg.)

STABILITY OF STRUCTURES

Professional Elective-2

Course Objectives: To impart knowledge on the elastic, inelastic buckling and torsional buckling of structures.
Course Outcomes: The learner will be able to understand buckling of bars and frames.

UNIT – I

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load- application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowablestresses.

UNIT - II

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built upcolumns.

UNIT - III
Inelastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design –various end conditions

UNIT - IV

Torsion Buckling: Pure torsion of thin walled bars of open cross section – Non-uniform torsion of thin walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

UNIT – V

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

TEXT BOOKS

1. Theory of elastic Stability by Timshenko & Gere -McGraw Hill

REFERENCES

1 Stability of metallic structures by Blunch- McGrawHill
2 Theory of Beam- Columns Vol. I by Chem. & Atste McGrawHill
3 Stability Theory of Structures by Ashwini Kumar, AlliedPublishers.

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RETROFITTING & REHABILITATION OF STRUCTURES

Professional Elective-2

Course Objectives:
1. Learn the fundamentals of maintenance and repair strategies.
2. Study the quality assurance, serviceability and durability of concrete.
3. Know the various materials and techniques used for repair of structures.
4. Educate the different repair, strengthening, rehabilitation and retrofitting techniques.
5. Instruct the various health monitoring and demolition techniques.

Course Outcomes
1. Understand the fundamentals of maintenance and repair strategies.
2. Diagnose for serviceability and durability aspects of concrete.
3. Know the materials and techniques used for repair of structures.
4. Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
5. Use an appropriate health monitoring and demolition techniques.

UNIT - I

Maintenance: Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

Repair Strategies: Causes of distress in concrete structures, Construction and design failures, Condition assessment and distress-diagnostic techniques, Assessment procedure for Inspection and evaluating a damaged structure.

UNIT - II

Serviceability and Durability of Concrete: Quality assurance for concrete construction, concrete properties – strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking.

UNIT - III

Materials and Techniques for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Bacterial concrete, Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection.

UNIT - IV

Repair, Rehabilitation and Retrofitting Techniques: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure, Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V

Health Monitoring and Demolition Techniques: Long term health monitoring techniques, Engineered demolition techniques for dilapidated structures, Use of Sensors – Building Instrumentation.

TEXT BOOKS

1. Concrete Technology by A. R. Santhakumar, Oxford Universitypress
2. Defects and Deterioration in Buildings, E F & N Spon,London

REFERENCES:

1. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey UniversityPress
2. Maintenance, Repair & Rehabilitation and Minor Works of Buildings by P. C. Varghese,PHI.
3. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta,Standard Publications.
4. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso,(1981)
5. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson,(1991**).**

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M. Tech – I Year – II Sem. (Structural Engg.)

HIGH RISE STRUCTURES
Professional Elective-2

Course Objective: To impart knowledge on analysis of high rise buildings.

Course Outcomes: The learner will be able to analyse and chose a appropriate systems for high rise buildings.

UNIT- I:

Introduction to Tall Buildings: Design Principles for Lateral Load resistance, ductility considerations in earthquake resistant design of concrete buildings, construction methods, choice of materials, cladding systems and their design principles, types of foundations for tall buildings.
Wind Loads on Tall Buildings: Introduction to wind, characteristics of wind, Computation of wind loads on buildings as per IS code methods, Wind Tunnel testing, Introduction to Computational Fluid Dynamics.

UNIT- II:
Seismic Loads on Tall Buildings: Introduction to Earthquakes, Characteristics of Earthquake, Computation of seismic loads on tall buildings – Response Spectrum Method, Vibration Control – active control & passive control, Liquefaction effects of earthquake, Introduction to Time history Analysis and Pushover analysis.

UNIT – III:
Structural systems for Tall Buildings: Necessity of special structural systems for tall buildings, Structural Systems for Steel Buildings -Braced frames, Staggered Truss System, Eccentric Bracing System, Outrigger & Belt truss system, Tube Systems; Structural Systems for Concrete Buildings - shear walls, frame tube structures, bundled tube structures; Design of shear wall as per IS code. Design of Pile Foundation.

Special Topics in Tall Buildings: Second order effects of gravity loading, Creep and shrinkage in columns, Differential shortening of columns, Floor levelling problems, Panel zone effects, P-Delta analysis

.
UNIT – IV:
RCC Chimneys: Introduction, parts of an RCC chimney, design factors, stresses in RC shafts due to self weight and wind loads, stresses in horizontal reinforcement due to shear force, stresses due to temperature difference, design of RCC chimney, design of reinforcements in chimneys using charts, dynamic loads effects on RCC chimneys.

UNIT – V:

Transmission Line Towers: Classification, economical spacing and design loads - IS code provisions - Calculation of wind loads and permissible stresses – Overall arrangement and design procedure - Detailed design including foundations

TEXTBOOKS:

1. B. S. Taranath ,Reinforced Concrete Design of Tall Buildings, McGraw-Hill Book Company, 2010.
2. E. Simlu, Wind Effect on Structures: An Introduction to Wind Engineering, Wile& Sons, 1986.

REFERENCES

1. M. Fintel, Hand Book of Concrete Engineering, Von Nostrand,2004.
2. Emilio Rosenblueth, Design of Earthquake Resistant Structures, Pentech Press Ltd., 1990.
3. W. Schuellar, High Rise Building Structures,John Wiley & Sons Inc, 1977.
4. Bryan Stafford Smith & Alex Coull,Tall Building Structures: Analysis & Design, Wiley India Pvt Ltd, 1991.
5. Lynn S. Beedle Advances in Tall Building,s, CBS Publishers and Distributors Delhi, 1996.

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SOIL STRUCTURE INTERACTION
Professional Elective-2

Course Objectives: To enable the student

1. To understand the soil behaviour and scope of its interaction analysis with the elastic structure.

2. To understand the interaction analysis between the soil-structure

3. To understand the analysis of infinite and Winkler shapes of plates

4. To understand the solutions for settlement and load distribution behaviour of piles

5. To understand the behaviour of laterally loaded piles.

Course Outcomes: At the end of the course, student is able to

1. Analyse soil behaviour.

2. Analyse the interaction between soil structures with reference to relative stiffness of beams

3. Analyse infinite and Winkler plate and numerical solutions for finite plates.

4. Give theoretical solutions for settlement and load distribution of pile and pile group.

5. Predict load deflection for laterally loaded piles and its subgrade reaction

UNIT - I: Soil-Foundation Interaction: Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.

UNIT - II: Beam on Elastic Foundation - Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

UNIT - III: Plate on Elastic Medium: Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

UNIT - IV: Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

UNIT - V: Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts.

TEXT BOOKS:

1. J. A. Hemsley, “Elastic Analysis of Raft Foundations”, Thomas Telford, 1998.

2. D. F. McCarthy, “Essentials of Soil Mechanics and Foundations, basic geotechnics”, Prentice Hall, 2002.

REFERENCES:

1. H. G. Poulos,and E. H. Davis., “Pile Foundation Analysis and Design”, John Wiley, 1980.
2. P. S. Selvadurai, “Elastic Analysis of Soil Foundation Interaction”, Elsevier, 2015
3. H. G. Poulos, and E. H. Davis, “Pile Foundation Analysis and Design”, John Wiley, 1980.
4. R. F. Scott, “Foundation Analysis”, Prentice Hall, 1981. 7. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978. ACI 336

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THEORY OF PLATES

Professional Elective-3

Course Objectives: To impart knowledge on the behavior of plates and to analyse the problems pertaining to beams on elastic foundation.

Course Outcomes: The learner will be able to understand the behavior of plates for loadings and boundary conditions.
Perquisite: Mechanics of Solids, Mathematics.

UNIT - I
Cylindrical Bending: Different kind of plates – Assumptions – Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.
Pure Bending of Plates: Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending –Moment in any direction-Principal moments-Strain energy in pure bending –Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNIT - II
Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier's solution – Application to different loading cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT - III
Circular Plates: Symmetrical loading – Relations between slope, deflection, moments and curvature–Governing differential equation – Uniformly loaded plates with clamped and simply supported edges–Central hole – bending by moments and shearing forces uniformly distributed.
Orthotropic Plates: Introduction – Bending of anisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet – Application to the theory of grid works.

UNIT - IV
Plates on Elastic Foundations: Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions – Large plate loaded at equidistant points by concentrated forces.

UNIT - V
Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simple loading for various boundary conditions. Problems

TEXT BOOKS

1. Timoshenko Theory of Plates and Shells, McGraw Hill Book Co., New York. 2017.
2. Bhavikatti SS. Theory of plates and shells. New Age International; 2012.

REFERENCES:

1. P. Szilard Theory and Analysis of Plates, Prentice Hall.2014.
2. Reddy JN. Theory and analysis of elastic plates and shells. CRC press; 2006.
3. N. K. Bairagi Plate Analysis, Khanna Publishers. New Delhi.2010.

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BRIDGE ENGINEERING

Professional Elective-3

Course Objectives:
To impart knowledge about different types of bridges, their analysis and design for combination of different loading condition as per codal provisions.

Course Outcomes:
The learner will be in a position to understand and design different types of bridges.

Prerequisite: Structural Analysis I &II, Reinforced Concrete Design

UNIT I
Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead Load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.
Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT II
Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT III
Box Culvert: - Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts.
Design of Critical sections.

UNIT IV
Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped Composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V
Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments. Health Monitoring of Bridge structures.

TEXT BOOKS:
1. N. Krishna Raju Design of Bridges, Oxford & IBH
2. Johnson Victor Essentials of Bridge Engineering, Oxford & IBH

REFERENCES

1. M.G. Aswani, V.N.Vazirani and M.M.Ratwani Design of Concrete Bridges.
2. E.C. Hambly Bridge Deck Behaviour.
3. V.K.Raina. Concrete Bridge Design and Practice
4. V.V. Sastry Design of Bridges, Dhanpat Rai & Co.

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INDUSTRIAL STRUCTURES

Professional Elective-3

Course Objective

To introduce method for design of Industrial steel structures with loading and design standards

Course Outcomes

After completing this course, the student will be able to:

CO-1: develop ability to carry out research in Steel design and development work.

CO-2: design steel structures with latest technologies.

Unit-I

Design of Industrial building, Crane, Gantry Girder, North Light and Lattice girder structure

Unit-II

Multistory steel building (Maximum 2 bay and four storey), including composite construction

Unit-III

Design of Bunker and Silo (Rectangular or Circular), including supporting systems.

Unit-IV

Design of Pressure vessels and storage tanks (Circular) Introduction to IS 1893 Part IV

Unit-V

Design of Pre Engineered Building structures

Reference Books / Material

1. Subramanian, S. (2010). Steel structures design and practice, Oxford.
2. Reimbert, M. L., &Reimbert, A. M. (1987). Silos. Theory and practice. Vertical silos, horizontal silos (retaining walls) (No. Ed. 2). Lavoisier Publishing.
3. Johnson, R. P. (2008). Composite structures of steel and concrete: beams, slabs, columns, and frames for buildings. John Wiley & Sons.
4. Owens, G. W.& Knowles, P. R. (1992). Steel designers manual.
5. Faella, C., Piluso, V., &Rizzano, G. (1999). Structural steel semi rigid connections: theory, design, and software (Vol. 21). CRC press.

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COMPOSITE STRUCTURES

Professional Elective-3

Course Objective

The objective of this course is to familiarize the students with analysis and design of steel concrete composite structure.

Course Outcomes: At the completion of this course, the student is expected to acquire,

CO1. Knowledge of analysis of various engineering properties of composite cross section,

CO2. Ability to design steel-concrete composite member,

CO3. Ability to analyze and design of composite structure.

Unit-I

Analysis and design of steel-concrete composite deck floors

Unit-II

Analysis and design composite beam, composite beams with solid steel beam, composite **beams with steel beams with web opening**

Unit-III

Types of shear connectors and its function, analysis and design of shear connection between concrete slab and beam

Unit-IV

Analysis and design steel-concrete composite column, steel section embedded inconcrete, concrete in filled steel tubes

Unit-V

Analysis and design steel frame structure with concrete in-filled. Advanced topics and detailing in composite structures

Reference Books/Material

1 Taranath, B. S. (2011). Structural analysis and design of tall buildings: Steel and composite construction. CRC press.
2 Vinson, J. R., & Sierakowski, R. L. (2006). The behavior of structures composed of composite materials (Vol. 105). Springer Science & Business Media.
3 Vinson, J. R., &Sierakowski, R. L. (2012). The behavior of structures composed of composite materials (Vol. 5). Springer Science & Business Media.
4 Jones, R. M. (1975). Mechanics of composite materials (Vol. 1). New York: McGrawHill.
5 Christensen, R. M. (2012). Mechanics of composite materials. Courier Corporation. 64
6 Kaw, A. K. (2005). Mechanics of composite materials. CRC press.
7 Daniel, I. M., Ishai, O., Daniel, I. M., & Daniel, I. (1994). Engineering mechanics of composite materials (Vol. 3). New York: Oxford university press.
8 Liang, Q. Q. (2014). Analysis and Design of Steel and Composite Structures. CRC Press.
9 IS 11384 (1985). Code of Practice for Composite Construction in Structural Steel and Concrete, Indian Standard Institution, New Delhi.
10 IS 3935(1966). Code of practice for composite construction, Indian Standard Institution, New Delhi.
11 Narayanan, R. (Ed.). (1988). Steel-concrete Composite Structures (Vol. 7). CRC Press.
12 Owens, G. W., & Knowles, P. R. (1992). Steel designers manual.
13 Davison, B., & Owens, G. W. (Eds.). (2011). Steel designers' manual. John Wiley & Sons.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

PRESTRESSED CONCRETE STRUCTURES

Professional Elective-4

Course Objectives

1. Learn the concept of pre-stressed concrete, methods and systems of pre-stressing, losses of pre-stress.
2. Analyse and design the sections for flexure, torsion and shear using different methods.
3. Learn the design of sections for bond and anchorage and deflections of pre-stressed concrete beams.
4. Study the analysis and design of statically indeterminate beams

Course Outcomes

After completing this course, the student will be able to:

1. Analyse and design the sections for flexure, shear bond and anchorages.
2. Estimate the deflections of pre-stressed concrete elements.
3. Know the circular pre-stressing, analysis and design of statically indeterminate beams.
4. Solve the problems pertaining to axial members, slabs and grid floors.

UNIT - I

General Principles of PrestressedConcrete: Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, Magnel Blaton system – Lee-Mc call system. **Losses of Prestress:** Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure.

UNIT - II

Design of Section for Flexure: Allowable stresses – Elastic design of simple beams having rectangular and I-section for flexure – kern lines – cable profile and cable layout.
Design of Sections for Shear: Shear and Principal Stresses – Improving shear resistance by different prestressing techniques – horizontal, sloping and vertical prestressing – Analysis of rectangular and I–beam – Designofshear reinforcement – IS: 1343: 2012provisions.

Deflections of Prestressed Concrete Beams : Short term deflections of uncracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. Deflections.

UNIT – III

Transfer of Prestress in Pretensioned Members : Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS: 1343 : 2012 provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by approximate, Guyon and Magnel methods – Anchorage zone reinforcement.
Statically Indeterminate Structures : Advantages & disadvantages of continuous PSC beams

-Primary and secondary moments – P and C lines – Linear transformation concordant and non- concordant cable profiles – Analysis and design of two span continuous beams.

UNIT – IV

Tension Members: Introduction, Ties, Circular pre-stressing – Design of PSC pipes.

Compression Members: Introduction – Design of PSC columns.

UNIT – V

Slabs: Introduction –Types – rectangular and flat slabs – Codal provisions – Design of PSC floor slabs - one way and two way slabs, and simple flat slabs. Grid Floors: Introduction.

TEXT BOOKS:

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill Book – Co., NewDelhi, sixth edition, 2018.
2. Prestressed Concrete by S. Ramamrutham, DhanpatRai & Sons,Delhi.

REFERENCES:

1. Design of Prestressed Concrete Structures by T.Y. Lin and Burn, John Wiley, NewYork, third edition, 2010
2. Prestressed Concrete by N. Rajagopalan, Alpha ScienceInternational, second edition, 2005.
3. IS 1343 -2012 Prestressed Concrete – Code of Practice, Bureau of IndianStandards.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

STRUCTURAL HEALTH MONITORING

Professional Elective-4

Course Objectives:

1. Learn the fundamentals of structural health monitoring.
2. Study the various vibration-based techniques for structural health monitoring.
3. Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
4. Study the structural health monitoring using electrical resistance and electromagnetic techniques.

Course outcomes:

1. Understand the fundamentals of maintenance and repair strategies.
2. Diagnose for serviceability and durability aspects of concrete.
3. Know the materials and techniques used for repair of structures.
4. Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
5. Use an appropriate health monitoring technique and demolition technique.

UNIT-I

Introduction to Structural Health Monitoring: Definition of structural health monitoring (SHM) – Objectives- Need –Steps involved in SHM-Motivation for SHM - SHM as a way of making materials and structures smart - SHM and biomimetics - Process and pre usage monitoring as a part of SHM - SHM as a part of system management - The most remarkable characters of SHM Birth of the SHM community.

UNIT-II

Vibration-Based Techniques for SHM: Basic vibration concepts for SHM -Local and global methods - Damage diagnosis as an inverse problem -Model-based damage assessment - General dynamic behavior - State- space description of mechanical systems - Neural network approach to SHM - The basic idea of neural networks - Detection of delamination in a CFRP plate with stiffeners.

UNIT – III

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

SHM of Bridges: Assessment of health of bridges, collapse and investigation

UNIT – IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT –V

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS

1. Structural Health Monitoring, Daniel Balageas, Claus_PeterFritzen, Alfredo Güemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

REFERENCES:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc,2007.
3. M.V. Gandhi and B.D. Thompson, “Smart Materials and Structures,” Springer, 1992.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

NONLINEAR STRUCTURAL ANALYSIS

Professional Elective-4

Course Objective

To course will provide insight into advanced concepts of analysis and design of structures to withstand earthquake forces and related seismic safety issues

Course Outcomes

CO1. Students will be capable of identifying the sources of nonlinearity in the response of structure.
CO2. Students will be capable of carrying out static non-linear analysis of member.
CO3. Students will be capable to carrying out dynamic non-linear analysis of structure

Unit-I

Introduction to nonlinear structural analysis; Overview, Sources of nonlinearities, types of structural analysis (1st order elastic, 1st order inelastic, 2nd order elastic, and 2nd order inelastic)

Unit-II

Principles of computational plasticity; overview, yield criterion, flow rule, hardening rule, loading/unloading criterion. Some commonly used uniaxial material models; elastic material, elastic-perfectly plastic material, bilinear steel material with kinematic and isotropic hardening, Ramberg-Osgood steel material model, Giuffre-Menegotto-Pinto model with isotropic strain hardening, Kent-ScottPark concrete material model, Visco-elastic material model, Bouc-Wen model;

Unit-III

Member section analysis; fiber section discretization; moment-curvature response; forcedeformation response; Material nonlinear beam-column element formulation; lumped plasticity models (beam with hinges formulation), distributed nonlinearity models; displacement-based nonlinear beam-column element; force-based nonlinear beam-column element. Geometrically nonlinear analysis; simplified 2nd order P-Δ analysis, co-rotational formulations of truss and beam elements.

Unit-IV

Solution strategies for nonlinear system of equations; incremental single-step methods; Euler method, second-order Runge-Kutta methods, incremental-iterative methods, load control, displacement control, work control, arc-length control;

Unit-V

Nonlinear structural dynamic analysis; semi-discrete equations, of motion, explicit time integration, implicit time integration, dissipative integration algorithms, stability and accuracy. Application to hybrid 72 simulation; overview, sub-structuring in hybrid simulation; application to modeling analytical substructures, solution of time discretized equations of motion.

Reference Books/Material

1. Owen, D. R. &Hinton, E. (1980)Finite Elements in Plasticity (Theory and Practice), Pineridge Press Limited, Swansea.
2. Bathe, K. J. (1987)Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, New Jersey.
3. Crisfield, M. A. (1991)Non-Linear Finite Element Analysis of Solids and Structures (Vol. 1: Essentials), John Wiley & Sons, Chichester.
4. Washizu, K. (1975). Variational methods in elasticity and plasticity (Vol. 3). Oxford: Pergamon press.
5. Crisfield, M. A. (1993). Non-linear finite element analysis of solids and structures (Vol. 1). New York: Wiley.
6. James, F. D. (2010). Nonlinear analysis of thin-walled structures. Springer.
7. Denkowski, Z., Migórski, S., &Papageorgiou, N. S. (2013). An introduction to nonlinear analysis: theory. Springer Science & Business Media.
8. Li, G., & Wong, K. (2014). Theory of nonlinear structural analysis: The force analogy method for earthquake engineering. John Wiley & Sons.
9. Sathyamoorthy, M. (1997). Nonlinear analysis of structures (Vol. 8). CRC Press.

ANURAG UNIVERSITY
M. Tech – I Year – II Sem. (Structural Engg.)

DESIGN OF SUB STRUCTURES

Professional Elective-4

Course Objectives: To impart knowledge on geotechnical and structural design of different types of foundation appropriate to the type of soil for different structures.

Course Outcome: The learner will be able to design shallow and deep foundations from both geotechnical and structural considerations.

UNIT – I

Shallow Foundations: Basic requirements of foundation –Types and selection of foundations. Bearing capacity of foundations, structural design of isolated, combined, eccentric, strip, and strap footings, Detailing of reinforcement.

UNIT – II

Raft Foundations: Types of rafts, SBC of raft foundation and structural design of different raft foundations, Detailing of reinforcement.

UNIT – III

Pile Foundations: Types of piles, Load carrying capacity of single and pile groups, structural design of piles, pile caps and pile-raft foundation, Detailing of reinforcement.

UNIT – IV

Design of Retaining walls: Stability Checks and structural design of gravity, Cantilever retaining walls, Detailing of reinforcement, Design of Strut, Brace Excavation.

UNIT – V

Machine Foundations: Vibration analysis of machine foundation - Design of foundation for Reciprocating machines and Impact machines - as per l S Codes, Detailing of reinforcement.

TEXT BOOKS:

1. Varghese P.C. Design of RC foundations, PHI Learning Pvt.Ltd.
2. Unnikrishnana Pillai & Devadas Menon, Reinforces Concrete Design, McGraw Hill Publishing Pvt.Ltd.

REFERENCE:

1. Bowles. J.E., “Foundation Analysis and Design”, McGraw Hill Publishing co., New York,1986

2. Tomlinson.M.J,“FoundationDesignandConstruction”,Longman,SixthEdition,NewDelhi, 1995.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak, Foundation design manual, Dhanpat Rai & Sons,2006.
5. PrakashShamsherandPuriVijayK,FoundationsforMachines,AnalysisandDesign”John Wiley and Sons, USA,1988.
6. IS 2911: Part 1: Sec 1: 1979 Code of practice for design and construction of pilefoundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concretepiles.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

COMPUTER AIDED DESIGN LABORATORY

Course Objective: To impart knowledge on the use of various softwares

Course Outcome: the student will be able to analyze and design structural elements of abuilding

Experiments

1. Calculation of wind pressures and design forces on walls and roof of a rectangular building.
2. Calculation of design seismic force by static and dynamic methods of IS 1893.
3. Design of doubly reinforced beam using Excel as per IS 456 & 13920.
4. Design of RC slab one-way and two-way usingExcel
5. Design of RC short & long columns subjected to biaxialbending
6. Beam-column joint design of an RC frame building as per IS 13920.
7. Design of isolated footings usingExcel
8. Analysis & design of 2-D steeltruss subjected to gravity load.
9. Analysis & Design of 2-D buildingframe subjected to gravity load.
10. Analysis & Design of Multi-story space frame with seismic loads
11. Analysis & Design of Multi-story space frame with wind loads
12. Plate bending usingFEM.

Note: Exercises from 6-10 may be carried out using any relevant commercial software package

B. Tech. (Honors)

‘Smart City Planning and Development’

Courses structure

4T+1PROJ

S. No.	Course Title	Hours per week			Credits
		L	T	P/D	
1	Infrastructure Planning and Management	3	0	0	3
2	Intelligent Transportation Systems	3	0	0	3
3	Green Building	3	0	0	3
4	Metro Systems and Engineering	3	0	0	3
5	Project	0	0	12	6
	Total				**18**

Note : The above courses are offered by the department starting from II year I semester. The students may take up the above courses or equivalent course recommended by the internal BOS members . One has to obtain minimum of 18 credits for the award of degree with Honors by opting any of the above Courses.

B. Tech. (Minor)

‘Smart City Planning’

Course Structure

5T+2L

S. No.	**Course Title**	**Hours per week**			**Credits**
		L	**T**	**P/D**	
1	Infrastructure Planning and Management	3	0	0	3
2	Intelligent Transportation Systems	3	0	0	3
3	Green Building	3	0	0	3
4	Surveying	3	0	0	3
5	RS & GIS	3	0	0	3
6	Survey Laboratory	0	0	3	1.5
7	RS & GIS Laboratory	0	0	3	1.5
	Total				**18**

Note : The above courses are offered by the department starting from II year I semester. The students may take up the above courses or equivalent course recommended by the internal BOS members. One has to obtain minimum of 18 credits for the award of degree with Minor by opting any of the above Courses.

d) Minutes of the BoS in Computer Science & Engineering

Minutes of the Second Board of Studies (BoS) meeting

The Second Board of Studies (BoS) Meeting of the Department of Computer Science and Engineering (CSE), Anurag University was held on Tuesday 6th April 2021 at 2.00 p.m. The meeting was conducted in online mode due to the ongoing Pandemic of Covid-19. (http://meet.google.com/xcx-nfjc-igj).

The Chairperson, BoS has communicated the following well in advance to all the members of BoS:

a) Agenda of 2nd BoS b) Course structure of CSE c) Course structure of CSE-Cyber Security (CS) d) Course structure of CSE-Data Science (DS) e) Course structure of M.Tech CSE f) Course structure of Honors and Minor Degree g) Ph.D. Eligibility Test syllabus h) Pre Ph.D. Course Work.

The Meeting was convened to discuss and finalize the following R20 Regulations, Anurag University (AU-R20).

- Course structure and syllabus of B.Tech Computer Science and Engineering (CSE) II, III and IV year.
- Course structure and syllabus of B. Tech CSE-Data Science(DS) II, III and IV Year
- Course structure and syllabus of B. Tech CSE-Cyber Security(CS) II, III and IV Year
- Course structure and syllabus of M. Tech CSE I and II Year
- Introduction of B. Tech Honors and Minors and respective course structure
- Ph.D. Eligibility Test Syllabus
- Pre-Ph.D. course structure (Ph.D. Course work) and syllabus

The Chairman has welcomed the members and conducted the proceedings. The following Resolutions were made in the meeting.

Item No. 1: Course Structure and syllabus of II, III & IV Year of B. Tech in Computer Science and Engineering (CSE) of AU-R20

Resolution: The BoS members had a glance of the approved (it was approved in the First

BoS held on 7th July 2020) course structure of II, III & IV Year of B. Tech in Computer Science and Engineering. The Board approved the course Structure and syllabus.

Item No. 2: Course Structure and syllabus of II, III & IV Years of B. Tech in CSE-Data Science (DS) of AU-R20.

Resolution: The BoS members had an elaborate discussion on the Course structure and Syllabus of II, III & IV Year of B. Tech in CSE-DS and approved the same with the following modifications:

Dr. Rajiv Wankar, Professor, CSE Department University of Hyderabad and Dr. R.B.V.Subramanyam, Professor, CSE Dept.,of NIT Warangal suggested the following modifications :

a) To replace the course “Big data” with “Machine Learning” in 3rd year first semester

b) To replace “Mobile application development” of Professional Elective Course (PEC) – III in the 4th year First semester with “Big data and Analytics”. The PEC-3 is also provided with Lab.

c) To replace Machine Learning of 3rd year Second semester with “Data Visualization”. (Machine Learning course is moved to 3rd year first semester, (Point a)

d) To replace PEC-1 Lab of 3rd year Second semester with “Data Visualization Lab”.

The Board has approved the same.

Item No. 3: Course Structure and syllabus of II, III & IV Years of B. Tech in CSE-Cyber Security (CSE-CS) of AU-R20

Resolution: The BoS members had elaborate discussions on the Course structure and Syllabus of II, III & IV Years of B. Tech in CSE-CS and approved the Course structure and Syllabus of II year only. The members suggested for incorporating few other courses in 3rd and 4th years. The members asked the Chairperson BoS to convey another meeting for the approval of Course structure and Syllabus of III & IV Years of B. Tech in CSE-CS. The Board also suggested the internal BoS to work on this further.

Item No. 4: The List of open Elective courses and Syllabus offered by the CSE Department to other Departments (it was approved in the First BoS held on 7th July 2020)

Resolution: The Board approved the list of open Elective courses and syllabus to be offered to other departments by CSE department.

Item No. 5: Course Structure and syllabus of M.Tech (CSE) I and II Year, AU-R20

Resolution: The BoS Members after an elaborate discussion approved the same.

The Bos Members raised serious objection for having M.Tech course work in 3rd Semester. Dr. Rajiv Wankar, Professor, CSE Department University of Hyderabad, expressed that Central University experimented three Semesters course work for M.Tech program and it was a big failure and again they came back to one year course work structure and complete one year for Project work. Other members also suggested better to have one year for complete Project work for M.Tech students. This will help the PG students in securing the job or doing internships in and around Hyderabad. Dr. R.B.V.Subramanyam, Professor of CSE, NIT Warangal, suggested putting forward these comments to the Academic council for consideration. The other members expressed the same.

Item No.6: B.Tech Minor Degree in Computer Science and Engineering

Resolution: The proposed course structure has been approved by the Board. Prof.Sameen Fathima, Registrar, AU suggested to place the pre-requisites for the proposed courses. Prof.Balasubramanyam suggested to add few Security courses in the Minor Degree Program.

Item No.7: B.Tech Honors in Data Science, B.Tech Honors in Cyber security, B.Tech Honors in Artificial Intelligence and Machine Learning

Resolution: The Board has approved the proposal to offer B.Tech Honors in Data Science, Cyber Security and Artificial Intelligence and Machine Learning. The proposed course structure has been approved.

Item No. 8: Course structure and syllabus of Pre-Ph.D. courses (Ph.D. course work) in CSE, AU R20.

Resolution: The Board has approved the same. The board has also approved to offer the M.Tech.(CSE) courses as Pre-Ph.D. courses in CSE/ IT.

Item No. 9: Ph.D. Eligibility test syllabus for the Scholar to pursue Ph.D. in CSE/IT/AI/AI&ML and other allied branches of CSE in Anurag University.

Resolution: The Board has approved the proposed CSE GATE syllabus for Ph.D. Eligibility Test

Item No.10: In case of amendments/changes in the course structure or syllabi, the Board has suggested Chairperson:

Resolution: a) In any case, if there are major changes or amendments either in course structure or syllabus, the BOS meeting shall be called for its approval.

b) In any case, if there are minor changes or amendments either in course structure or syllabus, it will be communicated to all BOS members through e-mail for e-approval.

Item No.11: The Board has empowered the Chairperson, BoS to

a) Incorporate New Elective courses (Professional and Open) as per the need
b) Incorporate New courses in Minor and Honor Degrees by looking into MOOCs
c) Modify or change syllabus as per Item No.9.
d) Finalize the list of examiners for the external examinations/ project seminars/ Project Work

The meeting was concluded with the Vote of Thanks.

The following members have attended the meeting

S.No	Name	Designation	Designation in BoS
1	Dr. R.B.V.Subramanyam	Professor, Dept. of CSE, and Chief Investigator,Electronics&ICTAcademy(Set up by MeitY, Govt. of India), NIT, Warangal	External Member
2	Dr. Rajiv Wankar	Professor , Dept. of CSE , University of Hyderabad	External Member
3	Mr. Richard King	Regional Head, Academic Interface program , TCS, Hyderabad	External Member
4	Dr. G. Vishnu Murthy	Professor & Head Dept. of CSE, Dean-Engineering, AU	Internal Member
5	Ms. Sravanthi Satyavarapu	Asst. Manager, Tech. Mahindra , Alumini, Hyderabad	External Member
6	Dr. Sandeep Singh Rawat	Assoc. Professor Dept. of CSE, AU, Hyderabad	Internal Member
7	Dr.M. Sridevi	Assoc. Professor Dept. of CSE, AU, Hyderabad	Internal Member
8	Mrs V. Jyothi	Asst. Professor Dept. of CSE, AU, Hyderabad	Internal Member
9	Dr. V. Vijaya Kumar	Professor- Dean- Research & Development, AU, Hyderabad	Chairperson - CSE

Member Invitee

S.No	Name	Designation	Designation in BoS
1	Prof.Syeda Sameen Fatima,	Registrar, Professor, Dept. of AI, AU.	Member Invitee
2	Dr. K.Sudheer Reddy	Professor , Head Dept. of IT, AU	Member Invitee
3	Dr.A.Mallikarjun Reddy	Asst., Prof., Dept of CSE	Member Invitee
4	Dr.P.Srilatha	Asst., Prof., Dept of CSE	Member Invitee
5	Dr.G.Bindhu Madhavi	Asst., Prof., Dept of CSE	Member Invitee
6	Dr.Y.Sowmya	Asst., Prof., Dept of CSE	Member Invitee

Sd/

Chairperson Board of studies Department of Computer Science and Engineering Anurag University, Hyderabad

Second BOS-MoM-CSE-AU-6th April -2021

Course Structure of
B.Tech. (Computer Science and Engineering)
(I, II, III & IV Years)

FOUR YEARS COURSE STRUCTURE
R20 REGULATIONS

B.TECH I YEAR I SEM (1st semester) **4 T+ 5P**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–1	3	1	0	4.0
2	BSC	Applied Physics	3	1	0	4.0
3	BSC	Applied Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSSMC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming for Problem Solving- I	2	0	0	2.0
9	ESC	Programming for Problem Solving-I Lab	0	0	3	1.5
TOTAL						**19.5**

B.TECH I YEAR II SEM (2nd semester) **5T +3 P**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–II	3	1	0	4.0
2	BSC	Chemistry	3	1	0	4.0
3	BSC	Chemistry Lab	0	0	3	1.5
4	HSSMC	English	2	0	0	2.0
5	HSS&MC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming for Problem Solving-II	2	0	0	2.0
7	ESC	Programming for Problem Solving – II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
TOTAL						**18.5**

COMPUTER SCIENCE & ENGINEERING (CSE)

B.TECH (CSC) II YEAR I SEM (3rd semester) **5T +3L+1MC**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	ESC	Digital Logic Design	3	0	0	3
2	PCC	Data Structures	3	0	0	3
3	PCC	Python Programming	2	0	0	2
4	BSC	Discrete Mathematics	3	0	0	3
5	BSC	Probability and Statistics	3	0	0	3
6	PCC-Lab	Python Programming Lab	0	0	3	1.5
7	PCC-Lab	Data Structures Lab	0	0	3	1.5
8	PCC-Lab	Linux programming Lab	0	**1**	2	2
9	ESC-Lab	Design Thinking Lab	0	0	2	1
10	MC	Environmental Studies	2	0	0	0
Total						20

B.TECH (CSC)II YEAR II SEM (4th semester) **5T+3L+1MC**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	Computer Organization and Architecture	3	0	0	3
2	PCC	Formal Languages and Automata Theory	2	1	0	3
3	PCC	Java Programming	2	1	0	3
4	PCC	Design and Analysis of Algorithms	3	1	0	4
5	PCC	Database Management Systems	3	0	0	3
6	HSS&MC-Lab	Soft Skills for Success Lab	0	0	2	1
7	PCC-Lab	JAVA Programming Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

COMPUTER SCIENCE & ENGINEERING (CSE)

B.TECH (CSC) III YEAR I SEM (5th Semester) **5T+3L +1 MC**

Serial No	Category	Course Title	Hours per week L	T	P	Credits
1	PCC	ComputerNetworks	3	0	0	3
2	PCC	Operating Systems	3	0	0	3
3	PCC	Fundamentals of Artificial Intelligence	3	0	0	3
4	PCC	Web Technologies	3	0	0	3
5	OEC-1	1. English for Professionals 2. Essential English and Employability Skills 3. Intellectual Property Rights 4. Number Theory 5. Entrepreneurship Development	3	0	0	3
6	ESC-Lab	Quantitative Aptitude and reasoning	0	0	3	1.5
7	PCC-Lab	Operating Systems& Computer Networks Lab	0	0	3	1.5
8	PCC-Lab	Web Technologies Lab	0	0	4	2
9	MC	NSS/NSO	0	0	2	0
TOTAL						20

B.TECH (CSC)III YEAR II SEM (6th Semester) **5 T +3L**

Serial	Category	Course Title	Hours per week			Credits
1	PCC	Machine Learning	3	0	0	3
2	PCC	Compiler Design	3	1	0	4
3	PEC–I	1. R programming 2. Internet of things 3. Fundamentals of Digital Image Processing 4. Object Oriented Modeling	2	0	0	2
4	PEC–II	1. Software Engineering 2. Cryptography 3. Distributed System 4. Information Retrieval System	3	0	0	3
5	PCC	Cloud Computing	3	0	0	3
6	ESC	Verbal ability and Skill integrated Lab	0	0	4	2
7	PEC I -Lab	1.R programming Lab 2. Internet of things Lab 3. Fundamentals of Digital Image Processing Lab 4. Object Oriented Modeling Lab	0	0	3	1.5
8	PCC-Lab	Machine Learning Lab	0	0	3	1.5
*** Mini Project /Summer Internship carried out during summer vacation and evaluated in 7Th sem.** **TOTAL**						20

B.TECH (CSC) IV YEAR I SEM (7th Semester) 5 T +2 L + Mini project

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	HSS&M	Management Science	3	0	0	3
2	PCC	Information Security	3	1	0	4
3	PEC-III	1. Data Science and Analytics 2. Deep Learning 3. Mobile Application development 4. Block Chain Technology	3	1	0	4
4	PEC - IV	1. Big Data 2. Natural Language Processing 3. Web Mining 4. Software Testing Methodologies	3	0	0	3
5	PEC-V	1. Network Programming 2. Human Computer Interaction 3. Malware Analysis	3	0	0	3
6	PCC	Information Security Lab	0	0	3	1.5
7	PEC-III-Lab	1 Data Science and Analytics Lab 2. Deep Learning Lab 3.Mobile ApplicationDevelopment Lab 4. Block chain Technology Lab	0	0	3	1.5
8	PROJ	Mini Project /Summer Internship	0	0	4	2
Total						22

B.TECH (CSC) IV YEAR II SEM 2T +3 L/P

Subject Code	Category	Course Title	Hours per week			Credits
			L	T	P	
1	OEC-II	9. Technical and Business Communication Skills 10. Digital media literacy 11. Managerial Economics and Financial Analysis	3	0	0	3
2	OEC-III	7. Negotiation Skills 8. Project Management 9. Value Engineering	3	0	0	3
3	PROJ	Seminar	0	0	4	2
4		Comprehensive Viva-Voce	0	0	0	2
5	PROJ	Project	0	0	20	10
		Total				**20**

Credits Break-up

		Credit Break up	
Sno	**CATEGORY**	**As per AICTE**	**As per proposed curriculum**
1	Humanities and Social Sciences including Management courses (HSS&MC	12*	**12**
2	Basic Science courses BSC	25*	**25**
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. ESC	24*	**21.5**
4	Professional core courses PCC	48*	**59.5**
5	Professional Elective courses relevant to chosen specialization/branch PEC	18*	**18**
6	Open Electives Course OEC	18*	**09**
7	Project work, seminar and internship in industry or elsewhere PROJ	15*	**16**
8	Mandatory Courses MC [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	
9	Total credits	**160**	**160**

**Minor variation is allowed as per need of the respective disciplines*

Course code and definition:

Course code Definitions	**Course code Definitions**
L	L Lecture
T	T Tutorial
P	P Practical
BSC	BSC Basic Science Courses
ESC	ESC Engineering Science Courses

HSMC	HSMC Humanities and Social Sciences including Management courses
Management courses	
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	MC Mandatory courses
PROJ	PROJ Project

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SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

SECOND YEAR SYLLABUS - R20 REGULATIONS

B.TECH II YEAR I SEM

B.Tech. CSE II Year - I Sem	L	T / P / D	C
	3	0	3

DIGITAL LOGIC DESIGN

Pre requisites: None

Course Objectives:

Students will be able to:

1. Understand various number systems addition and subtractions in binary system, error detection and correction codes
2. Minimize boolean functions using boolean laws & k-maps and realize by using logic gates
3. Design various combinational circuits with practical applications
4. Understand the basic sequential circuits : Latches, Flip-Flops and their usage
5. Design synchronous and asynchronous counters

Course Outcomes:

After completion of the course student will be able to:

1. Understand various number systems, floating point representations, complements, error detecting and correcting codes (L2)
2. Apply boolean algebraic principles and k-maps for simplification of boolean functions (L3)
3. Design combinational circuits (L3)
4. Analyze various types of flip flops (L4)
5. Design sequential circuits (L3)

Unit I:

Number Systems: Binary, Octal, Hex Decimal, and Conversions; Binary additions and subtractions (using 1c, and 2c), concept of overflow; Representations of negative numbers using 1’s and 2’s complement and range; BCD numbers: 8421, 2421, Ex-3, Gray and Self

Complementary codes; Error Detecting codes: even & odd parity, hamming codes; Error correcting codes: hamming codes, block parity codes; Floating point representation.

Unit II:

Boolean Algebra and Digital Logic Gates, Basic Boolean laws and properties; Boolean functions, truth tables; Standard forms (SOP, POS) and Canonical forms, Conversion between Canonical and Standard forms ; Gate minimization using three and four variable K-Maps with and without don't cares, Logic Circuit Design using Universal Gates .

Unit III:

Introduction to combinational circuits and applications**,** Design Procedure, Combinational circuit for Half Adder, Full Adder, Half Subtractor and Full Subtractor, Binary Adder, Binary Adder-Subtractor, Decimal Adder, Code Converters, Decoders, Encoders, Multiplexers, Demultiplexers.

Unit IV:

Introduction to Sequential Circuits and its applications, Lathes, Flip flops, Storage Elements, Flip-flops: S-R Flip flop, D Flip Flop, J-K Flip Flop, T Flip flop, master slave J-K flip flop, Analysis of Clocked Sequential Circuits, Flip Flop Conversions

Unit V:

Registers and Counters: Introduction, Registers, Shift Registers, Ripple Counters: Up counter, Up-Down counter, Decade counter, Synchronous Counters: Up Counter, Up-Down counter, Decade Counter, Other Counters: Ring Counter, Johnson Counter

Text Books:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2012
2. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI, 2016

Reference Books:

1. Roth, Fundamentals of Logic Design, 5th Edition, Thomson, 2004.
2. John F. Wakerly, Digital Design, Principles and Practices, 4th Edition, Pearson / Prentice Hall, 2005.
3. Malvino & Leach, Digital Principles and Applications, Seventh Edition, Tata McGraw-Hill Education, 2010.
4. A.K. Maini, Digital Electronics, Principles and Integrated Circuits, 1st Edition, Wiley India Publications, 2007.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year - I Sem	L	T / P / D		C
	3	0		3

DATA STRUCTURES

Prerequisites: Any programming language

Course Objectives:

1. Understand various static and dynamic representations of data structures.
2. Understand fundamental algorithmic problems of various nonlinear data structures.
3. To be familiar with Graph representations and traversals.
4. Know the basic concepts of Hashing.

Course Outcomes:

After the completion of the course student will be able to:

1. Examine Static and Dynamic data structures in implementing Stack applications (L4)
2. Apply Tree traversal algorithms in solving real time applications (L3)
3. Analyze the concepts of Advanced Trees to generate search efficiently (L4)
4. Interpret the importance of Graphs in solving real time applications (L5)
5. Examine the concepts of hashing, collision and its resolution methods using hash function (L4)

Unit I :

Introduction: What is data structure, Types of data structures, Static and Dynamic representation of data structure and comparison. **Stacks-** definition, operations, **Applications of** stacks – Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack, Towers of Hanoi, Parenthesis checker.

Unit II :

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees-Inorder Threading. Representation of Trees using Arrays and Linked lists (advantages and disadvantages). Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals,
Heaps: Introduction, types of Heaps – Min binary heap, Max binary heap.

Unit III :

Advanced concepts on trees: Representation and Creation of Binary Search Trees (BST); Algorithm for Inserting, deleting and searching in BST representation and advantages of AVL Trees, algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees; B Tree of Order M, operations- Insertion and Searching, Introduction to Red-Black Trees and Splay Trees.

Unit IV:

Graphs-Basic terminology, Representation of graphs: sequential representation (Adjacency, Path Matrix) Linked representation.

Graph Traversals-Breadth First Search, Depth First Search with algorithms. Spanning Trees-Definition and properties, Minimum Spanning Tree, Dijkstra Algorithms.

Unit V :

Hashing: General Idea, Hash Functions, Collision Resolution- Separate Chaining ,Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Implementation of Dictionaries

Text Books:

1. Seymour Lipschutz, Schaum's Outlines,Data Structures, Special Second Edition, Tata McGraw-Hill, 2014.
2. Richard F.Gillber g& Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, Second Edition, Cengage Learning, India Edition, 2005.

Reference Books:

1. Aaron M. Tenenbaum,Yedidyah Langsam and Moshe J. Augenstein, Data Structures Using C and C++, PHI Learning Private Limited, Delhi India, 2002.

2. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd Delhi India, 1983.

3. A.K. Sharma, Data Structure Using C, Pearson Education India, Second Edition, 2013.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year - I Sem L T / P / D C

2 0 2

PYTHON PROGRAMMING

Prerequisites: None

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

Course Outcomes:

After completion of the course student will be able to:

1. Apply control structures, functions and packages in Problem Solving. (L3)
2. Analyze various String handling functions and data structures (L4)
3. Model the object-oriented problems with classes and objects (L4)
4. Solve the problems by using Inheritance and polymorphism (L3)
5. Illustrate programs on Exception Handling and various packages (L3)

Unit – I

Introduction to Python:

Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations.

Functions and Modules:

Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Unit – II

Strings and Regular Expressions:

String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.

Sequence: List, Tuples, Dictionaries, Sets.

Unit – III

Introduction to Object Oriented Programming: Features of OOP,Merits and demerits of Object Oriented Programming Languages, Applications of OOP

Implementation of classes and objects in Python:

Classes and Objects, Class Method and Self Argument. The __init__Method, Class Variables and Object Variables, The __del__Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Unit – IV

Implementation of Inheritance in Python:

Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class,

Implementation of Operator Overloading in Python:

Introduction, Implementing Operator Overloading, Overriding Methods

Exception Handling in Python:

Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

Unit V:

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib :, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages.

Text Book

1.ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017

2.James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Suggested / Reference Books

1.Charles Dierach, Introduction to Computer Science using Python,2013

2. https://www.programiz.com/python-programming

3. https://www.javatpoint.com/python-tutorial

4.. https://www.geeksforgeeks.org/python-programming-language/

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B.Tech. CSE II Year - I Sem	L	T / P / D	C
	3	**0**	**3**

DISCRETE MATHEMATICS

Pre requisites: Mathematics- I and II

Course Objectives:

1.Interpret the Sets, syntax and semantics of propositional and predicate logic.
2. Solve applications involving Permutations and Combinations.
3. Formulate Recurrence relations to solve problems involving an unknown sequence.
4. Explain the concepts of Relations and Graphs.
5. Illustrate the Algebraic Systems.

Course Outcomes:
After completion of course students will be able to

1. Analyze Statement Logic and Predicate Logic.(L4)
2. Apply the principles of Permutations and Combinations with repetition & without repetitions(L3)
3. Solve Recurrence Relations by using generating functions(L3)
4. Apply the knowledge of Relations and Graph Theory in the field of Computer Science.(L3)
5. Analyze the Algebraic Systems with their properties(L4)

UNIT I:
Foundations: Basics, Sets and Operations of Sets, Fundamentals of Logic, Logical Inferences, First order logic and other methods of Proof, Rules of Inference for Quantified Propositions. **(Problems Only and Theorems without Proofs)**

UNIT II:
Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumerating Combinations and Permutations with & without repetitions, constrained repetitions, and Principle of Inclusion and Exclusion. **(Problems Only and Theorems without Proofs)**

UNIT III:
Recurrence Relations: Generating Functions, Calculating coefficient of Generating Function, Solving Recurrence relations by substitution method and Generating Functions, The Method of Characteristic Roots, Solutions to inhomogeneous recurrence relations. **(Problems Only and Theorems without Proofs)**

UNIT IV:

Relations and Digraphs: Relations and Directed Graphs, Special Properties of Binary Relations, Equivalence Relations, Ordering Relations, Lattices, Operations on Relations, Paths and Closures, Directed Graphs and adjacency matrices. **(Problems Only and Theorems without Proofs)**

Graphs: Basic Concepts, Isomorphism's and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs. **(Problems Only and Theorems without Proofs)**

UNIT V:

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. **(Problems Only and Theorems without Proofs)**

Text Books:

1. Joe L. Mott, Abraham Kandel, Theodare P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition, PHI, 2019.
2. J. P.Tremblay and P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2007

Reference Books:

1. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill.
2. S. K. Chakraborthy and B.K. Sarkar," Discrete Mathematics ", Oxford, 2011.
3. C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.

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B.Tech. CSE II Year - I Sem	L	T / P / D	C
	0	3	1.5

DATA STRUCTURES LAB

Prerequisites: Any programming language and a parallel course on data structures.

Course Objectives:

1. To design and analyze simple linear and non-linear data structures.
2. To design and implement various data structure algorithms
3. To identify and apply the suitable data structure for the given real world problem

Course Outcomes:

Student will be able to:

1. Develop the programs on stacks and its applications.
2. Demonstrate the implementation of various advanced trees.
3. Design and implementation of programs on BST and Graph Traversals.
4. Develop the programs on Hashing and Dictionaries

Week 1:

Review of Stack and Queue Operations using arrays and Linked Lists

Week 2:

Program to convert infix to postfix notation

Program to evaluate postfix notations

Week 3:

Program to implement towers of Hanoi

Program to implement parenthesis checker

Week 4:

Program to illustrate tree traversals

a) In order b) Preorder c) Post order

Week 5:

Program to illustrate insertion, deletion and searching in Binary Search Tree.

Week 6:

Program to implement Heaps

a) Min Heap b) Max Heap

Week 7:

Program to illustrate Insertion on AVL Trees.

Program to illustrate deletion and Rotation on AVL Trees.

Week 8:

Program to implement B-Trees

a) Insertion b) Search c) Display

Week 9:

Program to illustrate Graph traversals

a. Breadth First Search
b. Depth First Search

Week 10:

Program to implement

a) Prims algorithm b) Kruskal's algorithm

Week 11:

Program to Implement Dijkstra algorithm.

Week 12 & 13:

Program to implement Hashing and collision resolution techniques

Week 14:

Program to implement Dictionaries.

Week 15:

Review

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year - I Sem	L	T / P / D	C
	0	3	1.5

PYTHON PROGRAMMING LAB

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Language.
3. Know the Data Structures in Python Programming Language.
4. Use the reusability concepts in Python Programming Language.
5. Use Exception Handling mechanism in Python Programming Language.
6. Know the packages in Python Programming Language.

Course Outcomes:

Student Able to

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write the programs on strings and functions
4. Implement programs on class and related issues.
5. Use of python exception handling and packages.

Week-1:

Installation and Environment set up of Python & Programs on Data types

Week-2:

Programs on Standard I/O, Operators and Expressions

Week-3:

Programs on Functions

Week-4

Programs on lists and Tuples

Week-5:

Programs on Dictionaries

Week-6:

Programs on Strings and string operations

Week-7:

Programs on Regular Expressions.

Week-8:

Programs on Inheritance and Polymorphism

Week-9:

Programs on Exception Handling

Week-10:

Demonstration of Numpy Package

Week-11:

Demonstration of Pandas Package

Week-12:

Demonstration of matplotlib Package and Tkinter Package

Week-13:

Demonstration of Date and Time Packages

Week-14: Overview

Week-15: Overview

ANURAG UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year - I Sem	L	T / P / D	C
	1	**2**	**2**

LINUX PROGRAMMING LAB

Course Objectives:

1. To gain an understanding of important aspects related to the Linux Commands.
2. To understand directory commands.
3. To provide a comprehensive introduction to SHELL programming.
4. To understand file handling utilities
5. To develop ability to use system calls.

Course Outcomes:
At the end of this course, Students will be able to:
1. Apply the basic commands in Linux Operating System.
2. Create directories and Shell Script programs.
3. Analyze a given problem and apply requisite facets of Shell programming.
4. Demonstrate UNIX commands for file handling mechanisms.
5. Develop a C Program for UNIX Commands.

List of Experiments:

Week-1:
Practice Vi Commands

Week-2:
a) Open the file created in session 1
b) Add some text
c) Change some text
d) Delete some text
e) Save the Changes

Week-3:
a) Create mytable (name of the table) using cat command for the following data.use tab to separate fields.

1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86

b) Use the cat command to display the file, mytable.
c) Use the vi command to correct any errors in the file, mytable.

Week-4:

a)Use the sort command to sort the file mytable according to the first field. Call the sorted file mytable (same name)

b) Print the file mytable

c) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)

d) Print the new file, mytable

e) Logout of the system.

Week-5:

a) Use the appropriate command to determine your login shell

b) Use the /etc/passwd file to verify the result of "step a".

c) Use the who command and redirect the result to a file called myfile1. Use the more command
to see the contents of myfile1.

d) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the
more command to check the contents of myfile2.

Week-6:

a) Write a sed command that deletes the first character in each line in a file.

b) Write a sed command that deletes the character before the last character in each line in a file.

c) Write a sed command that swaps the first and second words in each line in a file.

Week-7:

a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.

b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.

Week-8:

a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.

b) Write a shell script that accepts one or more file name as arguments and converts all of them
to uppercase, provided they exist in the current directory.

c) Write a shell script that determines the period for which a specified user is working on the System.

Week-9:

a) Write a shell script to perform the following string operations:

i) To extract a sub-string from a given string.

ii) To find the length of a given string.

b)Write a shell script that accepts a file name starting and ending line numbers as arguments anddisplays all the lines between the given line numbers.
c) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

Week-10:
a) Write a shell script that computes the gross salary of a employee according to the following rules:

i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.
ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic

The basic salary is entered interactively through the key board.
b) Write a shell script that accepts two integers as its arguments and compute the value of first number raised to the power of the second number.

Week-11:
a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, then program ask the user for the necessary information, such as the file name, new name and so on.

Week-12:
a) Write shell script that takes a login name as command – line argument and reports when that person logs in
b) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

Week-13:
a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

Week-14:
Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:
i) File type
ii) Number of links
iii) Read, write and execute permissions
iv) Time of last access
(Note: Use stat/fstat system calls)

Week-15
Over View
Text Books:
1. Unix concepts and applications, Fourth Edition, Sumitabha Das, TMH; 2. Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B. Tech CSE II Year II Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

Computer Organization and Architecture

Pre-requisites: Digital Logic Design

Course Objectives:

1. Understand the instruction format, life cycle and CPU Architecture and Organization
2. Know the basic architecture of Microprocessor
3. Learn various types of memories
4. Learn the concepts for data transfer between CPU & I/O devices.
5. Understand the concepts of Pipeline, Vector and Multiprocessors.

Course Outcomes:

Students will be able to:

1. Describe the basic organization of computer and different instruction formats and addressing modes.(L2)
2. Analyze the concept of pipelining, segment registers and pin diagram of CPU.(L4)
3. Analyze various issues related to memory hierarchy.(L4)
4. Compare various modes of data transfer between CPU and I/O devices.(L4)
5. Design Pipeline for the execution of instructions (L5)
6. Examine various inter connection structures of multi processors. (L4)

Unit-I:

Instruction: Instruction Definition, instruction cycle, flow chart for instruction cycle, instruction storage, types of instruction formats (Zero, one, two and three address). Addressing modes: mode field, implied, immediate register, register direct, register indirect, auto increment, decrement, indexed, relative, base address mode, Numerical examples and problems.

Unit-II:

CPU-Organization: 8086 –CPU –Block diagram and pin diagram, minimum and maximum mode, General purpose registers; segment register and generation of 20 bits address, segmentation of main memory, systems bus, Types of flags.

Unit-III:

Memory Hierarchy, Main memory, memory address map, memory connection to CPU; Auxiliary memory, Magnetic disks, Magnetic tapes; cache memory, hit and miss ratio, direct, associative and set associative mapping; Micro-programmed control: control memory, address sequencing.

Unit-IV:

I/O interface: I/O Bus and Interface modules, I/O versus Memory Bus, isolated vs Memory-mapped I/O. Asynchronous data transfer-strobe control, Hand shaking; Modes of Transfer: Example of programmed I/O, interrupt-initiated I/O. Daisy-Chaining priority. DMA: DMA Controller, DMA Transfer, Intel 8089 IOP.

Unit-V:

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multi-Processor; Interconnection structures: Timeshared common bus, multiport memory, crossbar switch, multi-stage switching network; Introduction to Flynn's classification: SISD, SIMD, MISD, MIMD (Introduction).

Textbooks:

1. M. Morris Mano, Computer System Architecture, Revised Third Edition, Pearson/PHI, 2017.
2. Carl Hamacher, Zvonks Vranesic, Safea Zaky, Computer Organization ,5th Edition, McGraw Hill,2011.
3. Douglas V Hall, Microprocessor and Interfacing, Second Edition, TATA McGraw Hill, 2006.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 6^{th}Edition, Pearson/PHI, 2007.
2. Andrew S. Tanenbaum, Structured Computer Organization, 4th Edition, PHI/Pearson.
3. http://nptel.iitm.ac.in.

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B.Tech. CSE II Year II Semester	L	T/P/D	C
	2	1	3

FORMAL LANGUAGES AND AUTOMATA THEORY

Prerequisites: Basics of any programming language.

Course Objectives:
The Course objectives are to:

1. Summarize the concepts of Formal Languages and different kinds of Finite Automata.
2. Interpret capabilities of Context Free Grammar.
3. Identify the significance of Push Down Automata.
4. Categorize various grammars of Regular Language
5. Outline the importance of Turing Machines.

Course Outcomes:
At the end of course student will be able to:

1. Design of regular expressions for language constructs and conversions of NFA to DFA.
2. Demonstrate the derivations and properties of context free grammars.
3. Analyze the applications of pushdown automata.
4. Construct DFA for Right Linear Grammar and Left Linear Grammar.
5. Appreciate the role of the Turing machine as computational and universal machine.

Unit -I:
Fundamental concepts: Strings, Alphabets, Language operations, Regular Expressions, Regular Languages: Finite automata, Types of finite automata (FA)-Non deterministic Finite Automata (NFA), Deterministic Finite Automata(DFA), NFA with ε-Moves, regular expression representation; Regular expressions to NFA; NFA with ε-Moves to NFA without ε-Moves; NFA to DFA Conversions; Minimization of DFA (Proofs Not Required)

Unit -II:
DFA with more than two outputs: Moore and Melay machines, Pumping Lemma for Regular Sets: Closure properties of Regular Sets (Proofs Not Required): Context Free Grammars (CFG), Right most, Left most –derivations, Parse Trees; Operator Grammar: Unit productions; Chomsky normal forms; (Proofs Not Required)

Unit -III
Left recursion and Elimination of left recursion in CFG: Elimination of useless symbols and unit productions; Greibach Normal Form, Push Down automata (PDA): Types of PDA: Design of a PDA for a given CFG. (Proofs Not Required)

Unit -IV:

Regular Grammars (RG), Design of DFA for a given RG: Right linear and left linear Grammars and conversions: Definition of Context Sensitive Grammar (CSG) and Linear bounded automata (LBA) (Proofs Not Required).

Unit -V:

Definition of unrestricted Grammar and Turing Machine (TM): Chomsky hierarchy on Languages, Grammars and recognizers; Design of TM as recognizer; Types of TM: Computational problems of TM with multiple tracks; Decidability Problem; Churches hypothesis (Proofs Not Required)

Text Book:

1. John E.Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, Introduction to Automata Theory, Languages and Computation, Third Edition, Pearson, 2013.
2. VivekKulakarni, Theory of Computation, Oxford University press 2013, Fifth Edition, 2018.

Reference Books:

1. Daniel I.A.Cohen, Introduction to Computer Theory, Second Edition, John Wiley,1996.
2. John C Martin, Introduction to languages and the theory of Computation, Third Edition, TATA McGraw Hill, 2014.

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year – II Sem	L	T / P / D	C
	2	1	3

JAVA PROGRAMMING

Prerequisites: Object Oriented Programming

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUI applications.

At the end of the course, students will be able to

1. Understand the Object Oriented Programming concepts(L2)
2. Design programs using package and interfaces.(L6)
3. Apply the concepts of Exceptions and multithreading.(L3)
4. Develop GUI applications and AWT using Frames (L6)
5. Design the programs using Applet and JDBC Concepts(L6)

Unit -I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

Unit- II

Inheritance –Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance

Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, Character Streams.

Unit- III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.

Multi threading: Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

Unit- IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT: class hierarchy, component, container, panel, window, frame, graphics class, Layout Manager – layout manager types – boarder, grid, flow, card and grib bag.

Unit- V

AWT controls: Labels, button, scrollbars, text components, check box, check box groups, choices, menu bar.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

JDBC Connectivity: JDBC Type 1 to 4 Drivers, connection establishment, QueryExecution

Text Books

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGraw Hill, Year of Publication:2017
2. Database Programming with JDBC&JAVA, Second Edition,GeorgeReese, O'ReillyMedia, Year of Publication:2009

Reference Books

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, Bruce Eckel
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

	L	T / P / D	C
B.Tech. CSE-II Year II Sem.	**3**	**1**	**4**

DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisites: Data Structures

Course Objectives:
Course Objectives of Design and Analysis of Algorithms are to:
1. Analyze the asymptotic performance of algorithms.
2. Apply the Paradigms and approaches to appreciate the impact of algorithm design in practice.
3. Synthesize efficient algorithms in common engineering design situations.
4. Analyze complex engineering problems using back tracking.
5. Utilize data structures and algorithmic design techniques in solving new problems.

Course Outcomes:
At the end of this Design and Analysis of Algorithms course, students will be able to:
1. Formulate the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm. (L6)
2. Design the major graph algorithms for model engineering problems and knowledge of the greedy paradigm(L6)
3. Apply the dynamic-programming paradigm and recite algorithms that employ this paradigm. (L3)
4. Illustrate the concept of back tracking, branch and bound paradigm for real time problems. (L4)
5. Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples. (L4)

UNIT I:
Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Disjoint Sets- disjoint set operations, union and find operations
Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort.

UNIT II:
Graphs: breadth first search, depth first search, spanning trees, connected and bi connected components.

Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III:

Dynamic Programming: General method, Multi stage graph, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

UNIT IV:

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - Travelling sales person problem,0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.

UNITV:

Lower Bound Theory: Comparison trees ,NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Clique Decision Problem(CDP), Node cover decision problem.

Text Books:

1. Ellis Horowitz, Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms,Galgotia publications pvt. Ltd, Second Edition, 2007.
2. Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivert and Clifford Stein, Introdution to Algorithms, Third Edition ,PHI Learning Private Limited , Eastern Economy Edition, 2008.

Reference Books:

1. Aho, Ullman and Hopcroft,Design and Analysis of algorithms, Pearson education, Reprint 2002
2. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill,2005.
3. Allen Weiss,Data structures and Algorithm Analysis in C++,Third edition, Pearson education.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE II Year II Sem.

L	T / P / D	C
3	**0**	**3**

DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Discuss Database management systems, databases and its applications
2. Familiarize the students with a good formal foundation on the relational model.
3. Outline the various systematic database design approaches
4. Describe the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. Explore the File organizations, indexing and hashing mechanisms.

Course Outcomes:

At the end of this Database Management Systems course, students will be able to:

1. Model Entity-Relationship diagrams for enterprise level databases[L3]
2. Formulate Queries using SQL and Relational Formal Query Languages[L3]
3. Apply different normal forms to design the Database[L3]
4. Summarize concurrency control protocols and recovery algorithms[L5]
5. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of Data[L3]

UNIT I:

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II:

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus.

UNIT III:

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+,}$ Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

UNIT IV:

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

UNIT V:

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Text Book:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books:

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eigth Edition Pearson 2006
3. P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

II Year B.Tech. CSE – II Sem	L	T / P / D	C
	0	3	1.5

JAVA PROGRAMMING LAB

Prerequisites: Data structures and a parallel course on java programming

Course Outcomes:

Student will be able to:

1. Explain Java Environment and use of Java Development Kit for the creation and execution of java programs
2. Develop programs on various concepts like data abstraction & data hiding, encapsulation, inheritance, polymorphism.
3. Develop the programs using interfaces and packages
4. Create and use threads and handle exceptions
5. Develop GUI applications using Applet and JDBC programs.

Week 1:-

1) Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object

2) Write a program to implement static and this keyword?

Week 2:-

3) Write a program to illustrate types of constructors and constructor overloading

4) Write a java program to illustrate Method overloading

Week 3:-

5) Write a Java program to practice using String class and its methods.

6) Write a program to illustrate parameter passing Techniques.

Week 4:

7) Write a program to find Minimum and Maximum element using Arrays

8) Write a java program to illustrate Recursion and nested class

Week 5:-

9) Write a program to illustrate types of inheritance.

10) Write a program to illustrate the use of creation of packages.

Week 6:-

11) Write a java program to demonstrate the concept of polymorphism.

12) Write a java program to illustrate Method Overriding and abstract class?

Week 7:-

13) Write a program to illustrate Interfaces

14) Write a program to illustrate Files

Week 8:-

15) Write a program to illustrate try, catch, throw, throws and finally keywords

16) Write a program to implement the concept of User defined Exceptions.

Week 9:-

17) Write a program to illustrate StringTokenizer, Date, Random and Scanner classes?

18) Write a program to illustrate collection classes and interfaces

Week 10:-

19) Write a program to illustrate Multithreading?

20) Write a program to illustrate thread priorities.

Week 11:-

21) Write a program to illustrate Thread Synchronization

22) Write a program to illustrate Inter Thread Communication

Week 12:-

23) Write a program to illustrate applet concept.

24) Write a program to illustrate passing parameters to applet

Week 13:-

25) Write a program to illustrate Event Handling(keyboard,Mouse events)

Week 14:-

26) Write a program to illustrate AWT controls.

27) Write a program to develop a calculator application using AWT

Week 15-16:-

28) Write a program to illustrate JDBC.

ANURAG UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

B.Tech. CSE- II Year II Sem.	L	T / P / D	C
	0	**3**	**1.5**

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

1. Familiarize the SQL Commands and Integrity Constraints
2. Write the PL/SQL procedures, triggers, functions and cursors

Course Outcomes:

At the end of this Database Management Systems Lab course, students will be able to:

1. Apply different types of SQL commands to create, manipulate and access data from database[L3]
2. Construct database by using various integrity constraints[L3]
3. Develop basic PL/SQL programs[L3]
4. Implement PL/SQL Programs using procedures, functions and cursors[L3]
5. Create trigger for given problem[L3]

List of Experiments:

Week 1:
Database user creation, Data definition Language commands, Data Manipulation commands, Data Control Language Commands, Transaction Control Language commands.

Week 2:
1. Database Schema for a customer-sale scenario

Customer (<u>Cust id: integer</u>, cust_name: string)
Item (<u>item_id: integer</u>,item_name: string, price: integer)
Sale (<u>bill_no: integer</u>, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the bills for the current date with the customer names and item numbers
d) List the total Bill details with the quantity sold, price of the item and the final amount
e) List the details of the customer who have bought a product which has a price>200
f) Give a count of how many products have been bought by each customer
g) Give a list of products bought by a customer having cust_id as 5
h) List the item details which are sold as of today

i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

Create a view which lists the daily sales date wise for the last one week

Week 3:

2. Database Schema for a Student Library scenario

Student (Stud_no : integer,Stud_name: string)
Membership (Mem_no: integer,Stud_no: integer)
Book (book_no: integer, book_name:string, author: string)
Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the student names with their membership numbers
d) List all the issues for the current date with student and Book names
e) List the details of students who borrowed book whose author is CJDATE
f) Give a count of how many books have been bought by each student
g) Give a list of books taken by student with stud_no as 5
h) List the book details which are issued as of today
i) Create a view which lists out the iss_no, iss _date, stud_name, book name
j) Create a view which lists the daily issues-date wise for the last one week

Week 4:

3 Database Schema for a Employee-pay scenario

employee (emp_id : integer,emp_name: string)
Department (dept_id: integer,dept_name:string)
Paydetails (emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)
Payroll (emp_id : integer, pay_date: date)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List the employee details department wise
d) List all the employee names who joined after particular date
e) List the details of employees whose basic salary is between 10,000 and 20,000
f) Give a count of how many employees are working in each department
g) Give a names of the employees whose netsalary>10,000
h) List the details for an employee_id=5
i) Create a view which lists out the emp_name, department, basic, deductions, netsalary
j) Create a view which lists the emp_name and his netsalary

Week 5:

4. Database Schema for a Video Library scenario

Customer (cust_no: integer,cust_name: string)
Membership (Mem_no: integer, cust_no: integer)
Cassette (cass_no:integer, cass_name:string, Language: String)

Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the customer names with their membership numbers
d) List all the issues for the current date with the customer names and cassette names
e) List the details of the customer who has borrowed the cassette whose title is "The Legend"
f) Give a count of how many cassettes have been borrowed by each customer
g) Give a list of books which has been taken by the student with mem_no as 5
h) List the cassettes issues for today
i) Create a view which lists outs the iss_no, iss_date, cust_name, cass_name
j) Create a view which lists issues-date wise for the last one week

Week 6:

5. Database Schema for a student-Lab scenario

Class (class_no: string,descrip: string)
Student (stud_no: integer, stud_name: string, class_no: string)
Lab (mach_no: integer, Lab_no: integer, description: String)
Allotment (Stud_no: Integer, mach_no: integer, dayof week: string)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the machine allotments with the student names, lab and machine numbers
d) List the total number of lab allotments day wise
e) Give a count of how many machines have been allocated to the 'CSIT' class
f) Give a machine allotment etails of the stud_no 5 with his personal and class details
g) Count for how many machines have been allocatedinLab_no1 for the day of the week as "Monday"
h) How many students class wise have allocated machines in the labs
i) Create a view which lists out the stud_no, stud_name, mach_no, lab_no, dayofweek
j) Create a view which lists the machine allotment details for "Thursday".

Week 7:

6. Write a program to find largest number from the given three numbers.
7. Simple programs using loop, while and for iterative control statement.
8. Write a program to check whether the given number is Armstrong or not
9. Write a program to generate all prime numbers below 100.

Week 8:

10. Write a program to demonstrate the GOTO statement.
11. Write a program to demonstrate %type and %row type attributes

Week 9:

12. Write a program to demonstrate predefined exceptions
13. Write a program to demonstrate user defined exceptions
14. Create a cursor, which displays all employee numbers and names from the EMP table.

Week 10:
15. Create a cursor, which update the salaries of all employees who works in dept no 10.
16. Create a cursor, which displays names of employees having salary > 50000.

Week 11:
17. Create a procedure to find reverse of a given number
18. Create a procedure to update the salaries of all employees whose salary is between 25000 to 50000

Week 12:
19. Create a procedure to demonstrate IN, OUT and INOUT parameters
20. Create a function to check whether given string is palindrome or not.

Week 13:
21. Create a function to find sum of salaries of all employees working in depart number 10.
22. Create a trigger before/after update on employee table for each row/statement.

Week 14:
23. Create a trigger before/after delete on employee table for each row/statement.
24. Create a trigger before/after insert on employee table for each row/statement.

Week 15:
Review

Text Book:
1. Ivan Bayross, SQL, PL/SQLThe programming Language of Oracle, 3rd Revised Edition, BPBPublications, 2008.

ANURAG UNIVERSITY

School of Engineering

Department of COMPUTER SCIENCE & ENGINEERING (CSE)

TWO YEARS COURSE STRUCTURE CSE-CS

R20 REGULATIONS

B.TECH (CSC) I YEAR I SEM (1st semester) 4 T+ 5P

Serial No	Category	Subject Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–1	3	1	0	4.0
2	BSC	Physics	3	1	0	4.0
3	BSC	Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSS&MC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming for Problem Solving- I	2	0	0	2.0
9	ESC	Programming for Problem Solving-I Lab	0	0	3	1.5
TOTAL			**11**	**02**	**13**	**19.5**

B.TECH (CSC)I YEAR II SEM (2nd semester) 5T +3 P

Serial No	Category	Subject Name	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–II	3	1	0	4.0
2	BSC	Chemistry	3	1	0	4.0
3	BSC	Chemistry Lab	0	0	3	1.5
4	HSS&MC	English	2	0	0	2.0
5	HSS&MC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming for Problem Solving-II	2	0	0	2.0
7	ESC	Programming for Problem Solving – II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
TOTAL			**11**	**2**	**11**	**18.5**

B.Tech. CSE-Cyber Security (CS)

B.TECH II (CSC)YEAR I SEM (3rd semester) **5T +4L+1MC**

Serial No	Category	Subject Name	Hours per week			Credits
			L	T	P	
1	ESC	Digital Logic Design	3	0	0	3
2	PCC	Data Structures	3	0	0	3
3	PCC	Python Programming	2	0	0	2
4	BSC	Discrete Mathematics	3	0	0	3
5	BSC	Probability and Statistics	3	0	0	3
6	PCC-Lab	Python Programming Lab	0	0	3	1.5
7	PCC-Lab	Data Structures Lab	0	0	3	1.5
8	PCC-Lab	Linux programming Lab	0	1	2	2
9	ESC-Lab	Design Thinking Lab	0	0	2	1
9	MC	Environmental Studies	2	0	0	0
Total						20

B.TECH (CSC)II YEAR II SEM (4th semester) **5T+3L+1MC**

Serial No	Category	Subject Name	Hours per week			Credits
			L	T	P	
1	PCC	Computer Organization and Architecture	3	0	0	3
2	PCC	Computer Networks	3	0	0	3
3	PCC	Java Programming	2	1	0	3
4	PCC	Design and Analysis of Algorithms	3	1	0	4
5	PCC	Database Management Systems	3	0	0	3
6	HSS&MC -Lab	Soft Skills for Success Lab	0	0	2	1
7	PCC-Lab	JAVA Programming Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

ANURAG UNIVERSITY
SCHOOL OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)
SECOND YEAR SYLLABUS – CSE-CS
R20 REGULATIONS
B.TECH II YEAR I SEM

B.Tech. **CSE-CS**- II Year I Sem	L	T / P / D	C
	3	0	3

DIGITAL LOGIC DESIGN

Pre requisites: None

Course Objectives:

Students will be able to:

1. Understand various number systems addition and subtractions in binary system, error detection and correction codes
2. Minimize boolean functions using boolean laws & k-maps and realize by using logic gates
3. Design various combinational circuits with practical applications
4. Understand the basic sequential circuits : Latches, Flip-Flops and their usage
5. Design synchronous and asynchronous counters

Course Outcomes:

After completion of the course student will be able to:

1. Understand various number systems, floating point representations, complements, error detecting and correcting codes (L2)
2. Apply boolean algebraic principles and k-maps for simplification of boolean functions (L3)
3. Design combinational circuits (L3)
4. Analyze various types of flip flops (L4)
5. Design sequential circuits (L3)

Unit I:

Number Systems: Binary, Octal, Hex Decimal, and Conversions; Binary additions and subtractions (using 1c, and 2c), concept of overflow; Representations of negative numbers using 1's and 2's complement and range; BCD numbers: 8421, 2421, Ex-3, Gray and Self Complementary codes; Error Detecting codes: even & odd parity, hamming codes; Error correcting codes: hamming codes, block parity codes; Floating point representation.

Unit II:

Boolean Algebra and Digital Logic Gates, Basic Boolean laws and properties; Boolean functions, truth tables; Standard forms (SOP, POS) and Canonical forms, Conversion between Canonical and Standard forms ; Gate minimization using three and four variable K-Maps with and without don't cares, Logic Circuit Design using Universal Gates .

Unit III:

Introduction to combinational circuits and applications**,** Design Procedure, Combinational circuit for Half Adder, Full Adder, Half Subtractor and Full Subtractor, Binary Adder, Binary Adder-Subtractor, Decimal Adder, Code Converters, Decoders, Encoders, Multiplexers, Demultiplexers.

Unit IV:

Introduction to Sequential Circuits and its applications, Lathes, Flip flops, Storage Elements, Flip-flops: S-R Flip flop, D Flip Flop, J-K Flip Flop, T Flip flop, master slave J-K flip flop, Analysis of Clocked Sequential Circuits, Flip Flop Conversions

Unit V:

Registers and Counters: Introduction, Registers, Shift Registers, Ripple Counters: Up counter, Up-Down counter, Decade counter, Synchronous Counters: Up Counter, Up-Down counter, Decade Counter, Other Counters: Ring Counter, Johnson Counter

Text Books:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2012
2. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI, 2016

Reference Books:

1. Roth, Fundamentals of Logic Design, 5th Edition, Thomson, 2004.
2. John F. Wakerly, Digital Design, Principles and Practices, 4th Edition, Pearson / Prentice Hall, 2005.
3. Malvino & Leach, Digital Principles and Applications, Seventh Edition, Tata McGraw-Hill Education, 2010.
4. A.K. Maini, Digital Electronics, Principles and Integrated Circuits, 1st Edition, Wiley India Publications, 2007.

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

CSE-CS

B.Tech. CSE-CS II Year - I Sem	L	T / P / D	C
	3	0	3

DATA STRUCTURES

Prerequisites: Any programming language

Course Objectives:

1. Understand various static and dynamic representations of data structures.
2. Understand fundamental algorithmic problems of various nonlinear data structures.
3. To be familiar with Graph representations and traversals.
4. Know the basic concepts of Hashing.

Course Outcomes:

After the completion of the course student will be able to:

1. Examine Static and Dynamic data structures in implementing Stack applications (L4)
2. Apply Tree traversal algorithms in solving real time applications (L3)
3. Analyze the concepts of Advanced Trees to generate search efficiently (L4)
4. Interpret the importance of Graphs in solving real time applications (L5)
5. Examine the concepts of hashing, collision and its resolution methods using hash function (L4)

Unit I:

Introduction: What is data structure, Types of data structures, Static and Dynamic representation of data structure and comparison. **Stacks-** definition, operations, **Applications of** stacks – Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack, Towers of Hanoi, Parenthesis checker.

Unit II:

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees-Inorder Threading. Representation of Trees using Arrays and Linked lists (advantages and disadvantages). Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals,
Heaps: Introduction, types of Heaps – Min binary heap, Max binary heap.

Unit III:

Advanced concepts on trees: Representation and Creation of Binary Search Trees (BST); Algorithm for Inserting, deleting and searching in BST representation and advantages of AVL Trees, algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees; B Tree of Order M, operations- Insertion and Searching, Introduction to Red-Black Trees and Splay Trees.

Unit IV:
Graphs-Basic terminology, Representation of graphs: sequential representation (Adjacency, Path Matrix) Linked representation.
Graph Traversals-Breadth First Search, Depth First Search with algorithms. Spanning Trees-Definition and properties, Minimum Spanning Tree, Dijkstra Algorithms.

Unit V:
Hashing: General Idea, Hash Functions, Collision Resolution- Separate Chaining ,Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Implementation of Dictionaries

Text Books:

1. Seymour Lipschutz, Schaum's Outlines ,Data Structures, Special Second Edition,Tata McGraw-Hill, 2014.
2. Richard F.Gillberg&Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, Second Edition, Cengage Learning, India Edition, 2005.

Reference Books:

1. Aaron M. Tenenbaum,Yedidyah Langsam and Moshe J. Augenstein, Data Structures Using C and C++, PHI Learning Private Limited, Delhi India, 2002.
2. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd Delhi India, 1983.
3. A.K. Sharma , Data Structure Using C, Pearson Education India, Second Edition, 2013.

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PYTHON PROGRAMMING

Prerequisites: None

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

Course Outcomes:

After completion of the course student will be able to:

1. Apply control structures, functions and packages in Problem Solving. (L3)
2.Analyze various String handling functions and data structures(L4)
3.Model the object-oriented problems with classes and objects (L4)
4.Solve the problems by using Inheritance and polymorphism (L3)
5.Illustrate programs on Exception Handling and various packages(L3)

Unit – I
Introduction to Python:
Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations.
Functions and Modules:
Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Unit – II
Strings and Regular Expressions:
String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.
Sequence: List, Tuples, Dictionaries, Sets.

Unit – III
Introduction to Object Oriented Programming: Features of OOP,Merits and demerits of Object Oriented Programming Languages,Applications of OOP
Implementation of classes and objects in Python:
Classes and Objects, Class Method and Self Argument. The **__**init**__**Method, Class Variables and Object Variables, The **__**del**__**Method, Public and Private Data Members, Private

Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Unit – IV

Implementation of Inheritance in Python:
Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class,

Implementation of Operator Overloading in Python:
Introduction, Implementing Operator Overloading, Overriding Methods

Exception Handling in Python:
Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

Unit V:

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib :, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages.

Text Book

1.ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017

2.James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Suggested / Reference Books

1.Charles Dierach, Introduction to Computer Science using Python,2013

2. https://www.programiz.com/python-programming

3. https://www.javatpoint.com/python-tutorial

4.. https://www.geeksforgeeks.org/python-programming-language/

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DISCRETE MATHEMATICS

Pre requisites: Mathematics- I and II

Course Objectives:

1.Interpret the Sets, syntax and semantics of propositional and predicate logic.
2. Solve applications involving Permutations and Combinations.
3. Formulate Recurrence relations to solve problems involving an unknown sequence.
4. Explain the concepts of Relations and Graphs.
5. Illustrate the Algebraic Systems.

Course Outcomes:
After completion of course students will be able to

1. Analyze Statement Logic and Predicate Logic.(L4)
2. Apply the principles of Permutations and Combinations with repetition & without repetitions(L3)
3. Solve Recurrence Relations by using generating functions(L3)
4. Apply the knowledge of Relations and Graph Theory in the field of Computer Science.(L3)
5. Analyze the Algebraic Systems with their properties(L4)

UNIT I:
Foundations: Basics, Sets and Operations of Sets, Fundamentals of Logic, Logical Inferences, First order logic and other methods of Proof, Rules of Inference for Quantified Propositions. **(Problems Only and Theorems without Proofs)**

UNIT II:
Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumerating Combinations and Permutations with & without repetitions, constrained repetitions, and Principle of Inclusion and Exclusion. **(Problems Only and Theorems without Proofs)**

UNIT III:
Recurrence Relations: Generating Functions, Calculating coefficient of Generating Function, Solving Recurrence relations by substitution method and Generating Functions,

The Method of Characteristic Roots, Solutions to inhomogeneous recurrence relations. **(Problems Only and Theorems without Proofs)**

UNIT IV:

Relations and Digraphs: Relations and Directed Graphs, Special Properties of Binary Relations, Equivalence Relations, Ordering Relations, Lattices, Operations on Relations, Paths and Closures, Directed Graphs and adjacency matrices. **(Problems Only and Theorems without Proofs)**

Graphs: Basic Concepts, Isomorphism's and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs. **(Problems Only and Theorems without Proofs)**

UNIT V:

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. **(Problems Only and Theorems without Proofs)**

Text Books:

1. Joe L. Mott, Abraham Kandel, Theodare P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition, PHI, 2019.
2. J. P.Tremblay and P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2007

Reference Books:

1. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill.
2. S. K. Chakraborthy and B.K. Sarkar," Discrete Mathematics ", Oxford, 2011.
3. C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.

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DATA STRUCTURES LAB

Prerequisites: Any programming language and a parallel course on data structures.

Course Objectives:

1. To design and analyze simple linear and non linear data structures.
2. To design and implement various data structure algorithms
3. To identify and apply the suitable data structure for the given real world problem

Course Outcomes:

Student will be able to:

1. Develop the programs on stacks and its applications.
2. Demonstrate the implementation of various advanced trees.
3. Design and implementation of programs on BST and Graph Traversals.
4. Develop the programs on Hashing and Dictionaries

Week 1:

Review of Stack and Queue Operations using arrays and Linked Lists

Week 2:

Program to convert infix to postfix notation

Program to evaluate postfix notations

Week 3:

Program to implement towers of Hanoi

Program to implement parenthesis checker

Week 4:

Program to illustrate tree traversals
b) In order b) Preorder c) Post order

Week 5:

Program to illustrate insertion, deletion and searching in Binary Search Tree.

Week 6:

Program to implement Heaps

a)Min Heap b) Max Heap

Week 7:

Program to illustrate Insertion on AVL Trees.

Program to illustrate deletion and Rotation on AVL Trees.

Week 8:

Program to implement B-Trees

b) Insertion b) Search c) Display

Week 9:

Program to illustrate Graph traversals

c. Breadth First Search
d. Depth First Search

Week 10:

Program to implement

a) Prims algorithm b) Kruskal's algorithm

Week 11:

Program to Implement Dijkstra algorithm.

Week 12 & 13 :

Program to implement Hashing and collision resolution techniques

Week 14:

Program to implement Dictionaries.

Week 15:

Review

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PYTHON PROGRAMMING LAB

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Language.
3. Know the Data Structures in Python Programming Language.
4. Use the reusability concepts in Python Programming Language.
5. Use Exception Handling mechanism in Python Programming Language.
6. Know the packages in Python Programming Language.

Course Outcomes:

Student Able to

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write the programs on strings and functions
4. Implement programs on class and related issues.
5. Use of python exception handling and packages.

Week-1:

Installation and Environment set up of Python & Programs on Data types

Week-2:

Programs on Standard I/O, Operators and Expressions

Week-3:

Programs on Functions

Week-4

Programs on lists and Tuples

Week-5:

Programs on Dictionaries

Week-6:

Programs on Strings and string operations

Week-7:

Programs on Regular Expressions.

Week-8:

Programs on Inheritance and Polymorphism

Week-9:

Programs on Exception Handling

Week-10:

Demonstration of Numpy Package

Week-11:

Demonstration of Pandas Package

Week-12:

Demonstration of matplotlib Package and Tkinter Package

Week-13:

Demonstration of Date and Time Packages

Week-14: Overview

Week-15: Overview

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LINUX PROGRAMMING LAB

Course Objectives:

1. To gain an understanding of important aspects related to the Linux Commands.
2. To understand directory commands.
3. To provide a comprehensive introduction to SHELL programming.
4. To understand file handling utilities
5. To develop ability to use system calls.

Course Outcomes:
At the end of this course, Students will be able to:
1. Apply the basic commands in Linux Operating System.
2. Create directories and Shell Script programs.
3. Analyze a given problem and apply requisite facets of Shell programming.
4. Demonstrate UNIX commands for file handling mechanisms.
5. Develop a C Program for UNIX Commands.

List of Experiments:
Week-1:
Practice Vi Commands

Week-2:
a) Open the file created in session 1
b) Add some text
c) Change some text
d) Delete some text
e) Save the Changes

Week-3:
a) Create mytable (name of the table) using cat command for the following data.use tab to separate fields.

1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86

b) Use the cat command to display the file, mytable.
c) Use the vi command to correct any errors in the file, mytable.

Week-4:
a)Use the sort command to sort the file mytable according to the first field. Call the sorted file mytable (same name)
b) Print the file mytable
c) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)
d) Print the new file, mytable
e) Logout of the system.

Week-5:
a) Use the appropriate command to determine your login shell
b) Use the /etc/passwd file to verify the result of "step a".
c) Use the who command and redirect the result to a file called myfile1. Use the more command
d) to see the contents of myfile1.
e) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2.
f) Use the more command to check the contents of myfile2.

Week-6:
a) Write a sed command that deletes the first character in each line in a file.
b) Write a sed command that deletes the character before the last character in each line in a file.
c) Write a sed command that swaps the first and second words in each line in a file.

Week-7:
a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.
b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.

Week-8:
a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.
b) Write a shell script that accepts one or more file name as arguments and converts all of them
to uppercase, provided they exist in the current directory.
c) Write a shell script that determines the period for which a specified user is working on the System.

Week-9:
a) Write a shell script to perform the following string operations:
i) To extract a sub-string from a given string.
ii) To find the length of a given string.

b)Write a shell script that accepts a file name starting and ending line numbers as arguments anddisplays all the lines between the given line numbers.
c) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

Week-10:
a) Write a shell script that computes the gross salary of a employee according to the following rules:
i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.
ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic
The basic salary is entered interactively through the key board.
b) Write a shell script that accepts two integers as its arguments and compute the value of first number raised to the power of the second number.

Week-11:
a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, then program ask the user for the necessary information, such as the file name, new name and so on.

Week-12:
a) Write shell script that takes a login name as command – line argument and reports when that person logs in
b) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

Week-13:
a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

Week-14:
Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:
i) File type
ii) Number of links
iii) Read, write and execute permissions
iv) Time of last access
(Note: Use stat/fstat system calls)

Week-15
Over View
Text Books:
1. Unix concepts and applications, Fourth Edition, Sumitabha Das, TMH
2. Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education.

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CSE-CS

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Computer Organization and Architecture

Pre-requisites: Digital Logic Design

Course Objectives:

1. Understand the instruction format, life cycle and CPU Architecture and Organization
2. Know the basic architecture of Microprocessor
3. Learn various types of memories
4. Learn the concepts for data transfer between CPU & I/O devices.
5. Understand the concepts of Pipeline, Vector and Multiprocessors.

Course Outcomes:

Students will be able to:

1. Describe the basic organization of computer and different instruction formats and addressing modes.(L2)
2. Analyze the concept of pipelining, segment registers and pin diagram of CPU.(L4)
3. Analyze various issues related to memory hierarchy.(L4)
4. Compare various modes of data transfer between CPU and I/O devices.(L4)
5. Design Pipeline for the execution of instructions (L5)
6. Examine various inter connection structures of multi processors. (L4)

Unit-I:

Instruction: Instruction Definition, instruction cycle, flow chart for instruction cycle, instruction storage, types of instruction formats (Zero, one, two and three address). Addressing modes: mode field, implied, immediate register, register direct, register indirect, auto increment, decrement, indexed, relative, base address mode, Numerical examples and problems.

Unit-II:

CPU-Organization: 8086 –CPU –Block diagram and pin diagram, minimum and maximum mode, General purpose registers; segment register and generation of 20 bits address, segmentation of main memory, systems bus, Types of flags.

Unit-III:

Memory Hierarchy, Main memory, memory address map, memory connection to CPU; Auxiliary memory, Magnetic disks, Magnetic tapes; cache memory, hit and miss ratio, direct, associative and set associative mapping; Micro-programmed control: control memory, address sequencing.

Unit-IV:

I/O interface: I/O Bus and Interface modules, I/O versus Memory Bus, isolated vs Memory-mapped I/O. Asynchronous data transfer-strobe control, Hand shaking; Modes of Transfer: Example of programmed I/O, interrupt-initiated I/O. Daisy-Chaining priority. DMA: DMA Controller, DMA Transfer, Intel 8089 IOP.

Unit-V:

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multi-Processor; Interconnection structures: Timeshared common bus, multiport memory, crossbar switch, multi-stage switching network; Introduction to Flynn's classification: SISD, SIMD, MISD, MIMD (Introduction).

Textbooks:

1. M. Morris Mano, Computer System Architecture, Revised Third Edition, Pearson/PHI, 2017.
2. Carl Hamacher, Zvonks Vranesic, Safea Zaky, Computer Organization ,5th Edition, McGraw Hill,2011.
3. Douglas V Hall, Microprocessor and Interfacing, Second Edition, TATA McGraw Hill, 2006.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 6thEdition, Pearson/PHI, 2007.
2. Andrew S. Tanenbaum, Structured Computer Organization, 4th Edition, PHI/Pearson.
3. http://nptel.iitm.ac.in.

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COMPUTER NETWORKS

Prerequisites: C Programming Language and Data Structures.

Course Objectives:

1. Elaborate on the fundamental concepts of computer networks and network models.
2. Interpret the error and flow control mechanisms in the data link layer.
3. Explore the knowledge of various routing algorithms.
4. Describe the transport layer functionalities.
5. Illustrate different application layer functionalities.

Course Outcomes:
At the end of the course, students will be able to:

1. Illustrate the functionalities of various network models and Data link Layer. (L4)
2. Analyze error and flow control mechanisms in the data link layer. (L4)
3. Examine various Routing Protocols. (L4)
4. Compare various congestion control mechanisms to improve the QoS of networking. (L4)
5. Identify the suitable Application layer protocols for specific applications. (L1)

Unit - I:

Network Models: Layered Tasks, OSI model, Layers in the OSI model, TCP/IP protocol Suite, Addressing.
Data Link Control: Error detection and Correction- Introduction, Hamming Distance, CRC, Checksum.

Unit - II:

Data Link Layer: Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC.
Multiple Access: Random Access, Controlled Access, Channelization.

Unit- III:

Network Layer: IPV4, IPV6, Transition from IPv4 to IPv6,Delivery, Forwarding and Routing, **Routing protocols:** Distance Vector Routing, Link State Routing, Path Vector Routing

Unit- IV:

Transport Layer: Process-to-Process delivery, TCP, UDP, Congestion Control, Quality of Service, Techniques to improve QoS.

Unit-V:

Application Layer: Domain Name Space, Distribution of Name Space, DNS in Internet, Resolution, Domain Name Space (DNS) Messages, Electronic mail, File Transfer Protocol.

Text books:

1) Behrouz A Forouzan ,Data Communications and Networking,4th Edition, McGraw-Hill.
2) Andrew S. Tanenbaum, Computer Networks, Third Edition.

Reference Books:

1) William Stallings, Data Communications, Eight Edition, Pearson Publishers.

2) Sudakshina Kunda, Fundamentals of Computer Networks, Second Edition, PHI Publisher.

3) http://highered.mheducation.com/sites/0072967757/student_view0/index.html

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JAVA PROGRAMMING

Prerequisites: Object Oriented Programming

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUI applications.

At the end of the course, students will be able to

1. Understand the Object Oriented Programming concepts(L2)
2. Design programs using package and interfaces.(L6)
3. Apply the concepts of Exceptions and multithreading.(L3)
4. Develop GUI applications and AWT using Frames (L6)
5. Design the programs using Applet and JDBC Concepts(L6)

Unit -I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword,garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

Unit- II

Inheritance –Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance

Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, Character Streams.

Unit- III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.

Multi threading: Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

Unit- IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT: class hierarchy, component, container, panel, window, frame, graphics class, Layout Manager – layout manager types – boarder, grid, flow, card and grib bag.

Unit- V

AWT controls: Labels, button, scrollbars, text components, check box, check box groups, choices, menu bar.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

JDBC Connectivity: JDBC Type 1 to 4 Drivers, connection establishment, QueryExecution

Text Books

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGraw Hill, Year of Publication:2017
2. Database Programming with JDBC&JAVA, Second Edition,GeorgeReese, O’ReillyMedia, Year of Publication:2009

Reference Books

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, Bruce Eckel
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education

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DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisites: Data Structures

Course Objectives:
Course Objectives of Design and Analysis of Algorithms are to:
1. Analyze the asymptotic performance of algorithms.
2. Apply the Paradigms and approaches to appreciate the impact of algorithm design in practice.
3. Synthesize efficient algorithms in common engineering design situations.
4. Analyze complex engineering problems using back tracking.
5. Utilize data structures and algorithmic design techniques in solving new problems.

Course Outcomes:
At the end of this Design and Analysis of Algorithms course, students will be able to:
1. Formulate the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm. (L6)
2. Design the major graph algorithms for model engineering problems and knowledge of the greedy paradigm(L6)
3. Apply the dynamic-programming paradigm and recite algorithms that employ this paradigm. (L3)
4. Illustrate the concept of back tracking, branch and bound paradigm for real time problems. (L4)
5. Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples. (L4)

UNIT I :
Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Disjoint Sets- disjoint set operations, union and find operations
Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort.

UNIT II :
Graphs: breadth first search, depth first search, spanning trees, connected and bi connected components.

Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III :

Dynamic Programming: General method, Multi stage graph,applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

UNIT IV :

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - Travelling sales person problem,0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.

UNITV :

Lower Bound Theory: Comparison trees ,NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Clique Decision Problem(CDP), Node cover decision problem.

Text Books:

1. Ellis Horowitz, Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms,Galgotia publications pvt. Ltd, Second Edition, 2007.
2. Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivert and Clifford Stein, Introdution to Algorithms, Third Edition ,PHI Learning Private Limited , Eastern Economy Edition, 2008.

Reference Books:

1. Aho, Ullman and Hopcroft,Design and Analysis of algorithms, Pearson education, Reprint 2002
2. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai,Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill,2005.
3. Allen Weiss,Data structures and Algorithm Analysis in C++,Third edition, Pearson education.

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DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Discuss Database management systems, databases and its applications
2. Familiarize the students with a good formal foundation on the relational model.
3. Outline the various systematic database design approaches
4. Describe the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. Explore the File organizations, indexing and hashing mechanisms.

Course Outcomes:

At the end of this Database Management Systems course, students will be able to:

1. Model Entity-Relationship diagrams for enterprise level databases[L3]
2. Formulate Queries using SQL and Relational Formal Query Languages[L3]
3. Apply different normal forms to design the Database[L3]
4. Summarize concurrency control protocols and recovery algorithms[L5]
5. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of Data[L3]

UNIT I:

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II:

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus.

UNIT III:

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+,}$ Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

UNIT IV:

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

UNIT V:

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Text Book:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books:

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eigth Edition Pearson 2006
3. P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)
CSE-CS

B.Tech. **CSE-CS** II Year – II Sem	L	T / P / D	C
	0	3	1.5

JAVA PROGRAMMING LAB

Prerequisites: Data structures and a parallel course on java programming

Course Outcomes:

Student will be able to:

1. Explain Java Environment and use of Java Development Kit for the creation and execution of java programs
2. Develop programs on various concepts like data abstraction & data hiding, encapsulation, inheritance, polymorphism.
3. Develop the programs using interfaces and packages
4. Create and use threads and handle exceptions
5. Develop GUI applications using Applet and JDBC programs.

Week 1:-

1) Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object

2) Write a program to implement static and this keyword?

Week 2:-

3) Write a program to illustrate types of constructors and constructor overloading

4) Write a java program to illustrate Method overloading

Week 3:-

5) Write a Java program to practice using String class and its methods.

6) Write a program to illustrate parameter passing Techniques.

Week 4:

7) Write a program to find Minimum and Maximum element using Arrays

8) Write a java program to illustrate Recursion and nested class

Week 5:-

9) Write a program to illustrate types of inheritance.

10) Write a program to illustrate the use of creation of packages.

Week 6:-

11) Write a java program to demonstrate the concept of polymorphism.

12) Write a java program to illustrate Method Overriding and abstract class?

Week 7:-

13) Write a program to illustrate Interfaces

14) Write a program to illustrate Files

Week 8:-

15) Write a program to illustrate try, catch, throw, throws and finally keywords

16) Write a program to implement the concept of User defined Exceptions.

Week 9:-

17) Write a program to illustrate StringTokenizer, Date, Random and Scanner classes?

18) Write a program to illustrate collection classes and interfaces

Week 10:-

19) Write a program to illustrate Multithreading?

20) Write a program to illustrate thread priorities.

Week 11:-

21) Write a program to illustrate Thread Synchronization

22) Write a program to illustrate Inter Thread Communication

Week 12:-

23) Write a program to illustrate applet concept.

24) Write a program to illustrate passing parameters to applet

Week 13:-

25) Write a program to illustrate Event Handling(keyboard,Mouse events)

Week 14:-

26) Write a program to illustrate AWT controls.

27) Write a program to develop a calculator application using AWT

Week 15-16:-

28) Write a program to illustrate JDBC.

ANURAG UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)
CSE-CS

	L	T / P / D	C
B.Tech. CSE-CS- II Year II Sem.			
	0	**3**	**1.5**

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

1. Familiarize the SQL Commands and Integrity Constraints
2. Write the PL/SQL procedures, triggers, functions and cursors

Course Outcomes:

At the end of this Database Management Systems Lab course, students will be able to:

1. Apply different types of SQL commands to create, manipulate and access data from database[L3]
2. Construct database by using various integrity constraints[L3]
3. Develop basic PL/SQL programs[L3]
4. Implement PL/SQL Programs using procedures, functions and cursors[L3]
5. Create trigger for given problem[L3]

List of Experiments:

Week 1:
Database user creation, Data definition Language commands, Data Manipulation commands, Data Control Language Commands, Transaction Control Language commands.

Week 2:
1. Database Schema for a customer-sale scenario

Customer (Cust_id: integer, cust_name: string)
Item (item_id: integer,item_name: string, price: integer)
Sale (bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the bills for the current date with the customer names and item numbers
d)List the total Bill details with the quantity sold, price of the item and the final amount
e)List the details of the customer who have bought a product which has a price>200
f)Give a count of how many products have been bought by each customer
g)Give a list of products bought by a customer having cust_id as 5
h)List the item details which are sold as of today

i)Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

Create a view which lists the daily sales date wise for the last one week

Week 3:

2. Database Schema for a Student Library scenario

Student (Stud_no : integer,Stud_name: string)
Membership (Mem_no: integer,Stud_no: integer)
Book (book_no: integer, book_name:string, author: string)
Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the student names with their membership numbers
d)List all the issues for the current date with student and Book names
e)List the details of students who borrowed book whose author is CJDATE
f)Give a count of how many books have been bought by each student
g)Give a list of books taken by student with stud_no as 5
h)List the book details which are issued as of today
i)Create a view which lists out the iss_no, iss _date, stud_name, book name
j)Create a view which lists the daily issues-date wise for the last one week

Week 4:

3 Database Schema for a Employee-pay scenario

employee (emp_id : integer,emp_name: string)
Department (dept_id: integer,dept_name:string)
Paydetails (emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)
Payroll (emp_id : integer, pay_date: date)

For the above schema, perform the following—

a)Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List the employee details department wise
d)List all the employee names who joined after particular date
e)List the details of employees whose basic salary is between 10,000 and 20,000
f)Give a count of how many employees are working in each department
g)Give a names of the employees whose netsalary>10,000
h)List the details for an employee_id=5
i)Create a view which lists out the emp_name, department, basic, deductions, netsalary
j)Create a view which lists the emp_name and his netsalary

Week 5:

4. Database Schema for a Video Library scenario

Customer (cust_no: integer,cust_name: string)
Membership (Mem_no: integer, cust_no: integer)
Cassette (cass_no:integer, cass_name:string, Language: String)

Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the customer names with their membership numbers
d)List all the issues for the current date with the customer names and cassette names
e)List the details of the customer who has borrowed the cassette whose title is “ The Legend”
f)Give a count of how many cassettes have been borrowed by each customer
g)Give a list of books which has been taken by the student with mem_no as 5
h)List the cassettes issues for today
i)Create a view which lists outs the iss_no, iss_date, cust_name, cass_name
j)Create a view which lists issues-date wise for the last one week

Week 6:

5. Database Schema for a student-Lab scenario

Class (class_no: string,descrip: string)
Student (stud_no: integer, stud_name: string, class_no: string)
Lab (mach_no: integer, Lab_no: integer, description: String)
Allotment (Stud_no: Integer, mach_no: integer, dayof week: string)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the machine allotments with the student names, lab and machine numbers
d)List the total number of lab allotments day wise
e)Give a count of how many machines have been allocated to the ‘CSIT’ class
f)Give a machine allotment etails of the stud_no 5 with his personal and class details
g)Count for how many machines have been allocatedinLab_no1 for the day of the week as “Monday”
h)How many students class wise have allocated machines in the labs
i)Create a view which lists out the stud_no, stud_name, mach_no, lab_no, dayofweek
j)Create a view which lists the machine allotment details for “Thursday”.

Week 7:

6. Write a program to find largest number from the given three numbers.
7. Simple programs using loop, while and for iterative control statement.
8. Write a program to check whether the given number is Armstrong or not
9. Write a program to generate all prime numbers below 100.

Week 8:

10. Write a program to demonstrate the GOTO statement.
11. Write a program to demonstrate %type and %row type attributes

Week 9:

12. Write a program to demonstrate predefined exceptions
13. Write a program to demonstrate user defined exceptions
14. Create a cursor, which displays all employee numbers and names from the EMP table.

Week 10:
15. Create a cursor, which update the salaries of all employees who works in dept no 10.
16. Create a cursor, which displays names of employees having salary > 50000.

Week 11:
17. Create a procedure to find reverse of a given number
18. Create a procedure to update the salaries of all employees whose salary is between 25000 to 50000

Week 12:
19. Create a procedure to demonstrate IN, OUT and INOUT parameters
20. Create a function to check whether given string is palindrome or not.

Week 13:
21. Create a function to find sum of salaries of all employees working in depart number 10.
22. Create a trigger before/after update on employee table for each row/statement.

Week 14:
23. Create a trigger before/after delete on employee table for each row/statement.
24. Create a trigger before/after insert on employee table for each row/statement.

Week 15:
Review

Text Book:
1. Ivan Bayross, SQL, PL/SQLThe programming Language of Oracle, 3rd Revised Edition, BPBPublications, 2008.

FOUR YEARS COURSE STRUCTURE CSE-DS
R20 REGULATIONS

B.TECH CSE-DS I YEAR I SEM (1st semester) **4 T+ 5P**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–1	3	1	0	4.0
2	BSC	Applied Physics	3	1	0	4.0
3	BSC	Applied Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSSMC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming for Problem Solving- I	2	0	0	2.0
9	ESC	Programming for Problem Solving-I Lab	0	0	3	1.5
TOTAL			**11**	**02**	**13**	**19.5**

B.TECH CSE-DS I YEAR II SEM (2nd semester) **5T +3 P**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–II	3	1	0	4.0
2	BSC	Chemistry	3	1	0	4.0
3	BSC	Chemistry Lab	0	0	3	1.5
4	HSSMC	English	2	0	0	2.0
5	HSSMC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming for Problem Solving-II	2	0	0	2.0
7	ESC	Programming for Problem Solving – II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
TOTAL			**11**	**2**	**11**	**18.5**

B.Tech. CSE-Data Science (DS)

B.TECH CSE-DS II YEAR I SEM (3rd semester) **5T +3L+1MC**

Serial No		Category	Course Title	Hours per week			Credits
				L	T	P	
1		ESC	Digital Logic Design	3	0	0	3
2		PCC	Data Structures	3	0	0	3
3		PCC	Python Programming	2	0	0	2
4		BSC	Discrete Mathematics	3	0	0	3
5		BSC	Probability and Statistics	3	0	0	3
6		PCC-Lab	Python Programming Lab	0	0	3	1.5
7		PCC-Lab	Data Structures Lab	0	0	3	1.5
8		PCC-Lab	Linux programming Lab	0	**1**	2	2
9		ESC-Lab	Design Thinking Lab	0	0	2	1
10		MC	Environmental Studies	2	0	0	0
			Total				20

B.TECH CSE-DS II YEAR II SEM (4th semester) **5T+3L+1MC**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	Computer Organization and Architecture	3	0	0	3
2	PCC	Fundamentals of Artificial Intelligence	3	0	0	3
3	PCC	Java Programming	2	1	0	3
4	PCC	Design and Analysis of Algorithms	3	1	0	4
5	PCC	Database Management Systems	3	0	0	3
6	HSSMC-Lab	Soft Skills for Success Lab	0	0	2	1
7	PCC-Lab	JAVA Programming Lab	0	0	3	1.5
8	PCC-Lab	Database Management Systems Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	0	0
Total						20

B.Tech. CSE-Data Science (DS)

B.TECH CSE-DS III YEAR I SEM (5th Semester) **5T+3L +1 MC**

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	ComputerNetworks	3	0	0	3
2	PCC	Operating Systems	3	0	0	3
3	PCC	Machine Learning	3	0	0	3
4	PCC	Web Technologies	3	0	0	3
5	OEC-1	2. English for Professionals 3. Essential English and Employability Skills 4. Intellectual Property Rights 5. Number Theory; 6. 5Entrepreneurship Development	3	0	0	3
6	ESC-Lab	Quantitative Aptitude and reasoning	0	1	2	1.5
7	PCC-Lab	Web Technologies Lab	0	0	4	2
8	PCC-Lab	Operating Systems& Computer Networks Lab	0	0	3	1.5
9	MC	NSS/NSO	0	0	2	0
TOTAL						20

B.TECH CSE-DS III YEAR II SEM (6th Semester) 5 T +3L

Sl. No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	Data Visualization	3	0	0	3
2	PCC	Predictive Analytics using R Programming	3	1	0	4
3	PEC–I	1. Mobile Application development 2. Internet of things 3. Fundamentals of Digital Image Processing 4. Object Oriented Modeling	2	0	0	2
4	PEC–II	1. Software Engineering 2. Language Processors 3. Information Retrieval System 4. Distributed System 5. Formal languages and AuitomataTheory	3	0	0	3
5	PCC	Cloud Computing	3	0	0	3
6	ESC	Verbal ability and Skill integrated Lab	0	0	4	2
7	PEC I - Lab	Data Visualization Lab	0	0	3	1.5
8	PCC-Lab	Predictive Analytics using R Programming Lab	0	0	3	1.5
*** Mini Project /Summer Internship is carried out during summer vacation and evaluated in 7Th sem. TOTAL**						20

B.Tech. CSE-Data Science (DS)

B.TECH CSE-DS IV YEAR I SEM (7th Semester) 5 T +2 L + Mini project

Serial No	Category	Course Title	Hours per week			Credits
			L	T	P	
1	HSSM	Management Science	3	0	0	3
2	PCC	Data Science and Analytics	3	1	0	4
3	PEC-III	1.Information Security 2.Deep Learning 3.Big Data and Analytics 4.Block Chain Technology	3	1	0	4
4	PEC - IV	1. Social Web & Mobile Analytics 2. Natural Language Processing 3. Web Mining 4. Software Testing Methodologies	3	0	0	3
5	PEC-V	1. Cloud Computing 2. Sequence Data Analysis 3. Human Computer Interaction 4. Malware Analysis	3	0	0	3
6	PCC	Data Science and Analytics Lab	0	0	3	1.5
7	PEC-III-Lab	1. Information Security Lab 2. Deep Learning Lab 3. Big Data and Analytics lab 4. Block chain Technology Lab	0	0	3	1.5
8	PROJ	Mini Project / Summer Intern ship	0	0	4	2
Total						22

B.TECH IV YEAR II SEM 2T +3 L/P

Subject Code	Category	Course Title	Hours per week			Credits
			L	T	P	
1	OEC-II	1. Technical and Business Communication Skills 2. Digital media literacy 3. Managerial Economics and Financial Analysis	3	0	0	3
2	OEC-III	1. Negotiation Skills 2. Project Management 3. Value Engineering	3	0	0	3
3	PROJ	Seminar	0	0	4	2
4		Comprehensive Viva-Voce	0	0	0	2
5	PROJ	Project	0	0	20	10
		Total				**20**

Credits Break-up

Sno	CATEGORY	Credit Break up	
		As per AICTE	**As per proposed curriculum**
1	Humanities and Social Sciences including Management courses	12*	**11**
2	Basic Science courses	25*	**25**
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	24*	**21.5**
4	Professional core courses	48*	**59.5**
5	Professional Elective courses relevant to chosen specialization/branch	18*	**18**
6	Open Electives	18*	**09**
7	Project work, seminar and internship in industry or elsewhere	15*	**16**
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	
9	Total credits	**160**	**160**

**Minor variation is allowed as per need of the respective disciplines*

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

SECOND YEAR SYLLABUS – CSE-DS

R20 REGULATIONS

B.TECH II YEAR I SEM

B.Tech. **CSE-DS** II Year **-** I Sem

L	T / P / D	C
3	0	3

DIGITAL LOGIC DESIGN

Pre requisites: None

Course Objectives:

Students will be able to:

1. Understand various number systems addition and subtractions in binary system, error detection and correction codes
2. Minimize boolean functions using boolean laws & k-maps and realize by using logic gates
3. Design various combinational circuits with practical applications
4. Understand the basic sequential circuits : Latches, Flip-Flops and their usage
5. Design synchronous and asynchronous counters

Course Outcomes:

After completion of the course student will be able to:

1. Understand various number systems, floating point representations, complements, error detecting and correcting codes (L2)
2. Apply boolean algebraic principles and k-maps for simplification of boolean functions (L3)
3. Design combinational circuits (L3)
4. Analyze various types of flip flops (L4)
5. Design sequential circuits (L3)

Unit I:

Number Systems: Binary, Octal, Hex Decimal, and Conversions; Binary additions and subtractions (using 1c, and 2c), concept of overflow; Representations of negative numbers using 1’s and 2’s complement and range; BCD numbers: 8421, 2421, Ex-3, Gray and Self

Complementary codes; Error Detecting codes: even & odd parity, hamming codes; Error correcting codes: hamming codes, block parity codes; Floating point representation.

Unit II:

Boolean Algebra and Digital Logic Gates, Basic Boolean laws and properties; Boolean functions,truth tables; Standard forms (SOP, POS) and Canonical forms, Conversion between Canonical and Standard forms ; Gate minimization using three and four variable K-Maps with and without don't cares, Logic Circuit Design using Universal Gates .

Unit III:

Introduction to combinational circuits and applications**,** Design Procedure, Combinational circuit for Half Adder, Full Adder, Half Subtractor and Full Subtractor, Binary Adder, Binary Adder-Subtractor, Decimal Adder, Code Converters, Decoders, Encoders, Multiplexers, Demultiplexers.

Unit IV:

Introduction to Sequential Circuits and its applications, Lathes, Flip flops, Storage Elements, Flip-flops: S-R Flip flop, D Flip Flop, J-K Flip Flop, T Flip flop, master slave J-K flip flop, Analysis of Clocked Sequential Circuits, Flip Flop Conversions

Unit V:

Registers and Counters: Introduction, Registers, Shift Registers, Ripple Counters: Up counter, Up-Down counter, Decade counter, Synchronous Counters: Up Counter, Up-Down counter, Decade Counter, Other Counters: Ring Counter, Johnson Counter

Text Books:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2012
2. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI, 2016

Reference Books:

1. Roth, Fundamentals of Logic Design, 5th Edition, Thomson, 2004.
2. John F. Wakerly, Digital Design, Principles and Practices, 4th Edition, Pearson / Prentice Hall, 2005.
3. Malvino & Leach, Digital Principles and Applications, Seventh Edition, Tata McGraw-Hill Education, 2010.
4. A.K. Maini, Digital Electronics, Principles and Integrated Circuits, 1st Edition, Wiley India Publications, 2007.

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

CSE-DS

B.Tech. CSE-DS II Year - I Sem	L	T / P / D	C
	3	0	3

DATA STRUCTURES

Prerequisites: Any programming language

Course Objectives:

1. Understand various static and dynamic representations of data structures.
2. Understand fundamental algorithmic problems of various nonlinear data structures.
3. To be familiar with Graph representations and traversals.
4. Know the basic concepts of Hashing.

Course Outcomes:

After the completion of the course student will be able to:

1. Examine Static and Dynamic data structures in implementing Stack applications (L4)
2. Apply Tree traversal algorithms in solving real time applications (L3)
3. Analyze the concepts of Advanced Trees to generate search efficiently (L4)
4. Interpret the importance of Graphs in solving real time applications (L5)
5. Examine the concepts of hashing, collision and its resolution methods using hash function (L4)

Unit I :

Introduction: What is data structure, Types of data structures, Static and Dynamic representation of data structure and comparison. **Stacks-** definition, operations, **Applications of** stacks – Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack, Towers of Hanoi, Parenthesis checker.

Unit II :

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees-Inorder Threading. Representation of Trees using Arrays and Linked lists (advantages and disadvantages). Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals,
Heaps: Introduction, types of Heaps – Min binary heap, Max binary heap.

Unit III :

Advanced concepts on trees: Representation and Creation of Binary Search Trees (BST); Algorithm for Inserting, deleting and searching in BST representation and advantages of AVL Trees, algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees; B Tree of Order M, operations- Insertion and Searching, Introduction to Red-Black Trees and Splay Trees.

Unit IV:

Graphs-Basic terminology, Representation of graphs: sequential representation (Adjacency, Path Matrix) Linked representation.

Graph Traversals-Breadth First Search, Depth First Search with algorithms. Spanning Trees-Definition and properties, Minimum Spanning Tree, Dijkstra Algorithms.

Unit V :

Hashing: General Idea, Hash Functions, Collision Resolution- Separate Chaining ,Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Implementation of Dictionaries

Text Books:

1. Seymour Lipschutz, Schaum's Outlines ,Data Structures, Special Second Edition,Tata McGraw-Hill, 2014.
2. Richard F.Gillberg&Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, Second Edition, Cengage Learning, India Edition, 2005.

Reference Books:

1. Aaron M. Tenenbaum,Yedidyah Langsam and Moshe J. Augenstein, Data Structures Using C and C++, PHI Learning Private Limited, Delhi India, 2002.

2. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd Delhi India, 1983.

3. A.K. Sharma , Data Structure Using C, Pearson Education India, Second Edition, 2013.

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)
CSE-DS

B.Tech. CSE-DS II Year - I Sem

L	T / P / D	C
2	0	2

PYTHON PROGRAMMING

Prerequisites: None

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

Course Outcomes:

After completion of the course student will be able to:

1. Apply control structures, functions and packages in Problem Solving. (L3)
2.Analyze various String handling functions and data structures(L4)
3.Model the object-oriented problems with classes and objects (L4)
4.Solve the problems by using Inheritance and polymorphism (L3)
5.Illustrate programs on Exception Handling and various packages(L3)

Unit – I
Introduction to Python:
Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations.
Functions and Modules:
Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Unit – II
Strings and Regular Expressions:
String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.
Sequence: List, Tuples, Dictionaries, Sets.

Unit – III
Introduction to Object Oriented Programming: Features of OOP,Merits and demerits of Object Oriented Programming Languages,Applications of OOP

Implementation of classes and objects in Python:

Classes and Objects, Class Method and Self Argument. The __init__Method, Class Variables and Object Variables, The __del__Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Unit – IV

Implementation of Inheritance in Python:

Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class,

Implementation of Operator Overloading in Python:

Introduction, Implementing Operator Overloading, Overriding Methods

Exception Handling in Python:

Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

UNIT V:

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib :, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages.

Text Book

1.ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017

2.James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Suggested / Reference Books

1.Charles Dierach, Introduction to Computer Science using Python,2013

2. https://www.programiz.com/python-programming

3. https://www.javatpoint.com/python-tutorial

4.. https://www.geeksforgeeks.org/python-programming-language/

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DISCRETE MATHEMATICS

Pre requisites: Mathematics- I and II

Course Objectives:

1.Interpret the Sets, syntax and semantics of propositional and predicate logic.
2. Solve applications involving Permutations and Combinations.
3. Formulate Recurrence relations to solve problems involving an unknown sequence.
4. Explain the concepts of Relations and Graphs.
5. Illustrate the Algebraic Systems.

Course Outcomes:
After completion of course students will be able to

1. Analyze Statement Logic and Predicate Logic.(L4)
2. Apply the principles of Permutations and Combinations with repetition & without repetitions(L3)
3. Solve Recurrence Relations by using generating functions(L3)
4. Apply the knowledge of Relations and Graph Theory in the field of Computer Science.(L3)
5. Analyze the Algebraic Systems with their properties(L4)

UNIT I:
Foundations: Basics, Sets and Operations of Sets, Fundamentals of Logic, Logical Inferences, First order logic and other methods of Proof, Rules of Inference for Quantified Propositions. **(Problems Only and Theorems without Proofs)**

UNIT II:
Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumerating Combinations and Permutations with & without repetitions, constrained repetitions, and Principle of Inclusion and Exclusion. **(Problems Only and Theorems without Proofs)**

UNIT III:

Recurrence Relations: Generating Functions, Calculating coefficient of Generating Function, Solving Recurrence relations by substitution method and Generating Functions, The Method of Characteristic Roots, Solutions to inhomogeneous recurrence relations. **(Problems Only and Theorems without Proofs)**

UNIT IV:

Relations and Digraphs: Relations and Directed Graphs, Special Properties of Binary Relations, Equivalence Relations, Ordering Relations, Lattices, Operations on Relations, Paths and Closures, Directed Graphs and adjacency matrices. **(Problems Only and Theorems without Proofs)**

Graphs: Basic Concepts, Isomorphism's and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs. **(Problems Only and Theorems without Proofs)**

UNIT V:

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. **(Problems Only and Theorems without Proofs)**

Text Books:

1. Joe L. Mott, Abraham Kandel, Theodare P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition, PHI, 2019.
2. J. P.Tremblay and P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2007

Reference Books:

1. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill.
2. S. K. Chakraborthy and B.K. Sarkar," Discrete Mathematics ", Oxford, 2011.
3. C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.

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DATA STRUCTURES LAB

Prerequisites: Any programming language and a parallel course on data structures.

Course Objectives:

1. To design and analyze simple linear and non linear data structures.
2. To design and implement various data structure algorithms
3. To identify and apply the suitable data structure for the given real world problem

Course Outcomes:

Student will be able to:

1. Develop the programs on stacks and its applications.
2. Demonstrate the implementation of various advanced trees.
3. Design and implementation of programs on BST and Graph Traversals.
4. Develop the programs on Hashing and Dictionaries

Week 1:

Review of Stack and Queue Operations using arrays and Linked Lists

Week 2:

Program to convert infix to postfix notation

Program to evaluate postfix notations

Week 3:

Program to implement towers of Hanoi

Program to implement parenthesis checker

Week 4:

Program to illustrate tree traversals
c) In order b) Preorder c) Post order

Week 5:

Program to illustrate insertion, deletion and searching in Binary Search Tree.

Week 6:

Program to implement Heaps

a)Min Heap b) Max Heap

Week 7:

Program to illustrate Insertion on AVL Trees.

Program to illustrate deletion and Rotation on AVL Trees.

Week 8:

Program to implement B-Trees

a) Insertion b) Search c) Display

Week 9:

Program to illustrate Graph traversals

a. Breadth First Search
b. Depth First Search

Week 10:

Program to implement

a) Prims algorithm b) Kruskal's algorithm

Week 11:

Program to Implement Dijkstra algorithm.

Week 12 & 13 :

Program to implement Hashing and collision resolution techniques

Week 14:

Program to implement Dictionaries.

Week 15:

Review

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PYTHON PROGRAMMING LAB

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Language.
3. Know the Data Structures in Python Programming Language.
4. Use the reusability concepts in Python Programming Language.
5. Use Exception Handling mechanism in Python Programming Language.
6. Know the packages in Python Programming Language.

Course Outcomes:

Student Able to

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write the programs on strings and functions
4. Implement programs on class and related issues.
5. Use of python exception handling and packages.

Week-1:

Installation and Environment set up of Python & Programs on Data types

Week-2:

Programs on Standard I/O, Operators and Expressions

Week-3:

Programs on Functions

Week-4

Programs on lists and Tuples

Week-5:

Programs on Dictionaries

Week-6:

Programs on Strings and string operations

Week-7:

Programs on Regular Expressions.

Week-8:

Programs on Inheritance and Polymorphism

Week-9:

Programs on Exception Handling

Week-10:

Demonstration of Numpy Package

Week-11:

Demonstration of Pandas Package

Week-12:

Demonstration of matplotlib Package and Tkinter Package

Week-13:

Demonstration of Date and Time Packages

Week-14: Overview

Week-15: Overview

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LINUX PROGRAMMING LAB

Course Objectives:

1. To gain an understanding of important aspects related to the Linux Commands.
2. To understand directory commands.
3. To provide a comprehensive introduction to SHELL programming.
4. To understand file handling utilities
5. To develop ability to use system calls.

Course Outcomes:
At the end of this course, Students will be able to:
1. Apply the basic commands in Linux Operating System.
2. Create directories and Shell Script programs.
3. Analyze a given problem and apply requisite facets of Shell programming.
4. Demonstrate UNIX commands for file handling mechanisms.
5. Develop a C Program for UNIX Commands.

List of Experiments:

Week-1:
Practice Vi Commands

Week-2:
a) Open the file created in session 1
b) Add some text
c) Change some text
d) Delete some text
e) Save the Changes

Week-3:
a) Create mytable (name of the table) using cat command for the following data.use tab to separate fields.

1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86

b) Use the cat command to display the file, mytable.

c) Use the vi command to correct any errors in the file, mytable.

Week-4:

a)Use the sort command to sort the file mytable according to the first field. Call the sorted file mytable (same name)

b) Print the file mytable

c) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)

d) Print the new file, mytable

e) Logout of the system.

Week-5:

a) Use the appropriate command to determine your login shell

b) Use the /etc/passwd file to verify the result of "step a".

c) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.

d) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

Week-6:

a) Write a sed command that deletes the first character in each line in a file.

b) Write a sed command that deletes the character before the last character in each line in a file.

c) Write a sed command that swaps the first and second words in each line in a file.

Week-7:

a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.

b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.

Week-8:

a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.

b) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.

c) Write a shell script that determines the period for which a specified user is working on the System.

Week-9:

a) Write a shell script to perform the following string operations:

i) To extract a sub-string from a given string.

ii) To find the length of a given string.

b)Write a shell script that accepts a file name starting and ending line numbers as arguments and

displays all the lines between the given line numbers.

c) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

Week-10:

a) Write a shell script that computes the gross salary of a employee according to the following rules:

i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.

ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic

The basic salary is entered interactively through the key board.

b) Write a shell script that accepts two integers as its arguments and compute the value of first number raised to the power of the second number.

Week-11:

a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, then program ask the user for the necessary information, such as the file name, new name and so on.

Week-12:

a) Write shell script that takes a login name as command – line argument and reports when that person logs in

b) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

Week-13:

a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.

b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

Week-14:

Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:

i) File type

ii) Number of links

iii) Read, write and execute permissions

iv) Time of last access

(Note: Use stat/fstat system calls)

Week-15
Overview

Text Books:
1. Unix concepts and applications, Fourth Edition, Sumitabha Das, TMH
2. Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education.

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Computer Organization and Architecture

Pre-requisites: Digital Logic Design

Course Objectives:

1. Understand the instruction format, life cycle and CPU Architecture and Organization
2. Know the basic architecture of Microprocessor
3. Learn various types of memories
4. Learn the concepts for data transfer between CPU & I/O devices.
5. Understand the concepts of Pipeline, Vector and Multiprocessors.

Course Outcomes:

Students will be able to:

1. Describe the basic organization of computer and different instruction formats and addressing modes.(L2)
2. Analyze the concept of pipelining, segment registers and pin diagram of CPU.(L4)
3. Analyze various issues related to memory hierarchy.(L4)
4. Compare various modes of data transfer between CPU and I/O devices.(L4)
5. Design Pipeline for the execution of instructions (L5)
6. Examine various inter connection structures of multi processors. (L4)

Unit-I:

Instruction: Instruction Definition, instruction cycle, flow chart for instruction cycle, instruction storage, types of instruction formats (Zero, one, two and three address). Addressing modes: mode field, implied, immediate register, register direct, register indirect, auto increment, decrement, indexed, relative, base address mode, Numerical examples and problems.

Unit-II:

CPU-Organization: 8086 –CPU –Block diagram and pin diagram, minimum and maximum mode, General purpose registers; segment register and generation of 20 bits address, segmentation of main memory, systems bus, Types of flags.

Unit-III:

Memory Hierarchy, Main memory, memory address map, memory connection to CPU; Auxiliary memory, Magnetic disks, Magnetic tapes; cache memory, hit and miss ratio, direct, associative and set associative mapping; Micro-programmed control: control memory, address sequencing.

Unit-IV:

I/O interface: I/O Bus and Interface modules, I/O versus Memory Bus, isolated vs Memory-mapped I/O. Asynchronous data transfer-strobe control, Hand shaking; Modes of Transfer: Example of programmed I/O, interrupt-initiated I/O. Daisy-Chaining priority. DMA: DMA Controller, DMA Transfer, Intel 8089 IOP.

Unit-V:

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multi-Processor; Interconnection structures: Timeshared common bus, multiport memory, crossbar switch, multi-stage switching network; Introduction to Flynn's classification: SISD, SIMD, MISD, MIMD (Introduction).

Textbooks:

1. M. Morris Mano, Computer System Architecture, Revised Third Edition, Pearson/PHI, 2017.
2. Carl Hamacher, Zvonks Vranesic, Safea Zaky, Computer Organization ,5th Edition, McGraw Hill,2011.
3. Douglas V Hall, Microprocessor and Interfacing, Second Edition, TATA McGraw Hill, 2006.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 6^{th}Edition, Pearson/PHI, 2007.
2. Andrew S. Tanenbaum, Structured Computer Organization, 4th Edition, PHI/Pearson.
3. http://nptel.iitm.ac.in.

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FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Pre-requisite: Programming Knowledge, Computer Organization

Course Objectives:

1. The main objective of this course is to introduce the basic concepts of artificial intelligence, its foundations
2. To analyze various search strategies in intelligent systems
3. To apply search algorithms in games
4. To learn various representations of logic and knowledge
5. To understand production systems and its components

Course Outcomes:

At the end of this course, students will be able to:

1. Understand Strong AI and Weak AI and identify problems applicable to AI
2. Compare and contrast various uninformed and informed search algorithms to find an optimal solution for a given problem
3. Apply appropriate search algorithms for winning games
4. Learn various representations applicable to logic and knowledge useful in reasoning
5. Learn to apply appropriate inference methods in production or expert systems

Unit I: Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versusWeak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, EarlyHistoryofAI, Recent HistoryofAIto thePresent, AIIn the New Millennium

Unit II : Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs,Generate-and-Test Paradigm,Blind Search Algorithms, Implementing and Comparing BlindSearch Algorithms **Informed Search:** Introduction, Heuristics, Informed Search Algorithms–Finding Any Solution, The Best-First Search, The Beam Search,Additional Metrics for SearchAlgorithms,Informed Search–FindingAn OptimalSolution,

Unit III: Search Using Games: Introduction,Game Trees and Minimax Evaluation, MinimaxWith Alpha-Beta Pruning, Variations and Improvements To Minimax, Games of Chance and theExpectiminimaxAlgorithm

UnitIV:LogicinArtificialIntelligence: Introduction,LogicandRepresentation,PropositionalLogic, Predicate Logic – Introduction, Several Other Logics, Uncertainty and

Probability**Knowledge Representation:** Introduction, Graphical Sketches and the Human Window,GraphsandtheBridgesofKönigsbergProblem,SearchTrees,RepresentationalChoices, ProductionSystems,Object Orientation, Frames,SemanticNetworks

Unit V: Production Systems: Introduction, Background, Production Systems and InferenceMethods,Production Systems and Cellular Automata, Stochastic Processes and Markov Chains,BasicFeatures and Examples of Expert Systems

Text Books:

1. StephenLucci,DannyKopec.ArtificialIntelligenceinthe21stCentury.ALivingIntroduction.MercuryLearningandInformation.2ndEdition.2016

Reference Books:

1. Russell,Norvig:ArtificialIntelligence,AModernApproach,PearsonEducation,SecondEdition. 2004
2. Rich,Knight,Nair:ArtificialIntelligence,TataMcGrawHill,ThirdEdition2009
3. SarojKaushik.ArtificialIntelligence.CengageLearning.2011

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JAVA PROGRAMMING

Prerequisites: Object Oriented Programming

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUI applications.

At the end of the course, students will be able to

6. Understand the Object Oriented Programming concepts(L2)
7. Design programs using package and interfaces.(L6)
8. Apply the concepts of Exceptions and multithreading.(L3)
9. Develop GUI applications and AWT using Frames (L6)
10. Design the programs using Applet and JDBC Concepts(L6)

Unit -I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword,garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

Unit- II

Inheritance –Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance

Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, Character Streams.

Unit- III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.

Multi threading: Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

Unit- IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT: class hierarchy, component, container, panel, window, frame, graphics class, Layout Manager – layout manager types – boarder, grid, flow, card and grib bag.

Unit- V

AWT controls: Labels, button, scrollbars, text components, check box, check box groups, choices, menu bar.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

JDBC Connectivity: JDBC Type 1 to 4 Drivers, connection establishment, QueryExecution

Text Books

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGraw Hill, Year of Publication:2017
2. Database Programming with JDBC&JAVA, Second Edition,GeorgeReese, O’ReillyMedia, Year of Publication:2009

Reference Books

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, Bruce Eckel
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education

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DESIGN AND ANALYSIS OF ALGORITHMS

Prerequisites: Data Structures

Course Objectives:
Course Objectives of Design and Analysis of Algorithms are to:

6. Analyze the asymptotic performance of algorithms.
7. Apply the Paradigms and approaches to appreciate the impact of algorithm design in practice.
8. Synthesize efficient algorithms in common engineering design situations.
9. Analyze complex engineering problems using back tracking.
10. Utilize data structures and algorithmic design techniques in solving new problems.

Course Outcomes:
At the end of this Design and Analysis of Algorithms course, students will be able to:

6. Formulate the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm. (L6)
7. Design the major graph algorithms for model engineering problems and knowledge of the greedy paradigm(L6)
8. Apply the dynamic-programming paradigm and recite algorithms that employ this paradigm. (L3)
9. Illustrate the concept of back tracking, branch and bound paradigm for real time problems. (L4)
10. Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples. (L4)

UNIT I :
Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Disjoint Sets- disjoint set operations, union and find operations
Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort.

UNIT II :
Graphs:breadth first search, depth first search, spanning trees, connected and bi connected components.

Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III :

Dynamic Programming: General method, Multi stage graph,applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

UNIT IV :

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - Travelling sales person problem,0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.

UNITV :

Lower Bound Theory: Comparison trees ,NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Clique Decision Problem(CDP), Node cover decision problem.

Text Books:

1. Ellis Horowitz, Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms,Galgotia publications pvt. Ltd, Second Edition, 2007.
2. Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivert and Clifford Stein, Introdution to Algorithms, Third Edition ,PHI Learning Private Limited , Eastern Economy Edition, 2008.

Reference Books:

1. Aho, Ullman and Hopcroft,Design and Analysis of algorithms, Pearson education, Reprint 2002
2. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai,Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill,2005.
3. Allen Weiss,Data structures and Algorithm Analysis in C++,Third edition, Pearson education.

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DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Discuss Database management systems, databases and its applications
2. Familiarize the students with a good formal foundation on the relational model.
3. Outline the various systematic database design approaches
4. Describe the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. Explore the File organizations, indexing and hashing mechanisms.

Course Outcomes:

At the end of this Database Management Systems course, students will be able to:

1. Model Entity-Relationship diagrams for enterprise level databases[L3]
2. Formulate Queries using SQL and Relational Formal Query Languages[L3]
3. Apply different normal forms to design the Database[L3]
4. Summarize concurrency control protocols and recovery algorithms[L5]
5. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of Data[L3]

UNIT I:

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II:

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus.

UNIT III:

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing F^{+}, Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

UNIT IV:

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

UNIT V:

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Text Book:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books:

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eigth Edition Pearson 2006
3. P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

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JAVA PROGRAMMING LAB

Prerequisites: Data structures and a parallel course on java programming

Course Outcomes:

Student will be able to:

1. Explain Java Environment and use of Java Development Kit for the creation and execution of java programs
2. Develop programs on various concepts like data abstraction & data hiding, encapsulation, inheritance, polymorphism.
3. Develop the programs using interfaces and packages
4. Create and use threads and handle exceptions
5. Develop GUI applications using Applet and JDBC programs.

Week 1:-

1) Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object

2) Write a program to implement static and this keyword?

Week 2:-

3) Write a program to illustrate types of constructors and constructor overloading

4) Write a java program to illustrate Method overloading

Week 3:-

5) Write a Java program to practice using String class and its methods.

6) Write a program to illustrate parameter passing Techniques.

Week 4:

7) Write a program to find Minimum and Maximum element using Arrays

8) Write a java program to illustrate Recursion and nested class

Week 5:-

9) Write a program to illustrate types of inheritance.

10) Write a program to illustrate the use of creation of packages.

Week 6:-

11) Write a java program to demonstrate the concept of polymorphism.

12) Write a java program to illustrate Method Overriding and abstract class?

Week 7:-

13) Write a program to illustrate Interfaces

14) Write a program to illustrate Files

Week 8:-

15) Write a program to illustrate try, catch, throw, throws and finally keywords

16) Write a program to implement the concept of User defined Exceptions.

Week 9:-

17) Write a program to illustrate StringTokenizer, Date, Random and Scanner classes?

18) Write a program to illustrate collection classes and interfaces

Week 10:-

19) Write a program to illustrate Multithreading?

20) Write a program to illustrate thread priorities.

Week 11:-

21) Write a program to illustrate Thread Synchronization

22) Write a program to illustrate Inter Thread Communication

Week 12:-

23) Write a program to illustrate applet concept.

24) Write a program to illustrate passing parameters to applet

Week 13:-

25) Write a program to illustrate Event Handling(keyboard,Mouse events)

Week 14:-

26) Write a program to illustrate AWT controls.

27) Write a program to develop a calculator application using AWT

Week 15-16:-

28) Write a program to illustrate JDBC.

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CSE-DS

B.Tech. CSE-DS- II Year II Sem.	L	T / P / D	C
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DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

1. Familiarize the SQL Commands and Integrity Constraints
2. Write the PL/SQL procedures, triggers, functions and cursors

Course Outcomes:

At the end of this Database Management Systems Lab course, students will be able to:

1. Apply different types of SQL commands to create, manipulate and access data from database[L3]
2. Construct database by using various integrity constraints[L3]
3. Develop basic PL/SQL programs[L3]
4. Implement PL/SQL Programs using procedures, functions and cursors[L3]
5. Create trigger for given problem[L3]

List of Experiments:

Week 1:
Database user creation, Data definition Language commands, Data Manipulation commands, Data Control Language Commands, Transaction Control Language commands.

Week 2:
1. Database Schema for a customer-sale scenario

Customer (<u>Cust id: integer</u>, cust_name: string)
Item (<u>item_id: integer</u>,item_name: string, price: integer)
Sale (<u>bill_no: integer</u>, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the bills for the current date with the customer names and item numbers
d)List the total Bill details with the quantity sold, price of the item and the final amount
e)List the details of the customer who have bought a product which has a price>200
f)Give a count of how many products have been bought by each customer

g)Give a list of products bought by a customer having cust_id as 5
h)List the item details which are sold as of today
i)Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

Create a view which lists the daily sales date wise for the last one week

Week 3:

2. Database Schema for a Student Library scenario

Student (Stud_no : integer,Stud_name: string)
Membership (Mem_no: integer,Stud_no: integer)
Book (book_no: integer, book_name:string, author: string)
Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the student names with their membership numbers
d)List all the issues for the current date with student and Book names
e)List the details of students who borrowed book whose author is CJDATE
f)Give a count of how many books have been bought by each student
g)Give a list of books taken by student with stud_no as 5
h)List the book details which are issued as of today
i)Create a view which lists out the iss_no, iss _date, stud_name, book name
j)Create a view which lists the daily issues-date wise for the last one week

Week 4:

3 Database Schema for a Employee-pay scenario

employee (emp_id : integer,emp_name: string)
Department (dept_id: integer,dept_name:string)
Paydetails (emp_id : integer,dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)
Payroll (emp_id : integer, pay_date: date)

For the above schema, perform the following—

a)Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List the employee details department wise
d)List all the employee names who joined after particular date
e)List the details of employees whose basic salary is between 10,000 and 20,000
f)Give a count of how many employees are working in each department
g)Give a names of the employees whose netsalary>10,000
h)List the details for an employee_id=5
i)Create a view which lists out the emp_name, department, basic, deductions, netsalary
j)Create a view which lists the emp_name and his netsalary

Week 5:

4. Database Schema for a Video Library scenario

Customer (cust_no: integer,cust_name: string)

Membership (Mem_no: integer, cust_no: integer)
Cassette (cass_no:integer, cass_name:string, Language: String)
Iss_rec(iss_no: integer, iss_date: date, mem_no: integer, cass_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the customer names with their membership numbers
d)List all the issues for the current date with the customer names and cassette names
e)List the details of the customer who has borrowed the cassette whose title is " The Legend"
f)Give a count of how many cassettes have been borrowed by each customer
g)Give a list of books which has been taken by the student with mem_no as 5
h)List the cassettes issues for today
i)Create a view which lists outs the iss_no, iss_date, cust_name, cass_name
j)Create a view which lists issues-date wise for the last one week

Week 6:

5. Database Schema for a student-Lab scenario

Class (class_no: string,descrip: string)
Student (stud_no: integer, stud_name: string, class_no: string)
Lab (mach_no: integer, Lab_no: integer, description: String)
Allotment (Stud_no: Integer, mach_no: integer, dayof week: string)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b)Insert around 10 records in each of the tables
c)List all the machine allotments with the student names, lab and machine numbers
d)List the total number of lab allotments day wise
e)Give a count of how many machines have been allocated to the 'CSIT' class
f)Give a machine allotment etails of the stud_no 5 with his personal and class details
g)Count for how many machines have been allocatedinLab_no1 for the day of the week as "Monday"
h)How many students class wise have allocated machines in the labs
i)Create a view which lists out the stud_no, stud_name, mach_no, lab_no, dayofweek
j)Create a view which lists the machine allotment details for "Thursday".

Week 7:

6. Write a program to find largest number from the given three numbers.
7. Simple programs using loop, while and for iterative control statement.
8. Write a program to check whether the given number is Armstrong or not
9. Write a program to generate all prime numbers below 100.

Week 8:

10. Write a program to demonstrate the GOTO statement.
11. Write a program to demonstrate %type and %row type attributes

Week 9:

12. Write a program to demonstrate predefined exceptions

13. Write a program to demonstrate user defined exceptions
14. Create a cursor, which displays all employee numbers and names from the EMP table.

Week 10:
15. Create a cursor, which update the salaries of all employees who works in dept no 10.
16. Create a cursor, which displays names of employees having salary > 50000.

Week 11:
17. Create a procedure to find reverse of a given number
18. Create a procedure to update the salaries of all employees whose salary is between 25000 to 50000

Week 12:
19. Create a procedure to demonstrate IN, OUT and INOUT parameters
20. Create a function to check whether given string is palindrome or not.

Week 13:
21. Create a function to find sum of salaries of all employees working in depart number 10.
22. Create a trigger before/after update on employee table for each row/statement.

Week 14:
23. Create a trigger before/after delete on employee table for each row/statement.
24. Create a trigger before/after insert on employee table for each row/statement.

Week 15:
Review

Text Book:
1. Ivan Bayross, SQL, PL/SQLThe programming Language of Oracle, 3rd Revised Edition, BPBPublications, 2008.

COURSE STRUCTURE of M.Tech (CSE)

R20 REGULATIONS

M.TECH (CSE) I YEAR I SEM (1st Semester) 6T+ 2L+1 Audit Course

S No	Category	Course title	L	T	P	Credits
1	PCC-I	Advanced Data structures	3	0	0	3
2	PCC-II	Python Programming	3	0	0	3
3	PEC-I	1.Information Security 2. Artificial Intelligence 3. Computer Networks 4. Digital Image Processing	3	1	0	4
4	PEC-II	1Web Technologies 2.Data Mining 3.Operating Systems 4. Cloud Computing	3	0	0	3
5	PEC-III	1.Cyber Security 2. Software Engineering 3.Object Oriented Programming (Java) 4.Machine Learning	3	0	0	3
6		Research Methodology	2	0	0	2
7	PCC I-Lab	Advanced Data structures Lab	0	0	3	1.5
8	PCC-II-Lab	Python Programming Lab	0	0	3	1.5
9		Audit Course 1	2	0	0	0
		Total	**19**	**0**	**8**	**21**

M.Tech (CSE) I YEAR II SEM (2nd Semester)5T+ 1L+ 1 seminar

S No	category	Course title	L	T	P	credits
1	PCC-III	Big Data Analytics	3	1	0	4
2	PCC-IV	Data science	3	1	0	4
3	PEC-IV	1.Block Chain Technology 2. Advanced Database Management Systems 3. Principles of Internet of Things 4. Deep Learning	3	0	0	3
4	PEC-V	1. Natural Language Processing 2. Predictive Analytics with R 3. Mobile Applications & Development 4. Human Computer Interaction	3	0	0	3
5	OE-1	OPEN ELECTIVE-1	3	0	0	3
6	PCC Lab	Data Science Lab	0	0	4	2
7	Seminar	Seminar-I	0	0	4	2

		Total	**15**	**2**	**8**	**21**

M.Tech (CSE) II YEAR I SEM(3rd Semester)Project Phase I

Sno	category	Course title	L	T	P	Credits
1		Project Review I	0	0	24	12
		Total	**0**	**0**	**20**	**12**

M.Tech (CSE) II YEAR II SEM (4th Semester) Project Phase II

Sno	category	Course title	L	T	P	Credits
1		Project Review II	0	0	28	14
		Total	**0**	**0**	**28**	**14**

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ADVANCED DATA STRUCTURES

(PCC)

Prerequisites: Data Structures and Java Programming.

Course Objectives:

1. Understand various static and dynamic representations of data structures.
2. Know the basic concepts of Hashing.
3. To introduce various techniques for representation of the data in the real world.
4. To be familiar with Graph representations and traversals.
5. Compute the complexity of various algorithms

Course Outcomes:

1. Design and implement the mechanism of stacks, general tree data structures with their applications.
2. Outline the concepts of hashing, collision and its resolution methods using hash Function.
3. Implement various algorithms on graph data structures.
4. Implementation of various advance concepts of binary trees with real time applications.
5. Determine and analyse the complexity of given Algorithms

UNIT I:

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Data structures-Linear and non-linear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays.

UNIT II:

Stack and Queue ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, array and linked list representations , implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap, java.util package-ArrayList, LinkedList, Vector classes, Stacks and Queues in java.util, Iterators in java.util.

UNIT III:

Searching–Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util-HashMap, HashSet, Hashtable.

Sorting –Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

UNIT IV:

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non recursive traversals, Java code for traversals, threaded binary trees.

Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-DFS and BFS, Java code for graph traversals, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

UNIT V:

Search trees- Binary search tree-Binary search tree ADT ,insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees – Definition and examples only, B-Trees-definition, insertion and searching operations, Trees in java.util-TreeSet, TreeMap Classes, Tries(examples only), Pattern matching-KMP algorithm.

TEXT BOOKS:

1.Data structures, Algorithms and Applications in Java, S.Sahni, Universities Press.

2.Data structures and Algorithms in Java, Adam Drozdek, 3rd edition, Cengage learning.

3 Data structures and Algorithm Analysis in Java, M. A. Weiss, 2nd edition, Addison-Wesley (Pearson Education).

REFERENCE BOOKS:

1.Java for Programmers, Deitel and Deitel, Pearson education.

2Data structures and Algorithms in Java, R.Lafore, Pearson education.

3java: The Complete Reference, 8th edition, Herbert Schildt, TMH.

4Data structures and Algorithms in Java, M. T. Goodrich, R. Tomassia, 3rd edition, Wiley India Edition

5.Data structures and the Java Collection Frame work, W. J. Collins, Mc Graw Hill.

6.Classic Data structures in Java, T.Budd, Addison-Wesley (Pearson Education).

7. www.tutorialspoint.com/Data Structures Algorithms

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PYTHON PROGRAMMING

(PCC)

Course Objectives

1. Use Python interactively, execute a Python script at the shell prompt, use Python types,
   expressions, and None,use string literals and string type, use Python statements (if...elif..else, for, pass, continue, . . .)
2. understand the difference between expressions and Statements.
3. utilize high-level data types such as lists and dictionaries, understand the difference between mutable and immutable types.
4. write a simple class and access methods and attributes,
5. import and utilize a module, read from and write to a text file.

Course Outcomes

1. Build programs using primitive data types and user defined functions.
2. Write applications that include string builtin functions, modules, packages along with respective exceptional handling mechanism.
3. Writes applications using OO features of Python
4. Develops web-based applications to deal with data communication between client and server modules and also process data that is stored in possible databases.
5. Hands on exposure on SciPy/Tkinter/ Plotpy modules

Unit -I:

Introduction to Python: History, Features, setting up path, Working with Python Basic Syntax

Variable and Data Types, Operator. Conditional Statements (If, If- else, Nested if-else) Looping (for, While Nested loops) Control Statements (Break, Continue, Pass)

Functions: Defining a function, Calling a function, Types of functions, Function Arguments

Anonymous functions, Global and local variables

Unit-II:

String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods
Lists: Accessing list, Operations, Working with lists Function and Methods
Tuple: Accessing tuples, Operations, Working.
Dictionaries: Accessing values in dictionaries, Working with dictionaries, Properties Functions and Methods.

Unit-III:

Modules: Importing module, Math module, Random module, Packages, Composition
Input-Output: Printing on screen, reading data from keyboard, Opening and closing file
Regular expressions: Match function, Search function, Matching VS Searching, Modifiers Patterns.

Unit-IV:

Advance Python- OOPs concept: Class and object, Attributes, Inheritance, Overloading Overriding, Data hiding
Exception Handling: Exception, Exception Handling, Except clause, Try, finally clause User Defined Exceptions

Unit -V:

CGI : Introduction , Architecture ,CGI environment variable, GET and POST methods Cookies, File upload.
Python for Database: Introduction, Connections, Executing queries, Transactions Handling error Working with NumPy/ PlotPy/ SciPy/GUI Programming, Introduction, Tkinter programming, Tkinter widgets

Text books:

1.Think Python: How to Think Like a Computer Scientist Allen B. Downey, O'Relly publications.
2. Learning with Python by Jeffrey Elkner, Chris Meyers Allen Downey , Dreamtech Press.

Reference books:

1.Introduction to Computation and Programming using Python, Revised and Expanded Edition,John V. Guttag, The MIT Press.
2. Programming Python,Fourth Edition by Mark Lutz, O'Relly
3. Python Programming using problem solving approach, Reema Thareja, Oxford Higher Education.

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INFORMATION SECURITY

(PEC-I)

Course Objectives:

1. Describe the encryption and decryption Algorithms
2. Illustrate basics of application of cryptography which are one of the key technologies to implement security functions.
3. Describe the importance of security in the real world through Applications
4. Interpret various types of Intruders and Viruses.
5. Explore Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.

Course Outcomes:

1. Demonstrate information security, in both management aspect and technical aspect.
2. Design symmetric and asymmetric cryptography applications.
3. Describe the importance of security in the real world through Applications
4. Illustrate various types of Intruders and Viruses
5. Understand of various types of security incidents and attacks, and learn methods to prevent, detect and react incidents and attacks..

UNIT I:

Information Security: Introduction, History of Information security, What is Security, CNSS Security Model, Components of Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Security Systems Development Life Cycle.

UNIT II :

Cryptography: Concepts and Techniques, symmetric and asymmetric key cryptography, steganography, Symmetric key Ciphers: DES structure, DES Analysis, Security of DES, variants of DES, Block cipher modes of operation , AES structure, Analysis of AES , Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange.

UNIT III:

Message Authentication and Hash Functions: Authentication requirements and functions, MAC and Hash Functions, MAC Algorithms: Secure Hash Algorithm, Whirlpool, HMAC, Digital signatures, X.509, Kerberos.

UNIT IV:

Security at layers (Network, Transport, Application): IPSec, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Electronic Transaction(SET), Pretty Good Privacy(PGP), S/MIME.

UNIT V:

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

Text Books:

1. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, 4th Edition, Cengage Learning.
2. William Stallings, Cryptography and Network Security, 7th Edition, 2017 Pearson Education.

Reference Books:

1. C K Shyamala, N Harini, Dr T R Padmanabhan, Cryptography and Network Security, 1st Edition, Wiley India,
2. Bernard Menezes, Network Security and Cryptography: Cengage Learning
3. AtulKahate, Cryptography and Network Security, 2nd Edition, McGraw Hill.

Reference Links:

1. http://www.cs.iit.edu/~cs549/cs549s07/lectures.htm
2. http://williamstallings.com/Extras/Security-Notes/
3. http://williamstallings.com/NetworkSecurity/styled/

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ARTIFICIAL INTELLIGENCE

(PEC-I)

Pre-requisite: Programming Knowledge, Computer Organization

Course Objectives:

1. The main objective of this course is to introduce the basic concepts of artificial intelligence, its foundations
2. To analyze various search strategies in intelligent systems
3. To apply search algorithms in games
4. To learn various representations of logic and knowledge
5. To understand production systems and its components

Course Outcomes:

At the end of this course, students will be able to:

1. Understand Strong AI and Weak AI and identify problems applicable to AI
2. Compare and contrast various uninformed and informed search algorithms to find an optimal solution for a given problem
3. Apply appropriate search algorithms for winning games
4. Learn various representations applicable to logic and knowledge useful in reasoning
5. Learn to apply appropriate inference methods in production or expert systems

Unit I: Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versusWeak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, EarlyHistoryofAI, Recent HistoryofAIto thePresent, AIIn the New Millennium

Unit II : Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs,Generate-and-Test Paradigm,Blind Search Algorithms, Implementing and Comparing BlindSearch Algorithms **Informed Search:** Introduction, Heuristics, Informed Search Algorithms–Finding Any Solution, The Best-First Search, The Beam Search,Additional Metrics for SearchAlgorithms,Informed Search–FindingAn OptimalSolution,

Unit III: Search Using Games: Introduction,Game Trees and Minimax Evaluation, MinimaxWith Alpha-Beta Pruning, Variations and Improvements To Minimax, Games of Chance and theExpectiminimaxAlgorithm

UnitIV:LogicinArtificialIntelligence: Introduction,LogicandRepresentation,PropositionalLogic, Predicate Logic – Introduction, Several Other Logics, Uncertainty and Probability**Knowledge Representation:** Introduction, Graphical Sketches and the Human Window,GraphsandtheBridgesofKönigsbergProblem,SearchTrees,RepresentationalChoices, ProductionSystems,Object Orientation, Frames,SemanticNetworks

Unit V: Production Systems: Introduction, Background, Production Systems and InferenceMethods,Production Systems and Cellular Automata, Stochastic Processes and Markov Chains,BasicFeatures and Examples of Expert Systems

Text Books:

1. StephenLucci,DannyKopec.ArtificialIntelligenceinthe21st Century.ALivingIntroduction. MercuryLearningandInformation.2nd Edition.2016

Reference Books:

1. Russell,Norvig:ArtificialIntelligence,AModernApproach,PearsonEducation,SecondEdition. 2004
2. Rich,Knight,Nair:ArtificialIntelligence,TataMcGrawHill,ThirdEdition2009
3. SarojKaushik.ArtificialIntelligence.CengageLearning.2011

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COMPUTER NETWORKS

(PEC-I)

Prerequisites: C Programming Language and Data Structures.

Course Objectives:

1.Elaborate on the fundamental concepts of computer networks and network models.

2.Know about the error and flow control mechanisms in the data link layer.

3.Explore the knowledge of various routing algorithms.

4.Describe the transport layer functionalities.

5.Illustrate different application layer functionalities.

Course Outcomes:

1. Illustrate the functionalities of various network models and Data link Layer.
2. Analyze error and flow control mechanisms in the data link layer
3. Examine various Routing Protocols.
4. Compare various congestion control mechanisms to improve the QoS of networking.
5. Identify the suitable Application layer protocols for specific applications.

UNIT - I:

Network Models: Layered Tasks, OSI model, Layers in the OSI model, TCP/IP protocol Suite, Addressing.

Data Link Control: Error detection and Correction- Introduction, Hamming Distance, CRC, Checksum.

UNIT - II:

Data Link Layer: Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC.

Multiple Access: Random Access, Controlled Access, Channelization.

UNIT- III:

Network Layer: IPV4, IPV6, Transition from IPv4 to IPv6,Delivery, Forwarding and Routing, **Routing protocols:** Distance Vector Routing, Link State Routing, Path Vector Routing

UNIT- IV:

Transport Layer: Process-to-Process delivery, TCP, UDP, Congestion Control, Quality of Service, Techniques to improve QoS.

UNIT-V:

Application Layer: Domain Name Space, Distribution of Name Space, DNS in Internet, Resolution, Domain Name Space (DNS) Messages, Electronic mail, File Transfer Protocol.

Text Books:

1) Behrouz A Forouzan ,Data Communications and Networking,4th Edition, McGraw-Hill.

Reference Books:

1) Andrew S. Tanenbaum, Computer Networks, Third Edition.

2) William Stallings, Data Communications, Eight Edition. Pearson Publishers.

3) http://highered.mheducation.com/sites/0072967757/student_view0/index.html

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DIGITAL IMAGE PROCESSING

(PEC-I)

Prerequisites: Mathematics

Course Objectives:

1. Comprehend fundamental aspects of digital image processing
2. Understand the image noise models and enhancement methods
3. Evaluate the image segmentation methodologies
4. Understand the colour image processing techniques
5. Understand image morphological operations

Course Outcomes:

At the end of the course the students will be able to:

1. Understand the fundamental concepts of digital image processing system.
2. Analyze the image noise models and enhancement techniques.
3. Comprehend the different image segmentation and restoration methodologies.
4. Analyze the concepts of colour image processing.
5. Apply morphological operations on binary images.

UNIT-I:

Introduction: Definition, Pixel, Digital image representation, Types of images, Fundamental steps in image processing, image processing applications. Digital image processing operations – Basic relationships and distance metrics, Classification of image processing operations- Arithmetic operations, Logical operations.

UNIT – II:

Image Enhancement and Restoration – Image quality and Need for image enhancement, image enhancement point operations, Histogram based techniques.

Categories of Image Degradations- Image Restoration in the presence of noise only- Mean filters, order statistics filters.

UNIT-III:

Image Segmentation: Introduction, classification of image segmentation algorithms, detection of discontinuities, edge detection- stages in edge detection, types of edge detectors, First-order edge detection operators, second-order derivatives filters, edge operator performance, edge linking algorithms, principle of thresholding.

UNIT –IV:

Colour image processing: introduction, devices of colour imaging, colour image storage and processing, colour models-RGB Colour Model, HSI Colour Models, HSV Colour Model, Colour Quantization, Image filters for colour images.

UNIT –V:

Image Morphology: Need for morphological processing Morphological operators: Erosion, Dilation, Opening & Closing, Hit-or-Miss transform, Basic morphological algorithms, Gray-scale morphology

Text Books

1. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd edition 2016.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2nd Edition, 2015.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
4. Gonzalez R.C., Woods R.E, Digital image processing, Pearson, Prentice-Hall of India Pvt.Ltd. New Delhi, 3rd Edition, 2018
5. Jan Erik Solem, Programming Computer Vision with Python, O'Reilly ,1st Edition, 2012

References

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, 4th Edition, Cengage Learning, 2013
2. Fundamentals of Digital Image Processing, by Anil K. Jain, Prentice- Hall of India Pvt. Ltd, New Delhi, 2002
3. Prince, Simon JD. Computer Vision: Models, Learning and Inference, Cambridge University Press, 1st Edition, 2012.

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WEB TECHNOLOGIES

(PEC-II)

Pre-requisites: Basics of Object Oriented programming, Java

Course Objectives:

1. To provide knowledge on web architecture, web services.
2. Client side scripting technologies to focus on the development of web-based information systems and web services.
3. To provide skills to design interactive and dynamic web sites.
4. To provide knowledge for implementing web applications with database connection

Course Outcomes:

Studentwill be able to:

1. Design static web pages and provide client side authentication.(L6)
2. Prepare Static Web pages With Validations.(L6)
3. Develop new tag sets using XML mechanism.(L5)
4. Design and develop web applications using JSP and MVC architecture.(L6)
5. Understand database connectivity and retrieving data using client/server database.(L2)

Unit I:

INTRODUCTION TO WEB: Understanding Internet and Web, Web Architecture, Web servers, protocols: HTTP, Introduction HTML: History of HTML, WWW, HTML Basics: Elements, Attributes, Tags, Tables, Forms, Frames.div and span tags.HTML5

Unit II:

CSS: Introduction to cascading style sheet, Types of style sheets, page layout, selectors, pseudo classes and elements.CSS3

JAVA SCRIPT: Introduction to scripting, control structures, conditional statements, Arrays functions, objects.JS framework(ReactJS)

HTML DOM: Predefined object (Window, Location, History, Navigator). Events, DOM Node methods, Navigation, creating nodes, adding nodes, inserting nodes, removing &

Replaces Nodes, Form object and Elements, DHTML with Java Script. front end frameworks(bootstrap),

Unit III:

XML: Basics of XML, Elements, Attributes, validation, Name space.

XML Scheme Languages: Introduction to DTD, internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, Elements, parsing XML: XML DOM, Document node, element node, Text node, Java and DOM, Navigating DOM Tree.

Unit IV:

AJAX: Introduction, Environment, Asynchronous communication, process steps, sending and Retrieving Information, Ajax with XML.

Servlets : Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications, Session Tracking: Hidden form fields, cookies, URL- Rewriting, session.

Unit V:

JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects, using Action elements.

JDBC: Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture.

Text Book:

1. Uttam K. Roy, Web Technologies, 8^{th} Impression, Oxford Publication, 2014.

Reference Books:

1. Thomas Powell, “The Complete Reference HTML and CSS”, 5th Edition, Tata McGraw Hill, 2010.
2. Thomas Powell, Fritz Schneider, “The Complete Reference JavaScript 2.0”, 3rd Edition, Tata McGraw Hill, 2012.

M.Tech(CSE)

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DATA MINING

(PEC-II)

Prerequisites: Basic Statistics Knowledge, Data Structures & Algorithms and Database management system

Course Objectives:

1. To gain a foundational understanding of data mining and preprocessing techniques.
2. To understand the frequent patterns and association mining.
3. To understand and use of basic classification and prediction algorithms for real world problems.
4. To understand and use of clustering algorithms for real world problems.
5. To consistently apply knowledge concerning current data mining research and how this may contribute to the effective design and implementation of data mining applications.

Course Outcomes:

At the end of the course the students will be able to:

1. Describe what Data Mining is and apply preprocessing techniques in different datasets.
2. Apply Association and classification knowledge to different data sets
3. Apply basic classification & predictive algorithms in real world problems
4. Apply the clustering Techniques for different data sets
5. Explore recent trends in data mining such as web mining, spatial-temporal mining

UNIT I:

Introduction to Data Mining: Fundamentals of data mining, Data Mining Functionalities, Data Mining Task Primitives, Major issues in Data Mining. **Data Preprocessing**: Needs for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT II:

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT III:

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Support Vector Machines, kNN. **Prediction:** Regressions, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods—Increasing the Accuracy, Model Selection.

UNIT IV:

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods-K-means, PAM, Hierarchical Methods-BIRCH, Density-Based Methods-DBSCAN, Outlier Detection.

UNIT V:

Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Data Mining System Products and Research Prototypes, Trends in Data Mining (web mining, spatial-temporal mining).

Text Book:

1.Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier, 2007.

Reference Books:

1. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw Hill, Tenth Reprint, 2007.
2. Arun K. Pujari, Data Mining Techniques,2nd Edition, Universities press.

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OPERATING SYSTEMS

(PEC-II)

Prerequisites : Computer Organization, Data Structures

Course Objectives:

1. Introduce basic concepts of operating system and process management
2. Discuss various CPU scheduling algorithms and problems of process synchronization.
3. Demonstrate different methods for handling deadlock.
4. Describe about memory management Techniques.
5. Explore the File system, system security and protection mechanisms.

Course Outcomes:

At the end of the course, students will be able to:

1. Summarize operating system and process management concepts.
2. Apply process scheduling and synchronization related issues.
3. Outline Deadlock Prevention, Avoidance, Detection and recovery mechanisms.
4. Analyze effectively memory management concepts.
5. Illustrate various protection and security measures.

UNIT I:

Operating Systems Overview and Process Management: Introduction-What operating

system do, uni-programmed and multi programmed, Operating system operations, Operating system services, System calls, Types of System calls, Operating

system structure.

Process Management: Process concepts, Operations on processes, Inter process communication. Threads: overview, Multithreading models

UNIT II:

Process Scheduling and Synchronization:

Process Scheduling – Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling.

Process Synchronization: Background, The critical section problem, Peterson's solution, Synchronization hardware, Semaphore, Classical problems of synchronization, Monitors.

UNIT III:

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks,

Deadlock prevention, Detection and avoidance, Recovery from deadlock.

UNIT IV:

Memory Management: Swapping, Contiguous memory allocation, Paging, Segmentation.

Virtual memory management - Demand paging, copy-on-write, page-replacement, Thrashing.

UNIT V:

File system, system protection and security: Storage management – File concept, Accessmethods, Directory and disk structure, File-system mounting. System protection-Goals ofprotection, principles of protection, Domain of protection, Access matrix.

System Security – Security problem, Program threats, System and Network threats.

Text Book:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts,
9th edition, John Wiley, 2016.

Reference Books:

1. D.M. Dharmdhere, Operating Systems – A Concept based Approach, 2nd Edition. TMH, 2007.

2. Andrew S Tanenbaum, Modern Operating Systems, 3rd Edition, PHI, 2008.

3. Behrouz A. Forouzan, Richard F. Gilberg, Unix and shell programming, cengage Learning 2009.

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CLOUD COMPUTING

(PEC-II)

Prerequisites: Computer organization and computer networks.

Course Objectives:

1. To understand the concepts of virtualization and its benefits
2. To impart fundamental concepts in the area of cloud computing.
3. To impart knowledge in applications of cloud computing.
4. To understand various services in cloud applications
5. To know the architecture of disaster recovery and security of cloud

Course Outcomes:

At the end of the course the students will be able to:

1. Compare and contrast various cloud architectures. (L4)
2. Learn & Implement Virtualization .(L3)
3. Analyze and design storage mechanisms. (L4)
4. Apply security mechanism for the Cloud. (L3)
5. Discuss Disaster recovery in Cloud .(L5)

Unit I:

Introduction to Virtualization: Objectives of virtualization, history of virtualization, benefits of virtualized technology, the virtual service desk, what can be virtualized, related forms of computing, cloud computing, software as a service – SaaS, grid computing, utility computing, virtualization processes.

Virtualization Technologies-I: Ubuntu (server edition),Altiris, Windows server, Software virtualization, VMware, Intel virtualization, Red Hat virtualization, Soft grid application, Linux virtualization, Desktop virtualization, Hardware virtualization, Resource virtualization, Processor virtualization, Application virtualization.

Unit II:

Virtualization Technologies-II: Storage virtualization, Virtualization density, Para-virtualization, OS virtualization, Virtualization software, Data Storage virtualization, Intel virtualization technology, Thinstall virtualization suite, Net framework virtualization, Windows virtualization on Fedora, Storage virtualization technologies, Virtualization level, Security monitoring and virtualization, Oracle virtualization.

Unit III:

Virtualization and Storage Management: The heart of cloud computing-virtualization, defining virtualization, why virtualize, what can be virtualized, where does virtualization happen, how does virtualization happen, on the road to storage virtualization, improving availability using virtualization, improving performance through virtualization, improving capacity through virtualization, business value for virtualization.

Unit IV:

Introduction to Cloud Computing: Cloud Introduction and overview- Components, Infrastructure and Services, Why Use Cloud Computing, Benefits and Limitations, Cloud Application Architectures, Cloud Infrastructure Models, Cloud Computing Technology-Hardware & Software Infrastructure

Cloud Computing Architecture: Requirements, Introduction to Cloud Computing Architecture, various kinds of Cloud Computing Architecture, Grid Computing, Transactional Computing, On Demand Computing, and Distributed Computing.

Unit V:

Security: Security issues in Cloud Computing - Data Security, Network Security, and Host Security

Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

Scaling a Cloud Infrastructure- Capacity Planning, Cloud Scale.

Case Studies: Amazon S3, Google APP Engine, IBM Clouds, Oracle OBIEE

Text Books:

1. Ivanka Menken, Gerard Blokdijk ,Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book, 2009.
2. George Reese, Cloud Application Architectures Building Applications and Infrastructure in the Cloud, O'Reilly Media Press, 2009.

Reference Books:

1. Anthony T. Velte, Tobe J. Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Publication Person Education, 2009
2. Tom Clark, Storage Virtualization: Technologies for Simplifying Data Storage and Management, Addison-Wesley, 2005
3. Curtis Brian J.S. Chee, Cloud Computing Technologies and Strategies of the Ubiquitous Datacenter, 2010

Web Resource:https://bibliotech2803.files.wordpress.com/2018/04/cloud-application-architectures-oreilly-media.pdf

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CYBER SECURITY

(PEC-III)

Course Objectives:

1. Analyze the importance of cyber Security and discuss major issues concerning cyber security

2. Identify different cyber security vulnerabilities

3. Apply tools for cyber security safeguard

4. Interpret various malwares and implement different tools

5. Discuss the importance of cyber forensics.

Course Outcomes:

At the end of the course the students will be able to:

1. Analyze the role of cyber security and its challenges
2. Summarize various security vulnerabilities in Internet
3. Identify different tools to safeguard the network
4. Discuss various malwares and tools to analyze them
5. Interpret the role of cyber forensics in cyber secuirty

UNIT I

Foundations of Cyber Security Concepts: Essential Terminologies, CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning).Open Source/ Free/ Trial Tools: nmap, zenmap, PortScanners, Network scanners.

UNIT II

Cyber Security Vulnerabilities: Internet Security, Cloud Computing &Security, Social Network sites security, Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness.

UNIT III

Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment.Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit .

UNIT IV

Malware Analysis: Types of Malware: Virus, Worms, Trojans, Rootkits, Robots, Adware's,Spywares, Ransom wares, Zombies etc., OS Hardening (Process Management, Memory Management,Task Management, Windows Registry/ services another configuration), Malware Analysis. Open Source/ Free/ Trial Tools: Antivirus Protection, Anti Spywares, System tuning tools, Anti Phishing.

UNIT V

Introduction to Cyber Forensics, Need of Cyber Forensics, Cyber Evidence, Documentation and Management of Crime Sense, Image Capturing and its importance, Partial Volume Image, Web Attack

Investigations, Denial of Service Investigations, Internet Crime Investigations, Internet Forensics, Steps for Investigating Internet Crime, Email Crime Investigations.

Text Books:

1. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.

2. Atul Kahate, "Cryptography and Network Security", McGraw Hill.

Reference Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.

2. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.

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SOFTWARE ENGINEERING
(PEC-III)

Prerequisites: Any Programming Language

Course objectives:

1. Understand the framework activities for a given project.
2. Choose a process model for given project requirements.
3. Design various system models for a given scenario.
4. Design various testing techniques.
5. Understand metrics for Products.

Course Outcomes:

At the end of the course the students will be able to:

1. Outline the framework activities for a given project.
2. Apply Right process model for a given project.
3. Design various system models for a given Context.
4. Apply various testing techniques for a given project.
5. Identify various risks in project development.

UNIT I:

Introduction To Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI),

Process models: The waterfall model, Incremental process models, Evolutionary process model.

[TB-1,Ch-1,2,3]

UNIT II:

Agile Process Model: Agile principles, Extreme programming, Dynamic System Development Methods, Feature Driven Development, Scrum framework, Sprint, Scrum master, Roles of Scrum Master, Implementing Scrum - A case study. [TB-1,Ch-4]
Software Requirements: Functional and non-functional requirements, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. [TB-2,Ch-6,7]

UNIT III:

System Models: Context Models, Behavioral models, Data models, Object models, structured methods. [TB-2,Ch-8]

Design Engineering: Design process and Design quality, Design concepts, the design model.Modeling component level design: design class based components, conducting component level design. Performing User interface design: Golden rules. [TB-1,Ch-9,11]

UNIT IV:

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing.

Product metrics : Software Quality, Metrics for Analysis Model- function based metrics, Metrics for Design Model-object oriented metrics, class oriented metrics, component design metrics, Metrics for source code, Metrics for maintenance. [TB-1,Ch-13,14,15]

UNIT V:

Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management: Quality concepts, Metrics for Software Quality, Software Reviews, Formal Technical Reviews, Software Reliability, The ISO 9000 quality standards.

[TB-1,Ch-25,26]

Text Books:

1. Roger S. Pressman, Software Engineering - A practitioner‘s Approach, 6th edition. McGraw Hill International Edition, 2005.
2. Somerville, Software Engineering, 7th edition, Pearson education, 2009.

Reference Books:

1. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers,3rd edition, 2008
2. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, 3rd edition 2005.
3. James F. Peters, Witold Pedrycz, Software Engineering - an Engineering approach, JohnWiely, 2007.
4. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies, 2013.

Reference Links:

1.https://nptel.ac.in/courses/106/105/106105182/

2.https://ff.tu-sofia.bg/~bogi/knigi/SE/Mcgraw%20Hill%20-%20Software%20Engineering%20-%20A%20Practitioner%27s%20Approach%20-%20Pressman%20(5Th%20Ed,2001,Bookmarked,Cover).pdf

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OBJECT ORIENTED PROGRAMMING (JAVA)

(PEC-III)

Prerequisites: Object Oriented Programming

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUI applications.

Course Outcomes:

At the end of the course the students will be able to:

1. Understand the Object Oriented Programming concepts
2. Design programs using package and interfaces.
3. Apply the concepts of Exceptions and multithreading.
4. Develop GUI applications and AWT using Frames .
5. Design the programs using Applet and JDBC Concepts.

UNIT -I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword,garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

UNIT- II

Inheritance –Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance

Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, Character Streams.

UNIT- III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.

Multi threading: Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT- IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT: class hierarchy, component, container, panel, window, frame, graphics class, Layout Manager – layout manager types – boarder, grid, flow, card and grib bag.

UNIT- V

AWT controls: Labels, button, scrollbars, text components, check box, check box groups, choices, menu bar.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

JDBC Connectivity: JDBC Type 1 to 4 Drivers, connection establishment, QueryExecution.

Text Books:

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGraw Hill, Year of Publication:2017
2. Database Programming with JDBC&JAVA, Second Edition,GeorgeReese, O'ReillyMedia, Year of Publication:2009

Reference Books:

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, Bruce Eckel
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education

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MACHINE LEARNING

(PEC-III)

Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To study the various supervised and unsupervised learning algorithms in machine learning
3. To understand the latest trends in machine learning
4. To design appropriate machine learning algorithms for problem solving

Course Outcomes:

At the end of the course the students will be able to:

1. Describes Fundamental concepts of machine learning and its applications, and the setup for the practical knowledge (L2)
2. Analyzing Supervised Learning Methods to achieve the accuracy on the training data.(L4)
3. Apply Unsupervised Learning algorithms to various grouping problems(L3)
4. Usage of Ensemble learning for better prediction. (L5)
5. Analyze the problem of unwanted increase in dimension to fixate granularity in Data.(L4)

UNIT I:

Introduction to Machine Learning: What is Machine Learning, Why Machine Learning, Types of Machine Learning Systems, Challenges of Machine Learning Why Python, Essential libraries and Tools, A first Application –Classifying Iris Species.

UNIT II:

Supervised Learning : Classification and Regression, Generalization over fitting and under fitting, Supervised Machine Learning Algorithms, Sample Datasets, k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers

UNIT III:

Unsupervised Learning and Preprocessing: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Preprocessing and Scaling, clustering, k-Means Clustering, Agglomerative Clustering, Comparing and evaluating the clustering algorithms.

UNIT IV:

Ensemble Learning and Random forest :Voting Classifiers, Bagging and pasting, Random Patches and Random subspaces, Random Forest, Boosting-Ada Boost and Gradient Boost

UNIT V:

Dimensionality Reduction: The curse of Dimensionality, main approaches to Dimensionality r reduction, PCA, Kernel PCA

Reinforcement Learning - Learning to Optimize Rewards, Introduction to OpenAI Gym, Markov Decision Processes

Text Books:

1. Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido October 2016,O'Reilly Media, Inc.
2. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow
3. Concepts, Tools, and Techniques to Build Intelligent Systems, By Aurélien Géron · 2019.

Reference Books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. http://www.cs.cmu.edu/~tom/mlbook.html

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ADVANCED DATA STRUCTURES LAB

(PCC LAB)

1.Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:

a) Linear search b) Binary search

2.Write Java programs to implement the following using arrays and linked lists

a) List ADT

3.Write Java programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4.Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).

5.Write a Java program to implement circular queue ADT using an array.

6.Write Java programs to implement the following using a singly linked list.

a) Stack ADT b) Queue ADT

7. Write Java programs to implement the deque (double ended queue) ADT using

a) Array b) Singly linked list c) Doubly linked list.

8.Write a Java program to implement priority queue ADT.

9.Write a Java program to perform the following operations:

a) Construct a binary search tree of elements.
b) Search for a key element in the above binary search tree.
c) Delete an element from the above binary search tree.

10.Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.

11. Write a Java program to implement Dijkstra's algorithm for Single source shortest1 path problem.

12.Write Java programs for the implementation of bfs and dfs for a given graph.

13.Write Java programs for implementing the following sorting methods:

a) Bubble sort d) Merge sort g) Binary tree sort

b) Insertion sort e) Heap sort

c) Quick sort f) Radix sort

14. Write a Java program to perform the following operations: a) Insertion into a B-tree b) Searching in a B-tree

15.Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.

16.Write a Java program that implements KMP algorithm for pattern matching.

(Note: Use packages like java.io, java.util, etc)

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PYTHON PROGRAMMING LAB

(PCC LAB)

Week-1:

Installation and Environment set up of Python & Programs on Data types, Operators

Week-2:

Programs on Standard I/O, String, Files, List, Tuple

Week-3:

Programs on Dictionaries

Week-4:

Programs on Control Statement

Week-5

Programs on Functions

Week-6:

Programs on Strings and string operations

Week-7:

Programs on Regular Expressions.

Week-8:

Programs on Inheritance and overloding

Week-9:

Programs on Exception Handling

Week-10

Programs on Python Additional Concepts: Email and Web Programming

Week-11

Programs on Python Libraries

Week-12

Implementation of different application based on python programming.

Week-13:

Demonstration of Date and Time Packages

Week-14:Overview

Week-15:Overview

Text Books:

1. Beginning Python: using python 2.6 and Python 3.1, by James Payne, wiley Publication

2. Learning Python, 5th edition, O'reilly Publication

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BIG DATA ANALYTICS
(PCC)

Prerequisites: Database management system, Java and Linux

Course Objectives:

1. To understand about Big Data and Analytics.
2. To learn the tools for Big Data Analytics.
3. To Understand Hadoop Fundamentals
4. To Understand the MapReduce and Hbase.
5. To learn Social and Mobile Analytics.

Course Outcomes: After the completion of course students will be able to:

1. Identify need of Big Data and Analytics
2. Identify various Data Analytics Tools
3. Analyze components of HDFS
4. Apply several data intensive tasks using Map-Reduce paradigm
5. Demonstrate the applications of Social and Mobile Analytics

UNIT – I

Big Data Analytics: What is big data, Evolution of Big Data; Structuring Big Data; Characteristics of Big Data; What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE);

UNIT – II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Developing an Analytic Team; Understanding Text Analytics;

Analytical Approach and Tools to Analyze Data: Analytical Approaches; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT - III

Big Data Technology Landscape and Hadoop: Hadoop; RDBMS versus Hadoop; History of Hadoop; Hadoop Overview; Hadoop Distributors, Processing of Data with Hadoop;

Storing Data in Hadoop: Introduction of HDFS, Architecture, HDFS (Hadoop Distributed File System), HDFS Daemons, read, write, Replica, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability.

UNIT – IV

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing;

Introducing HBase: Architecture, Storing Big Data with HBase, Interacting with the Hadoop Ecosystem; HBase in Operations Programming with HBase; Combining HBase and HDFS;

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

TEXT BOOKS:

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.

2. BIG DATA, Black Book TM, DreamTech Press, 2015 Edition.

3. BUSINESS ANALYTICS 5e, BY Albright |Winston

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies and Management", John Wiley 2011.

2. Lariss T. Moss,ShakuAtre, " Business Intelligence Roadmap", Addison-Wesley It Service.

3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

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DATA SCIENCE
(PCC)

CourseObjectives:

1. Togainafoundationalunderstandingofdatascience.
2. Tounderstandthedataexplorationanalysis indatascience.
3. Tounderstandandusebasicmachinelearningalgorithmsforpredictivemodeling.
4. TounderstandandusethevariousgraphicsinRandTableaufordatavisualization.
5. Tounderstandtheethicaland privacyissuesindatascience.

CourseOutcomes:

1. DescribewhatDataScienceis and theskillsets neededto beadatascientist.
2. Explainthesignificanceofexploratorydataanalysis(EDA)indatascience.
3. Applybasicmachine learningalgorithmsforpredictivemodeling.
4. Learntopersuadeeffectivevisualizationofgivendata.
5. Reasonaroundethicalandprivacyissuesindatascienceconductandapplyethicalpractices.

UNIT I:

IntroductionToData Science: What is Data Science, Big Data and Data Science hype – and getting past the hype,Whynow?– Datafication,Currentlandscapeofperspectives,Skillsetsneeded,StatisticalInference,Populationsandsamples,Statisticalmodeling,probabilitydistributions,fittingamodel,Introductionto R.

UNIT II:

ExploratoryDataAnalysisAndTheDataScienceProcess: Basictools(plots,graphsandsummarystatistics)ofEDA,PhilosophyofEDA,TheDataScienceProcess, CaseStudy.

UNITIII:

BasicMachineLearningAlgorithms: LinearRegression,k-NearestNeighbors(k-NN),k-means,Motivatingapplication:FilteringSpam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes andwhyitworksfor Filtering Spam.

UNIT IV:

DataVisualization: Basicprinciples,ideasandtoolsfordatavisualization,Examplesofinspiring(industry)projects,IntroductiontoTableau. Creatingownvisualizationofacomplex dataset.

UNIT V:

DataScienceAndEthicalIssues: Discussionsonprivacy,security,ethics,AlookbackatDataScience,Next-generationdatascientists.

TextBooks:

1. CathyO'NeilandRachelSchutt.DoingDataScience,Straight TalkFrom The Frontline.O'Reilly.2014.
2. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to KnowaboutDataMining andData-analyticThinking. ISBN 1449361323. 2013.

ReferenceBooks:

1. TrevorHastie,RobertTibshiraniandJerome Friedman.ElementsofStatisticalLearning,SecondEdition. ISBN0387952845. 2009.
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques,ThirdEdition. ISBN0123814790. 2011.
3. ChrisEaton,DirkDeRoos,TomDeutsch,GeorgeLapis,PaulZikopoulos,"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data",McGrawHillPublishing, 2012.
4. https://docs.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit?pli=1

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech(CSE)

M.Tech(CSE)- I Year II Sem	L	T / P / D	C
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BLOCK CHAIN TECHNOLOGY

(PEC-IV)

Prerequisites: Object Oriented Programming Through Java, Basic Knowledge Of Computer Security and Data Structures

Course Objectives:

1. Identify different components and types of Blockchain.
2. Apply Ethereum tool for application development
3. Interpret various components of DApps and multichain
4. Summarize the architecture of Hyperledger Fabric
5. Analyse the impact of Blockchain in business

Course Outcomes:

1. Summarize types and applications of Blockchain
2. Illustrate the design and deployment of smart contract through Ethereum
3. Apply DApps through Truffle IDE
4. Apply Hyper Ledger Fabric model in different Networks
5. Categorize different Business Applications of Blockchain

UNIT I:

What is Blockchain: Definition, history,Digital Money to Distributed Ledgers

Why Blockchain: Properties of Blockchain, Requirements for consensus protocols, Proof of Work (PoW), Proof of Stake (PoS),Zero Knowledge Proofs, Byzantine Models, hashing, Merkle Tree,Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork ,Types of Blockchain.

UNIT II:

Ethereum Solidity: Introduction, Datatype, operator, enum, arrays, loops, Mapping, Structure, State Modifiers, Exception Handling in Solidity, Inheritance, Events, Self Destruction, ERC Tokens, Constructors, Libraries, Compile and Deploy the Smart Contract

UNIT III:

Truffle IDE: Creating user interface, textboxes, radio buttons, drop down list, developing a DApp, Publish the DApp Connecting to DApp, truffle migrate, truffle test.

Multichain: Chain code (go) and MultiChain, Privacy and Permissions in MultiChain ,Mining in MultiChain, Multiple configurable Blockchains using MultiChain ,Setting up a Private Blockchain, Blockchain Bytes.

UNIT IV:

Hyperledger (go Lang): Introduction, architecture, Consensus, API, frameworks, setting up Development Environment using Composer, Developing and Testing business networks, Hyperledger Fabric Model Various ways to create Hyperledger Fabric Blockchain Network.

UNIT V:

Blockchain transforming business, Blockchain in governance.

Case Studies: Supply chain management, real estate, healthcare, Government sectors, bitcoin.

Text Books:

1. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

Reference Books

1. Blockchain Technology:Chandramouli Subramanian,Asha A George,Abhilash K A and Meena Karthikeyan,Published by University Press
2. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos Blockchain by Melanie Swa, O’Reilly
3. Philipp Hacker, Ioannis Lianos (2019). **Regulating Blockchain: Techno-Social and Legal Challenges**, OUP Oxford. (ISBN-13: 978-0198842187).

Reference Links:

1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

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ADVANCED DATABASE MANGEMENT SYSTEMS

(PEC-IV)

Prerequisites: DBMS

Course Objectives:

1. To provide a sound introduction to Database management systems, databases and its applications and familiarize the student to give a good formal foundation on the relational model of data
2. To Introduce SQL for storing and retrieving databases
3. To give an introduction to systematic database design approaches concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
4. To Explore the File organizations, indexing and hashing mechanisms
5. To Explain the concepts of Distributed Database Management System

Course Outcomes:

1. Model Entity-Relationship diagrams for enterprise level databases (L3)
2. Formulate optimized Queries using SQL and Relational Formal Query Languages (L3)
3. Apply Various Normal forms for schema refinement and Differentiate serial and concurrent transaction and various concurrency control protocols algorithms (L4)
4. Use of suitable File organization, Indices and Hashing mechanisms for effective storage and retrieval of Data (L3)
5. Identify the features and advantages of Distributed Databases over centralized databases

UNIT I:

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query

Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II:

Introduction to SQL : Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages & Query Optimization: The Relational Algebra, Tuple Relational Calculus.Algorithm for Executing Query Operations: Select operation, Join operation, Project and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization.

UNIT III:

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+,}$ Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

Transactions & Concurrency Control: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability. Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols.

UNIT IV:

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

UNIT V:

Distributed Database Introduction of DDB, DDBMS architectures, Homogeneous and Heterogeneous databases, Distributed data storage, Advantages of Data Distribution, Disadvantages of Data Distribution Distributed transactions, Commit protocols, Availability, Concurrency control & recovery in distributed databases, Directory systems, Data Replication, Data Fragmentation. Distributed database transparency features, distribution transparency.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books :

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, eigth Edition Pearson 2006
3. Tamer Ozsu.Patrick Valdureiz , Principles of Distributed Database Systems , Third Edition,Springer
4. P Raja Sekhar Reddy, A MallikarjunaReddy ,Foundations of Database Management Systems ,Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

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M.Tech(CSE)

M.Tech(CSE)- I Year II Sem	L	T / P / D	C
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PRINCIPLES OF INTERNET OF THINGS

(PEC-IV)

Pre-requisites: Computer Networks, Python Programming

Course Objectives:

1. Describe IoT and its working
2. Understand IoT Applications
3. Develop an IoT Application using Raspberry Pi Board
4. Design an IoT Application using Arduino Board
5. Understand different areas of robotics

Course Outcomes:

At the end of the course student will be able to:

1. Summarize the concepts of Internet of Things (L2)
2. Interpret Domain specific Internet of Things Applications (L2)
3. Develop programs for interfacing using Raspberry Pi (L6)
4. Design basic IoT applications using Arduino (L6)
5. Recite the fundamentals of Robotics (L1)

UNIT - I

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.

UNIT – II

Domain specific applications of IoT: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and lifestyle.

UNIT - III

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi-Interfaces (serial, SPI, I2C), Programming Raspberry PI with Python- Controlling LED with Raspberry PI, interfacing an LED and Switch with Raspberry PI and Interfacing a light sensor (LDR) with Raspberry PI.

UNIT - IV

Programming Arduino: Introduction, Arduino Boards, Programming-variables, if, loops, functions, digital inputs and outputs, the serial monitor, arrays and strings, analog inputs and outputs, using libraries, Arduino data types and commands. Programming Arduino Uno with Arduino- Controlling LED with Arduino, interfacing an LED and Switch with Arduino and Interfacing a light sensor (LDR) with Arduino.

UNIT - V

Introduction to Robotics: Classification, Advantages and Disadvantages, Components, Robot Joints, Robot Coordinates, Characteristics, Applications. Robotics Kinematics-Matrix representations. Actuators-Characteristics, Types of Actuators. Sensors-characteristics, types of sensors. (10 hours) Academic Project Work Submission using the Above Concepts.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015.

2. Simon Monk, Programming Arduino Next Steps: Going Further with Sketches, Second Edition,2019.

3. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia,2001.

Reference Books:

1.The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).

2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014.

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DEEP LEARNING

(PEC-IV)

Prerequisites: Basic Mathematics, P&S, Python and Machine Learning

Course Objectives:

1. To Give an exposure to Supervised Deep Learning for working with Linearly Non Separable Data
2. To provide understanding of Mathematical, Statistical and Computational challenges of building improved neural net representations. .
3. To Know the application of Convolution Neural Networks for High-Dimensional data, such as image and other data types
4. To Explore Deep Recurrent and Memory Networks for Sentiment Analysis, Machine Translation and Computer Vision tasks

Course outcomes:

1. Implement Deep Neural Networks for solving Classification and Regression Problems (L3)
2. Apply Regularization Methods to improve the way neural networks learn.(L3)
3. Analyze different optimation algorithms for training deep neural models(L4)
4. Apply the concepts of the Deep Convolution Neural networks for Image classification (L3)
5. Solve the sequence learning problems using Deep Recurrent Neural Networks and Memory Networks (L3)

UNIT I:

Introduction to Neural Networks: Challenges Motivating Deep Learning, AI vs ML vs DL, Applications of Deep Learning, Perceptron Model, Sigmoid Neuron Model, Feed Forward Neural Networks, Learning with Gradient Descent, Working of Backpropagation Algorithm, Loss Functions: Squared Error Loss, Perceptron Loss, and Cross Entropy Loss, Output Layer Functions: Sigmoid and Softmax Functions

UNIT II:

Regularization for Deep Learning: Bias and Variance Tradeoff, Regularization Need for Overfitting, Techniques of Regularization: L2 Regularization, L1 Regularization, Drop Out, Data Augmentation, and Early Stopping, Weight Initialization, Hyper-Parameters Tuning: Learning Rate and Batch Size.

UNIT III:

Optimization for Training Deep Models: Challenges to Train Deep Neural Networks: Vanishing Gradient Problem, Exploding Gradient Problem, and Unstable Gradient Problem, Optimization Algorithms: Momentum Based Gradient Descent, Nesterov Based Gradient Descent, AdaGrad, RMSProp, and Adam, Parameter Initialization Strategies

UNIT IV:

Convolutional Neural Networks: Convolution Operation: 1D Convolution Operation, 2D Convolution Operation, 2D Convolution with a 2D Filter, Padding and Stride, Motivation: How Convolution Operation related to Neural Networks, Max Pooling, CNN Architectures: Alexnet, and VGGNet, Batch Normalization, Drop Out.

UNIT V:

Recurrent Neural Networks: Introduction to Sequential Model Problems, Recurrent Neural Network Model, Computing radients in RNN, Challenge of Long- Term Dependencies, The Long Short Term Memory and other Gated RNNs.

Text Books:

1) Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning (1st Edition), MIT Press,2017, ISBN 978-0262035613.
2) Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

Reference Books:

1) Bharath Ramsundar & Reza Bosagh Zadeh, Tensor Flow for Deep Learning, O'Reilly Media ,2018
2) Francois Chollet, Deep Learning with Python (1st Edition), Manning Publications Company, 2017. ISBN 978-1617294433.
3) Aurélien Géron, Hands-on Machine Learning with Scikit-Learn and TensorFlow (2nd Edition), O'Reilly Media, 2019. ISBN 978-9352139057.
4) http://faculty.neu.edu.cn/yury/AAI/Textbook/Deep%20Learning%20with%20Python.pdf
5) http://www.deeplearningbook.org/
6) https://www.pdfdrive.com/deep-learning-with-applications-using-python-chatbots-and-face-object-and-speech-recognition-with-tensorflow-and-keras-e184016771.html
7) https://www.pdfdrive.com/tensorflow-for-deep-learning-e187559485.html

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech(CSE)

I Year M.Tech (CSE)- II Sem

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NATURAL LANGUAGE PROCESSING

(PEC-V)

Prerequisites: Artificial Intelligence, Machine Learning, Python Programming

Course Objectives:

1. To learn the fundamentals of Natural Language Processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To apply the NLP techniques to IR applications

Course outcomes:

1. To model the language using N-grams .
2. To implement a shallow processing models to tackle morphology/syntax of a language.
3. To Examine Syntagmatic and Paradigmatic relations be used for processing the real-time applications.
4. To apply the algorithms for Discourse Analysis.

UNIT I:

Introduction : Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Text Normalization, Minimum Edit Distance, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors

UNIT II :

Word Level Analysis : Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III :

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV:

Semantics And Pragmatics : Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V :

Discourse Analysis And Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Daniel Jurafsky, James H. Martin ,"Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Deepti Chopra, Nisheeth Joshi, Iti Mathur "Mastering Natural Language Processing with Python" First Edition, Packt Publishing, 2016

Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, Benjamin, Cummings publishing company, 1995.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python" , First Edition, OReilly Media, 2009
3. Rajesh Arumugam, Rajalingappaa Shanmugamani, "Hands-On Natural Language Processing with Python" , Packt Publishing Ltd., 2018
4. http://www.pdfdrive.com/natural-language-processing-with-python-e1251452.html
5. https://learning.oreilly.com/library/view/hands-on-natural-language/9781789139495

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech(CSE)

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M.Tech(CSE)- I Year II Sem			
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PREDICTIVE ANALYTICS WITH R

(PEC-V)

Prerequisites : Basics of Statistics, Machine Learning and Basic knowledge in any Programming language

Course Objectives:

After taking the course, students will be able to

1. Use R for statistical programming, computation, graphics, and modeling,
2. Write functions and use R in an efficient way
3. Fit some basic types of statistical models
4. Use R in their own research,

Course Outcomes:

After successful completion of the course students should be able to

1. Understand the basics in R programming in terms of constructs, control statements, functions,
2. Access online resources for R and import new function packages into the R workspace
3. Import, review, manipulate and explore ,summarize data-sets in R
4. Apply the R programming from a statistical perspective
5. Apply R Graphics and Tables to visualize results of various Statistical operations on data.

Unit I :

Basics of R: Introduction, R-Environment Setup, Help functions in R, Vectors – Scalars – Declarations

Basic Data Types: Vectors – Scalars – Declarations, Creating and Naming Vectors, Vector Arithmetic, Vector Sub setting,

Matrices: Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Arrays - Class.

Unit II:

Factors: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Common functions used with factors

Data Frame: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Sub setting of Data Frames, Extending Data Frames, Sorting Data Frames.

Lists: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors, applying functions to lists

Conditionals and Control Flow: Arithmetic and Boolean operators and values, Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.

Unit III :

Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.

Functions in R: Introduction, Writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R, Cumulative Sums and Products, Calculus in R, Input and Output Operations.

Unit IV :

Apply Family in R : Introduction, Using Apply in R, Using Lapply in R, Using Sapply, Using Tapply in R: Split Function, Using Mapply in R,

Charts and Graphs : Introduction, Pie Chart: Chart Legend, 3D Pie Chart, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Unit V : Interfacing

Data Interfaces: Introduction, CSV Files: Syntax, Importing a CSV File, Excel Files: Syntax, Importing an Excel file, Binary Files: Syntax, XML Files, Web Data, Databases.

Statistical Applications: Introduction, Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering, Correlation and Covariance, T-Tests,-ANOVA.

<u>Text Books & Other References</u>

1. R Programming for Data Science by Roger D. Peng

2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.

Reference Books:

1. R for Everyone, Lander, Pearson
2. R Cookbook, PaulTeetor, Oreilly.
3. R in Action,Rob Kabacoff, Manning

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech(CSE)

M.Tech(CSE)- I Year II Sem	L	T / P / D	C
	3	0	3

MOBILE APPLICATIONS AND DEVELOPMENT

(PEC-V)

Course Objectives:
Outline the usage of Android development framework.

1. Understand the main components of an Android application and its entire life Cycle.
2. Develop database programming using SQLite.
3. Identify the use of location-based service in android applications.
4. Build SMS and MMS applications using Intents.

Course Outcomes:

1. Analyze the architecture of android and current trends in mobile operating systems.
2. Apply suitable software tools and APIs for the design of User Interfaces to a particular mobile application.
3. Design applications for mobile devices using SQLite Database.
4. Apply the location-based services in android applications.
5. Summarize the Monitoring changes to the phone, network, data connectivity and SIM states.

UNIT I:

Introduction To Android: Features of Android, The development framework**:** Understanding the Android Software Stack, Android Application Architecture; the Dalvik Virtual Machine, Creating First Android Application, Types of Android Applications, Android Development Tools: The Android Virtual Device Manager, Android Emulator, The Dalvik Debug Monitor Service.

UNIT II:

Creating applications and Activities: Introduction to the application Manifest File, Using the Manifest Editor, Externalizing Resources: Creating Resources - Simple Values, Drawables, Layouts, Menus, Animations.The Android Activity Life cycle. **Building User**

Interfaces: Fundamental Android UI design, Introducing Layouts: Defining Layouts, Using Layouts to Create Device Independent User Interfaces, Optimizing Layouts.

UNIT III:

Databases and Content Providers: Introduction to Android Databases, Introducing SQLite, Content Values and Cursors, working with SQLite Databases - Introducing the SQLiteOpenHelper, querying a Database, Extracting Values from a Cursor, Adding, Updating, and Removing Rows, Creating Content Providers, Using Content Providers - Introducing the Content Resolver, Querying Content Providers, Adding, Deleting, and Updating Content

UNIT IV:

Maps and Location based services: Using the location-based services, selecting a Location Provider, selecting a Location provider, finding current location; **Creating Map-Based Activities**: Introducing Map View and Map Activity, Creating a Map-Based Activity, Maps and Fragments

UNIT V:

Telephony and SMS: Using telephony - Initiating Phone Calls, Accessing Telephony Properties and Phone State, Monitoring Changes in Phone State Using the Phone State Listener, Introducing SMS and MMS - Using SMS and MMS in Your Application, Sending SMS and MMS from Your Application Using Intents, Sending SMS Messages Using the SMS Manager.

Text Book:

1. Reto Meier, Professional Android 4 Application Development, 1stEdition, Wrox Press, Wiley Publishing, 2014.

Reference Books:

1. Pradeep Kothari, Android Application Development (with Kitkat Support), Black Book, 2014, Dreamtech Press publisher, Kogent Learning Inc., 2014
2. Erik Hellman, Android Programming: Pushing the Limits, 1st Edition, Wiley Publications, 2014.
3. Mike Wolfson, Android Developer Tools Essentials, O’Reilly Edition, 1st Edition, 2013.

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HUMAN COMPUTER INTERACTION

(PEC-V)

Prerequisites:Web -Technologies

Course Objectives

1. Identify and formulate characteristics and components of graphical user interface.
2. Analyze various design paradigms for human computer interaction.
3. Design & implement human computer interaction using various design techniques.
4. Support Design rules to use HCI in the software process.

Course Outcomes:

1. Ability to identify the importance of user interfaces
2. Ability to Design interfaces as per the business requirements
3. Ability to apply latest technologies in developing interfaces.
4. Ability to explain software tools, methods and procedures for interface development

UNIT - I

Introduction : Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface. [T1]

UNIT – II

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. [T1 & R1]

UNIT – III

Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design. [T1 & R1]

UNIT – IV

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.

Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. [T1]

UNIT - V

Software tools – Specification methods, interface – Building Tools.

Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers. [T2 & R1]

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

References:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,

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DATA SCIENCE LAB

(PCC LAB)

Prerequisites: Basics of Python Programing, Basics of R programming and Statistics and probability

Course Objectives:

- To acquire in-depth understanding of the data analysis, machine learning and other advanced data science techniques.
- To empower students with tools and techniques for handling, managing, analyzing and interpreting data.
- To strengthen the analytical and problem solving skill through developing real time applications.
- To gain practical experience in programming tools for data sciences and machine learning.

Course outcomes

- Understand data science concepts and various use cases in different industries [L2]
- Apply statistics and probability for data science. [L3]
- Develop R and Python Code for Data Science solutions [L6]
- Create powerful business dashboards with Tableau [L6]

Programming Languages/Tools:

- R
- Tableau
- Python

List of Experiments:

Week 1: Introduction to Data Science with using Python / Revisiting of Jupiter/Installation of Libraries.

Week 2: Apply accessing and importing and exporting data using Python.

Week 3: Apply data preprocessing: Data manipulation and data cleaning using Python.

Week 4: Apply Machine Learning - Linear regression using Python.

Week 5: Apply Machine Learning - Logistic Regression using Python.

Week 6: Introduction to R tool for data analytics science / Revisiting of Installing R Libraries.

Week 8: Exploratory Data Analysis and apply statistics analysis and visualization using R

Week 9: Apply K-means clustering (supervised Learning) on given datasets using R.

Week 10: Apply K-NN (unsupervised learning) on given datasets using R.

Week 11: Data Visualization using tableau / Installation of Tableau / Introduction to Tableau interface.

Week 12: to Week 14: Create and connect to data/Visual analytics/mapping/creating dashboards and stories.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

TWO YEARS COURSE STRUCTURE M.Tech(DS)

M.TECH (DS) I YEAR I SEM (1st Semester) [6T+ 2L+1 Audit Course]

Sno	Category	Course title	L	T	P	Credits
1	PCC-I	Machine Learning Algorithms	3	0	0	3
2	PCC-II	Python Programming	3	0	0	3
	PCC-III	Statistical Foundations for Data Science	3	1	0	4
3	PEC-I	1. Sentiment Analysis 2. Information Retrieval Systems 3. Object Oriented Programming (Java) 4. Digital Image Processing	3	0	0	3
4	PEC-II	1. Artificial Intelligence 2. Advanced DBMS 3. Natural Language Processing 4. Introduction to IoT	3	0	0	3
6	PCC-III	Research Methodology	2	0	0	2
7	PCC I-Lab	Machine Learning Lab	0	0	**3**	**1.5**
8	PCC-II-Lab	Python Programming Lab	0	0	**3**	**1.5**
9		Audit Course 1	2	0	0	0
		Total	**19**	**0**	**8**	**21**

M.Tech (DS) I YEAR II SEM (2nd Semester) [5T+ 1L+ 1 seminar]

Sno	**Category**	**Course title**	**L**	**T**	**P**	**Credits**
1	PCC-IV	Big Data Analytics	3	1	0	4
2	PCC-V	Data Wrangling & Visualization	3	1	0	4
3	PEC-III	1. Cloud Computing 2. Text Mining 3. Parallel Programming 4. Image Analysis 5. Predictive Analytics with R	3	0	0	3
4	PEC-IV	1. Semantic Web 2. Recommender Systems 3. Data Storage Technologies 4. Deep Learning	3	0	0	3
5	OE-1	OPEN ELECTIVE-1	3	0	0	3
6	PCC-III Lab	Data Visualization Lab	0	0	4	2
7	Seminar	Seminar-I	0	0	4	2
		Total	**15**	**2**	**8**	**21**

M.Tech (DS) II YEAR I SEM   Major Project Phase I

Sno	category	Course title	L	T	P	credits
1		Project Review I / Dissertation	0	0	24	12
		Total	**0**	**0**	**20**	**12**

M.Tech (DS) II YEAR II SEM   Major Project Phase II

Sno	category	Course title	L	T	P	Credits
1		Project Review II / Dissertation	0	0	28	14
		Total	**0**	**0**	**28**	**14**

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	3	**0**	**3**

MACHINE LEARNING ALGORITHMS

(PCC-I)

Course Objectives: The main objective of this course is to teach the principles and foundations of machine learning algorithms

Course Outcomes:

At the end of the course the student will be able to understand

- Basics of Machine Learning and its limitations
- Machine Learning Algorithms: supervised, unsupervised, bio-inspired
- Probabilistic Modeling and Association Rule Mining

Unit-I

Introduction: What does it mean to learn, Some canonical Learning Problems, The Decision Tree Model of Learning, Formalizing the Learning Problem [Reference 1], ID3 Algorithm [[Reference 2]

Limits of Learning: Data Generating Distributions, Inductive Bias, Not Everything is learnable, Underfitting and Overfitting, Separation of training and test Data, Models, parameters and Hyperparameters, Real World Applications of Machine Learning [Reference 1]

Geometry and Nearest Neighbors: From Data to Feature Vectors, k-Nearest Neighbors, Decision Boundaries, k-means Clustering, High Dimensions [Reference 1]

Unit-II

The Perceptron: Bio-inspired Learning, The Perceptron Algorithm, Geometric Interpretation, Interpreting Perceptron Weights, Perceptron Convergence and Linear Separability, Improved Generalization, Limitations of the Perceptron [Reference 1]

Practical Issues: Importance of Good Features, Irrelevant and Redundant Features, Feature Pruning and Normalization, Combinatorial Feature Explosion, Evaluating Model

Performance, Cross Validation, Hypothesis Testing and Statistical Significance, Debugging Learning Algorithms, Bias Variance tradeoff [Reference 1]

Unit-III

Linear Models: The Optimization Framework for Linear Models, Convex Surrogate Loss Functions, Weight Regularization, Optimization and Gradient Descent, Support Vector Machines [Reference 1]

Probabilistic Modeling: Classification by Density Estimation, Statistical Estimation, Naïve Bayes Models, Prediction [Reference 1]

Unit-IV

Neural Networks: Bio-inspired Multi-Layer Networks, The Back-propagation Algorithm, Initialization and Convergence of Neural Networks, Beyond two layers, Breadth vs Depth, Basis Functions [Reference 1]

Unit-V

Unsupervised Learning: Clustering Introduction, Similarity and Distance Measures, Agglomerative Algorithms, Divisive Clustering, Bi Clustering, Principal Component Analysis, Factor Analysis,Outlier Detection, Neural network Models(unsupervised).

Text Books:

1. A Course in Machine Learning (CIML). Hal Daume III, 2017 (freely available online) http://ciml.info/

Reference Books:

1. Hands on Machine Learning with SciKit-Learn, Keras and Tensor Flow. AurélienGéron. O'Reily, 2019
2. Machine Learning with Python Cookbook. Chris Albo, O'Reily, 2018
3. Introduction to Machine Learning with Python: A guide. Andreas C Miller, Sarah Guido. O'Reily, 2017

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PYTHON PROGRAMMING

(PCC-II)

Course Objectives

6. Use Python interactively, execute a Python script at the shell prompt, use Python types,
   expressions, and None,use string literals and string type, use Python statements (if...elif..else, for, pass, continue, . . .)
7. understand the difference between expressions and Statements.
8. utilize high-level data types such as lists and dictionaries, understand the difference between mutable and immutable types.
9. write a simple class and access methods and attributes,
10. import and utilize a module, read from and write to a text file.

Course Outcomes

1. Build programs using primitive data types and user defined functions.
2. Write applications that include string builtin functions, modules, packages along with respective exceptional handling mechanism.
3. Writes applications using OO features of Python
4. Develops web-based applications to deal with data communication between client and server modules and also process data that is stored in possible databases.
5. Hands on exposure on SciPy/Tkinter/ Plotpy modules

Unit -I :

Introduction to Python: History, Features, setting up path, Working with Python Basic Syntax

Variable and Data Types, Operator. Conditional Statements (If, If- else, Nested if-else) Looping (for, While Nested loops) Control Statements (Break, Continue, Pass)

Functions: Defining a function, Calling a function, Types of functions, Function Arguments

Anonymous functions, Global and local variables

Unit-II:

String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods

Lists: Accessing list, Operations, Working with lists Function and Methods

Tuple: Accessing tuples, Operations, Working.

Dictionaries: Accessing values in dictionaries, Working with dictionaries, Properties Functions and Methods.

Unit-III:

Modules: Importing module, Math module, Random module, Packages, Composition

Input-Output: Printing on screen, reading data from keyboard, Opening and closing file

Regular expressions: Match function, Search function, Matching VS Searching, Modifiers

Patterns.

Unit-IV:

Advance Python- OOPs concept: Class and object, Attributes, Inheritance, Overloading

Overriding, Data hiding

Exception Handling: Exception, Exception Handling, Except clause, Try, finally clause User Defined Exceptions

Unit -V:

CGI : Introduction , Architecture ,CGI environment variable, GET and POST methods

Cookies, File upload.

Python for Database: Introduction, Connections, Executing queries, Transactions Handling error Working with NumPy/ PlotPy/ SciPy/GUI Programming, Introduction, Tkinter programming, Tkinter widgets

Text books:

1.Think Python: How to Think Like a Computer Scientist Allen B. Downey, O'Relly publications.

2. Learning with Python by Jeffrey Elkner, Chris Meyers Allen Downey , Dreamtech Press.

Reference books:

1.Introduction to Computation and Programming using Python, Revised and Expanded Edition,John V. Guttag, The MIT Press.

2. Programming Python,Fourth Edition by Mark Lutz, O'Relly

3. Python Programming using problem solving approach, Reema Thareja, Oxford Higher Education.

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INFORMATION RETRIEVAL SYSTEMS

(PEC-I)

Course Objectives:

To introduce the fundamental issues of information retrieval with theoretical foundations.

Course Outcomes: At the end of the course the student will be able to understand

- indexing and querying in information retrieval systems
- the different models for information retrieval
- text classification and clustering
- web searching

Unit-I

Boolean retrieval: An example information, Building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction.

Index construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

Unit-II

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant tf-idf functions.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.

Unit-III

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

Probabilistic information retrieval: Basic probability theory, The Probability Ranking Principle, The Binary Independence Model.

Language models for information retrieval: Language models, The query likelihood model.

Unit-IV

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, Feature selection.

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear versus nonlinear classifiers.

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

Unit-V

Matrix decompositions and latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.

Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.

Web crawling and indexes: Overview, Crawling, Distributing indexes, Connectivity servers.

Link analysis: The Web as a graph, PageRank, Hubs and Authorities.

Text Book:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, *An Introduction to Information Retrieval*, Cambridge University Press, Cambridge, England, 2008

Reference Books:

2. David A. Grossman, Ophir Frieder, *Information Retrieval – Algorithms and Heuristics*, Springer, 2nd Edition (Distributed by Universities Press), 2004.
3. Gerald J Kowalski, Mark T Maybury. *Information Storage and Retrieval Systems*, Springer, 2000
4. Soumen Chakrabarti, *Mining the Web : Discovering Knowledge from Hypertext Data*, Morgan-Kaufmann Publishers, 2002

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OBJECT ORIENTED PROGRAMMING (JAVA)

(PEC-I)

Prerequisites: Object Oriented Programming

Course Objectives:

1. Understand the concept of OOP and learn the basic syntax and semantics of the Java language and programming environment
2. Be familiar with the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Understand Exceptional handling and multithreading concepts
4. Be familiar with GUI applications.

Course Outcomes:

At the end of the course the students will be able to:

1. Understand the Object Oriented Programming concepts
2. Design programs using package and interfaces.
3. Apply the concepts of Exceptions and multithreading.
4. Develop GUI applications and AWT using Frames .
5. Design the programs using Applet and JDBC Concepts.

UNIT -I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, static keyword,garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, Strings.

UNIT- II

Inheritance –Introduction, forms of inheritance- specialization, specification, construction, extension, limitation, combination, Member access rules, super uses, using final with inheritance

Polymorphism- method overriding, abstract classes, Object class Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, File, Byte Streams, Character Streams.

UNIT- III

Exception handling - Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Package java.util- The Collection Interface, list interface, Queue interface, The Collection class: LinkedListClass, HashSetClass. TreeSetClass, StringTokenizer, Date, Random, Scanner.

Multi threading: Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT- IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

AWT: class hierarchy, component, container, panel, window, frame, graphics class, Layout Manager – layout manager types – boarder, grid, flow, card and grib bag.

UNIT- V

AWT controls: Labels, button, scrollbars, text components, check box, check box groups, choices, menu bar.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, create applets, passing parameters to applets.

JDBC Connectivity: JDBC Type 1 to 4 Drivers, connection establishment, QueryExecution.

Text Books:

1. Java- The Complete Reference, Seventh Edition, Herbert Schildt, Tata McGraw Hill, Year of Publication:2017
2. Database Programming with JDBC&JAVA, Second Edition,GeorgeReese, O’ReillyMedia, Year of Publication:2009

Reference Books:

1. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
2. Thinking in Java Fourth Edition, Bruce Eckel
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education

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DIGITAL IMAGE PROCESSING

(PEC-I)

Prerequisites:Mathematics

Course Objectives:

1. Comprehend fundamental aspects of digital image processing
2. Understand the image noise models and enhancement methods
3. Evaluate the image segmentation methodologies
4. Understand the colour image processing techniques
5. Understand image morphological operations

Course Outcomes:

At the end of the course the students will be able to:

1. Understand the fundamental concepts of digital image processing system.
2. Analyze the image noise models and enhancement techniques.
3. Comprehend the different image segmentation and restoration methodologies.
4. Analyze the concepts of colour image processing.
5. Apply morphological operations on binary images.

UNIT-I:

Introduction: Definition, Pixel, Digital image representation, Types of images, Fundamental steps in image processing, image processing applications. Digital image processing operations – Basic relationships and distance metrics, Classification of image processing operations- Arithmetic operations, Logical operations.

UNIT – II:

Image Enhancement and Restoration – Image quality and Need for image enhancement, image enhancement point operations, Histogram based techniques.

Categories of Image Degradations- Image Restoration in the presence of noise only- Mean filters, order statistics filters.

UNIT-III:

Image Segmentation: Introduction, classification of image segmentation algorithms, detection of discontinuities, edge detection- stages in edge detection, types of edge detectors, First-order edge detection operators, second-order derivatives filters, edge operator performance, edge linking algorithms, principle of thresholding.

UNIT –IV:

Colour image processing: introduction, devices of colour imaging, colour image storage and processing, colour models-RGB Colour Model, HSI Colour Models, HSV Colour Model, Colour Quantization, Image filters for colour images.

UNIT –V:

Image Morphology: Need for morphological processing Morphological operators: Erosion, Dilation, Opening & Closing, Hit-or-Miss transform, Basic morphological algorithms, Gray-scale morphology

Text Books

1. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd edition 2016.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2nd Edition, 2015.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
4. Gonzalez R.C., Woods R.E, Digital image processing, Pearson, Prentice-Hall of India Pvt.Ltd. New Delhi, 3rd Edition, 2018
5. Jan Erik Solem, Programming Computer Vision with Python, O'Reilly ,1st Edition, 2012

References

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, 4th Edition, Cengage Learning, 2013
2. Fundamentals of Digital Image Processing, by Anil K. Jain, Prentice- Hall of India Pvt. Ltd, New Delhi, 2002
3. Prince, Simon JD. Computer Vision: Models, Learning and Inference, Cambridge University Press, 1st Edition, 2012.

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ARTIFICIAL INTELLIGENCE

(PEC-II)

Pre-requisite: Programming Knowledge, Computer Organization

I Year B.Tech. AI - I Sem L T / P / D C 3 0 3

Course Objectives:

1. The main objective of this course is to introduce the basic concepts of artificial intelligence, its foundations
2. To analyze various search strategies in intelligent systems
3. To apply search algorithms in games
4. To learn various representations of logic and knowledge
5. To understand production systems and its components

Course Outcomes:

At the end of this course, students will be able to:

1. Understand Strong AI and Weak AI and identify problems applicable to AI
2. Compare and contrast various uninformed and informed search algorithms to find an optimal solution for a given problem
3. Apply appropriate search algorithms for winning games
4. Learn various representations applicable to logic and knowledge useful in reasoning
5. Learn to apply appropriate inference methods in production or expert systems

Unit I: Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versusWeak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, EarlyHistoryofAI, Recent HistoryofAIto thePresent, AIIn the New Millennium

Unit II : Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs,Generate-and-Test Paradigm,Blind Search Algorithms, Implementing and Comparing BlindSearch Algorithms **Informed Search:** Introduction, Heuristics, Informed Search Algorithms–Finding Any Solution, The Best-First Search, The Beam Search,Additional Metrics for SearchAlgorithms,Informed Search–FindingAn OptimalSolution,

Unit III: Search Using Games: Introduction,Game Trees and Minimax Evaluation, MinimaxWith Alpha-Beta Pruning, Variations and Improvements To Minimax, Games of Chance and theExpectiminimaxAlgorithm

UnitIV:LogicinArtificialIntelligence: Introduction,LogicandRepresentation,PropositionalLogic, Predicate Logic – Introduction, Several Other Logics, Uncertainty and Probability**Knowledge Representation:** Introduction, Graphical Sketches and the Human Window,GraphsandtheBridgesofKönigsbergProblem,SearchTrees,RepresentationalChoices, ProductionSystems,Object Orientation, Frames,SemanticNetworks

Unit V: Production Systems: Introduction, Background, Production Systems and InferenceMethods,Production Systems and Cellular Automata, Stochastic Processes and Markov Chains,BasicFeatures and Examples of Expert Systems

Text Books:

1. StephenLucci,DannyKopec.ArtificialIntelligenceinthe21stCentury.ALivingIntroduction. MercuryLearningandInformation.2ndEdition.2016

Reference Books:

1. Russell,Norvig:ArtificialIntelligence,AModernApproach,PearsonEducation,SecondEdition. 2004
2. Rich,Knight,Nair:ArtificialIntelligence,TataMcGrawHill,ThirdEdition2009
3. SarojKaushik.ArtificialIntelligence.CengageLearning.2011

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ADVANCED DATABASE MANGEMENT SYSTEMS

(PEC-II)

Prerequisites: DBMS

Course Objectives:

1. To provide a sound introduction to Database management systems, databases and its applications and familiarize the student to give a good formal foundation on the relational model of data
2. To Introduce SQL for storing and retrieving databases
3. To give an introduction to systematic database design approaches concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
4. To Explore the File organizations, indexing and hashing mechanisms
5. To Explain the concepts of Distributed Database Management System

Course Outcomes:

1. Model Entity-Relationship diagrams for enterprise level databases (L3)
2. Formulate optimized Queries using SQL and Relational Formal Query Languages (L3)
3. Apply Various Normal forms for schema refinement and Differentiate serial and concurrent transaction and various concurrency control protocols algorithms (L4)
4. Use of suitable File organization, Indices and Hashing mechanisms for effective storage and retrieval of Data (L3)
5. Identify the features and advantages of Distributed Databases over centralized databases

UNIT I:

Introduction to Database System Concepts: Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

Introduction to the Relation Models and Database Design using ER Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

UNIT II:

Introduction to SQL : Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

Formal Relational Query Languages & Query Optimization: The Relational Algebra, Tuple Relational Calculus.Algorithm for Executing Query Operations: Select operation, Join operation, Project and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization.

UNIT III:

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+,}$ Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

Transactions & Concurrency Control: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability. Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols.

UNIT IV:

File Organization: Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

UNIT V:

Distributed Database Introduction of DDB, DDBMS architectures, Homogeneous and Heterogeneous databases, Distributed data storage, Advantages of Data Distribution, Disadvantages of Data Distribution Distributed transactions, Commit protocols, Availability, Concurrency control & recovery in distributed databases, Directory systems, Data Replication, Data Fragmentation. Distributed database transparency features, distribution transparency.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

Reference Books :

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, eigth Edition Pearson 2006
3. Tamer Ozsu.Patrick Valdureiz , Principles of Distributed Database Systems , Third Edition,Springer
4. P Raja Sekhar Reddy, A MallikarjunaReddy ,Foundations of Database Management Systems ,Lambert Academic Publishing, 2020 (e-Book)
4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

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	3	0	3

NATURAL LANGUAGE PROCESSING

(PEC-II)

Prerequisites: Artificial Intelligence, Machine Learning, Python Programming

Course Objectives:

1. To learn the fundamentals of Natural Language Processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To apply the NLP techniques to IR applications

Course outcomes:

1. To model the language using N-grams .
2. To implement a shallow processing models to tackle morphology/syntax of a language.
3. To Examine Syntagmatic and Paradigmatic relations be used for processing the real-time applications.
4. To apply the algorithms for Discourse Analysis.

UNIT I:

Introduction : Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Text Normalization, Minimum Edit Distance, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors

UNIT II :

Word Level Analysis : Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III :

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV:

Semantics And Pragmatics : Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V :

Discourse Analysis And Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Daniel Jurafsky, James H. Martin ,"Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Deepti Chopra, Nisheeth Joshi, Iti Mathur "Mastering Natural Language Processing with Python" First Edition, Packt Publishing, 2016

Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, Benjamin, Cummings publishing company, 1995.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python" , First Edition, OReilly Media, 2009
3. Rajesh Arumugam, Rajalingappaa Shanmugamani, "Hands-On Natural Language Processing with Python" , Packt Publishing Ltd., 2018
4. http://www.pdfdrive.com/natural-language-processing-with-python-e1251452.html
5. https://learning.oreilly.com/library/view/hands-on-natural-language/9781789139495

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	3	0	3

INTRODUCTION TO INTERNET OF THINGS

(PEC-II)

Pre-requisites: Computer Networks, Python Programming

Course Objectives:

1. Describe IoT and its working
2. Understand IoT Applications
3. Develop an IoT Application using Raspberry Pi Board
4. Design an IoT Application using Arduino Board
5. Understand different areas of robotics

Course Outcomes:

At the end of the course student will be able to:

1. Summarize the concepts of Internet of Things (L2)
2. Interpret Domain specific Internet of Things Applications (L2)
3. Develop programs for interfacing using Raspberry Pi (L6)
4. Design basic IoT applications using Arduino (L6)
5. Recite the fundamentals of Robotics (L1)

UNIT - I

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.

UNIT – II

Domain specific applications of IoT: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and lifestyle.

UNIT - III

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi-Interfaces (serial, SPI, I2C), Programming Raspberry PI with Python- Controlling LED with Raspberry PI, interfacing an LED and Switch with Raspberry PI and Interfacing a light sensor (LDR) with Raspberry PI.

UNIT - IV

Programming Arduino: Introduction, Arduino Boards, Programming-variables, if, loops, functions, digital inputs and outputs, the serial monitor, arrays and strings, analog inputs and outputs, using libraries, Arduino data types and commands. Programming Arduino Uno with Arduino- Controlling LED with Arduino, interfacing an LED and Switch with Arduino and Interfacing a light sensor (LDR) with Arduino.

UNIT - V

Introduction to Robotics: Classification, Advantages and Disadvantages, Components, Robot Joints, Robot Coordinates, Characteristics, Applications. Robotics Kinematics-Matrix representations. Actuators-Characteristics, Types of Actuators. Sensors-characteristics, types of sensors. (10 hours) Academic Project Work Submission using the Above Concepts.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015.

2. Simon Monk, Programming Arduino Next Steps: Going Further with Sketches, Second Edition,2019.

3. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia,2001.

Reference Books:

1.The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).

2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O’Reilly (SPD), 2014.

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech (DS)

M.Tech (DS) I Year I Sem	L	T / P / D	C
	0	3	1.5

MACHINE LEARNING LAB

(PCC-I LAB)

Objective:

The main objective of this laboratory is to put into practice the various machine learning algorithms for data analysis using Python and Weka.

ML Toolkits

Students are expected to learn

1. Scikit-learn(https://scikit-learn.org/) an open source machine learning Python library that supports supervised and unsupervised learning. It also provides various tools for model fitting, data preprocessing, model selection and evaluation, and many other utilities.
2. Weka (http://www.cs.waikato.ac.nz/ml/weka/)is another widely used ML toolkit.

Datasets

1. The sklearn.datasets package embeds small toy datasets. It includes utilities to load these datasets. It also includes methods to load and fetch popular reference datasets and features some artificial data generators. Students are expected to study and make use of these datasets
2. Weka also has provides various data sets.

References:

1. scikit-learn user guide.https://scikit-learn.org/stable//_downloads/scikit-learn-docs.pdf
2. Ian Witten, Eibe Frank, and Mark Hall, Chris Pal. DATA MINING: Practical Machine Learning Tools and Techniques, 4th Edition. Morgan Kaufmann.

Exercises

Week 1:

Write a Python program using Scikit-learn to split the iris dataset into 70% train data and 30% test data. Out of total 150 records, the training set will contain 120 records and the test set contains 30 of those records. Print both datasets

Week 2:

Write Python program to use sklearn’sDecisionTreeClassifier to build a decision tree for the sklearn’s datasets. Implement functions to find the importance of a split (entropy, information gain, gini measure)

Week 3:

Write a Python program to implement your own version of the K-means algorithm. Then apply it to different datasets and evaluate the performance.

Week 4:

Design a perceptron classifier to classify handwritten numerical digits (0-9). Implement using scikit or Weka.

Week 5:

Write a Python program to classify text as spam or not spam using the Naïve Bayes Classifier

Week 6:

Use WEKA and experiment with the following classifiers: Association Rule Mining (Apriori), Agglomerative and Divisive Clustering.

Week 7:

Comparative Study of K-Means and MiniBatch Kmeans Clustering Algorithms.

Week 8:

Model Section with Principal component analysis.

Week 9-16:

Study projects on Machine Learning Algorithms. Decide groups (3 members). Submission of abstract, introduction, related work and progress review, Final report and final presentations.

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	0	3	1.5

PYTHON PROGRAMMING LAB

(PCC -II LAB)

Week-1:

Installation and Environment set up of Python & Programs on Data types, Operators

Week-2:

Programs on Standard I/O, String, Files, List, Tuple

Week-3:

Programs on Dictionaries

Week-4:

Programs on Control Statement

Week-5

Programs on Functions

Week-6:

Programs on Strings and string operations

Week-7:

Programs on Regular Expressions.

Week-8:

Programs on Inheritance and overloding

Week-9:

Programs on Exception Handling

Week-10

Programs on Python Additional Concepts: Email and Web Programming

Week-11

Programs on Python Libraries

Week-12

Implementation of different application based on python programming.

Week-13:

Demonstration of Date and Time Packages

Week-14:Overview

Week-15:Overview

Text Books:

1. Beginning Python: using python 2.6 and Python 3.1, by James Payne, wiley Publication

2. Learning Python, 5th edition, O'reilly Publication

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M.Tech (DS)

M.Tech (DS) I Year II Sem	L	T / P / D	C
	3	1	4

BIG DATA ANALYTICS

(PCC-IV)

Prerequisites: Database management system, Java and Linux

Course Objectives:

1. To understand about Big Data and Analytics.
2. To learn the tools for Big Data Analytics.
3. To Understand Hadoop Fundamentals
4. To Understand the MapReduce and Hbase.
5. To learn Social and Mobile Analytics.

Course Outcomes:

After the completion of course students will be able to:

1. Identify need of Big Data and Analytics
2. Identify various Data Analytics Tools
3. Analyze components of HDFS
4. Apply several data intensive tasks using Map-Reduce paradigm
5. Demonstrate the applications of Social and Mobile Analytics

UNIT – I

Big Data Analytics: What is big data, Evolution of Big Data; Structuring Big Data; Characteristics of Big Data; What is Big Data Analytics, What Big Data Analytics Isn’t, Why this sudden Hype Around Big Data Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE);

UNIT – II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Developing an Analytic Team; Understanding Text Analytics;

Analytical Approach and Tools to Analyze Data: Analytical Approaches; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT - III

Big Data Technology Landscape and Hadoop: Hadoop; RDBMS versus Hadoop; History of Hadoop; Hadoop Overview; Hadoop Distributors, Processing of Data with Hadoop;

Storing Data in Hadoop: Introduction of HDFS, Architecture, HDFS (Hadoop Distributed File System), HDFS Daemons, read, write, Replica, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability.

UNIT – IV

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing;

Introducing HBase: Architecture, Storing Big Data with HBase, Interacting with the Hadoop Ecosystem; HBase in Operations Programming with HBase; Combining HBase and HDFS;

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

TEXT BOOKS:

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.

2. BIG DATA, Black Book TM, DreamTech Press, 2015 Edition.

3. BUSINESS ANALYTICS 5e, BY Albright |Winston

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez,” Business Intelligence –Practice, Technologies and Management”, John Wiley 2011.

2. Lariss T. Moss,ShakuAtre, “ Business Intelligence Roadmap”, Addison-Wesley It Service.

3. Yuli Vasiliev, “Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech (DS)

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M.Tech (DS) I Year II Sem	3	1	4

DATA WRANGLING & VISUALIZATION

(PCC-V)

Course Objectives:

1. To introduce the basic concepts of data wrangling using Python
2. To obtain the input data from a variety of sources
3. To extract the data and convert it into representations suitable for data analytics
4. To visualize the data

Course Outcomes: At the end of this course, students will be able to:

1. Use the pandas library
2. Load, store data in different file formats
3. Clean and prepare the data
4. Plot and Visualize data
5. Do data aggregation

UNIT-I

Getting started with pandas: Introduction to pandas Data Structures, Series, Data Frame, Index Objects. Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data

UNIT-II

Data Loading, Storage, and File Formats:XML and HTML: Web Scraping, Binary Data Formats: Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Web APIs, Interacting with Databases

UNIT-III

Data Cleaning and Preparation: Handling Missing Data, Filtering Out Missing Data, Filling In Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, String Manipulation, String Object Methods, Regular Expressions

UNIT-IV

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot,Saving Plots to File, matplotlib Configuration, Plotting with pandas and seaborn, Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data, Other Python Visualization Tools, Conclusion

UNIT-V

Data Aggregation and Group Operations:GroupBy Mechanics, Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels, Data Aggregation, Column-Wise and Multiple Function Application, Returning Aggregated Data Without Row Indexes, Pivot Tables and Cross-Tabulation

Text Books:

1. Wes McKinney. Python for Data Analysis: Data Wrangling with pandas, NumPy and IPython. O'Reilly, 2017, 2nd Edition
2. Jacqueline Kazil and Katharine Jarmul. Data Wrangling with Python. O'Reilly, 2016

Reference Books:

1. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
2. TyeRattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, and Connor Carreras. Principles of Data Wrangling: Practical Techniques for Data Preparation. O'Reilly, 2017
3. Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language. Fabio Nelli, Apress, 2015

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech (DS)

M.Tech (DS) I Year II Sem	L	T / P / D	C
	3	0	3

CLOUD COMPUTING

(PEC-III)

Prerequisites: Computer organization and computer networks.

Course Objectives:

1. To understand the concepts of virtualization and its benefits
2. To impart fundamental concepts in the area of cloud computing.
3. To impart knowledge in applications of cloud computing.
4. To understand various services in cloud applications
5. To know the architecture of disaster recovery and security of cloud

Course Outcomes:
At the end of the course the students will be able to:

1. Compare and contrast various cloud architectures. (L4)
2. Learn & Implement Virtualization .(L3)
3. Analyze and design storage mechanisms. (L4)
4. Apply security mechanism for the Cloud. (L3)
5. Discuss Disaster recovery in Cloud .(L5)

Unit I:

Introduction to Virtualization: Objectives of virtualization, history of virtualization, benefits of virtualized technology, the virtual service desk, what can be virtualized, related forms of computing, cloud computing, software as a service – SaaS, grid computing, utility computing, virtualization processes.

Virtualization Technologies-I: Ubuntu (server edition),Altiris, Windows server, Software virtualization, VMware, Intel virtualization, Red Hat virtualization, Soft grid application, Linux virtualization, Desktop virtualization, Hardware virtualization, Resource virtualization, Processor virtualization, Application virtualization.

Unit II:

Virtualization Technologies-II: Storage virtualization, Virtualization density, Para-virtualization, OS virtualization, Virtualization software, Data Storage virtualization, Intel virtualization technology, Thinstall virtualization suite, Net framework virtualization, Windows virtualization on Fedora, Storage virtualization technologies, Virtualization level, Security monitoring and virtualization, Oracle virtualization.

Unit III:

Virtualization and Storage Management: The heart of cloud computing-virtualization, defining virtualization, why virtualize, what can be virtualized, where does virtualization happen, how does virtualization happen, on the road to storage virtualization, improving availability using virtualization, improving performance through virtualization, improving capacity through virtualization, business value for virtualization.

Unit IV:

Introduction to Cloud Computing: Cloud Introduction and overview- Components, Infrastructure and Services, Why Use Cloud Computing, Benefits and Limitations, Cloud Application Architectures, Cloud Infrastructure Models, Cloud Computing Technology-Hardware & Software Infrastructure

Cloud Computing Architecture: Requirements, Introduction to Cloud Computing Architecture, various kinds of Cloud Computing Architecture, Grid Computing, Transactional Computing, On Demand Computing, and Distributed Computing.

Unit V:

Security: Security issues in Cloud Computing - Data Security, Network Security, and Host Security
Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.
Scaling a Cloud Infrastructure- Capacity Planning, Cloud Scale.
Case Studies: Amazon S3, Google APP Engine, IBM Clouds, Oracle OBIEE

Text Books:

1. Ivanka Menken, Gerard Blokdijk ,Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book, 2009.
2. George Reese, Cloud Application Architectures Building Applications and Infrastructure in the Cloud, O'Reilly Media Press, 2009.

Reference Books:

1. Anthony T. Velte, Tobe J. Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Publication Person Education, 2009
2. Tom Clark, Storage Virtualization: Technologies for Simplifying Data Storage and Management, Addison-Wesley, 2005
3. Curtis Brian J.S. Chee, Cloud Computing Technologies and Strategies of the Ubiquitous Datacenter, 2010

Web Resource:

1. https://bibliotech2803.files.wordpress.com/2018/04/cloud-application-architectures-oreilly-media.pdf

ANURAG UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech (DS)

M.Tech (DS) I Year I Sem	L	T / P / D	C
	3	0	3

PREDICTIVE ANALYTICS WITH R

(PEC-V)

Prerequisites : Basics of Statistics, Machine Learning and Basic knowledge in any Programming language

Course Objectives:

After taking the course, students will be able to

1. Use R for statistical programming, computation, graphics, and modeling,
2. Write functions and use R in an efficient way
3. Fit some basic types of statistical models
4. Use R in their own research,

Course Outcomes:

After successful completion of the course students should be able to

1. Understand the basics in R programming in terms of constructs, control statements, functions,
2. Access online resources for R and import new function packages into the R workspace
3. Import, review, manipulate and explore ,summarize data-sets in R
4. Apply the R programming from a statistical perspective
5. Apply R Graphics and Tables to visualize results of various Statistical operations on data.

Unit I :

Basics of R: Introduction, R-Environment Setup, Help functions in R, Vectors – Scalars – Declarations

Basic Data Types: Vectors – Scalars – Declarations, Creating and Naming Vectors, Vector Arithmetic, Vector Sub setting,

Matrices: Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Arrays - Class.

Unit II :

Factors: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Common functions used with factors

Data Frame: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Sub setting of Data Frames, Extending Data Frames, Sorting Data Frames.

Lists: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors, applying functions to lists

Conditionals and Control Flow:Arithmetic and Boolean operators and values, Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.

Unit III :

Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.

Functions in R: Introduction, Writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R, Cumulative Sums and Products, Calculus in R, Input and Output Operations.

Unit IV :

Apply Family in R : Introduction, Using Apply in R, Using Lapply in R, Using Sapply, Using Tapply in R: Split Function, Using Mapply in R,

Charts and Graphs : Introduction, Pie Chart: Chart Legend, 3D Pie Chart, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Unit V : Interfacing

Data Interfaces: Introduction, CSV Files: Syntax, Importing a CSV File, Excel Files: Syntax, Importing an Excel file, Binary Files: Syntax, XML Files, Web Data, Databases.

Statistical Applications: Introduction, Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering, Correlation and Covariance, T-Tests,-ANOVA.

<u>Text Books & Other References</u>

1. R Programming for Data Science by Roger D. Peng

2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India.

Reference Books:

1. R for Everyone, Lander, Pearson
2. R Cookbook, PaulTeetor, Oreilly.
3. R in Action,Rob Kabacoff, Manning

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

M.Tech (DS)

M.Tech (DS) I Year II Sem	L	T / P / D	C
	3	0	3

DEEP LEARNING

(PEC-IV)

Prerequisites: Basic Mathematics, P&S, Python and Machine Learning

Course Objectives:

1. To Give an exposure to Supervised Deep Learning for working with Linearly Non Separable Data
2. To provide understanding of Mathematical, Statistical and Computational challenges of building improved neural net representations. .
3. To Know the application of Convolution Neural Networks for High-Dimensional data, such as image and other data types
4. To Explore Deep Recurrent and Memory Networks for Sentiment Analysis, Machine Translation and Computer Vision tasks

Course outcomes:

1. Implement Deep Neural Networks for solving Classification and Regression Problems (L3)
2. Apply Regularization Methods to improve the way neural networks learn.(L3)
3. Analyze different optimation algorithms for training deep neural models(L4)
4. Apply the concepts of the Deep Convolution Neural networks for Image classification (L3)
5. Solve the sequence learning problems using Deep Recurrent Neural Networks and Memory Networks (L3)

UNIT I :

Introduction to Neural Networks: Challenges Motivating Deep Learning, AI vs ML vs DL, Applications of Deep Learning, Perceptron Model, Sigmoid Neuron Model, Feed Forward Neural Networks, Learning with Gradient Descent, Working of Backpropagation Algorithm, Loss Functions: Squared Error Loss, Perceptron Loss, and Cross Entropy Loss, Output Layer Functions: Sigmoid and Softmax Functions

UNIT II:

Regularization for Deep Learning: Bias and Variance Tradeoff, Regularization Need for Overfitting, Techniques of Regularization: L2 Regularization, L1 Regularization, Drop Out, Data Augmentation, and Early Stopping, Weight Initialization, Hyper-Parameters Tuning: Learning Rate and Batch Size.

UNIT III:

Optimization for Training Deep Models: Challenges to Train Deep Neural Networks: Vanishing Gradient Problem, Exploding Gradient Problem, and Unstable Gradient Problem, Optimization Algorithms: Momentum Based Gradient Descent, Nesterov Based Gradient Descent, AdaGrad, RMSProp, and Adam, Parameter Initialization Strategies

UNIT IV:

Convolutional Neural Networks: Convolution Operation: 1D Convolution Operation, 2D Convolution Operation, 2D Convolution with a 2D Filter, Padding and Stride, Motivation: How Convolution Operation related to Neural Networks, Max Pooling, CNN Architectures: Alexnet, and VGGNet, Batch Normalization, Drop Out.

UNIT V:

Recurrent Neural Networks: Introduction to Sequential Model Problems, Recurrent Neural Network Model, Computing radients in RNN, Challenge of Long- Term Dependencies, The Long Short Term Memory and other Gated RNNs.

Text Books:

1) Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning (1st Edition), MIT Press,2017, ISBN 978-0262035613.
2) Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

Reference Books:

1) Bharath Ramsundar & Reza Bosagh Zadeh, Tensor Flow for Deep Learning, O’Reilly Media ,2018
2) Francois Chollet, Deep Learning with Python (1st Edition), Manning Publications Company, 2017. ISBN 978-1617294433.
3) Aurélien Géron, Hands-on Machine Learning with Scikit-Learn and

TensorFlow (2nd Edition), O'Reilly Media, 2019. ISBN 978-9352139057.
4) http://faculty.neu.edu.cn/yury/AAI/Textbook/Deep%20Learning%20with%20Python.pdf
5) http://www.deeplearningbook.org/
6) https://www.pdfdrive.com/deep-learning-with-applications-using-python-chatbots-and-face-object-and-speech-recognition-with-tensorflow-and-keras-e184016771.html
7) https://www.pdfdrive.com/tensorflow-for-deep-learning-e187559485.html

B.Tech Honors Degree
In Data Science
B.Tech Honors Degree In Data Science

Serial No	Course code	Subject Name	Hours per Week			Credits
			L	T	P	
1	PC	Data Science	3	0	0	3
2	PC	Computational Data analytics	3	0	0	3
3	PC	Web Data Mining	3	0	0	3
4	PC	Analyzing, Visualizing and Applying data science with python	3	0	0	3
****		**Or Any other courses approved by BoS**				
5	Project	Project work	0	0	12	6
TOTAL			**12**	**0**	**0**	**18**

- **** Any other relevant course offered by MOOCs and approved by BoS**

B.TECH Minor Degree in CSE

Serial No	Course code	Subject Name	Hours per Week			Credits
			L	T	P	
1	PC	Design of Algorithms	4	0	0	4
		SELCT ANY TWO FROM 2,3,4,5, ….				
2	PC	Python Programming	3	1	0	4
3	PC	Database Management Systems (DBMS)	3	1	0	4
4	PC	Operating Systems	3	1	0	4
5	PC	Computer Networks and Security	3	1	0	4
***6	PC	Any other relevant course offered by MOOCs approved by internal BoS.				
		Professional Electives – need to Choose two courses from the following				
7	PE	1. Introduction to Artificial Intelligence 2. Software Engineering 3. Introduction to Data science 4. Introduction to Mobile application development 5. Introduction to Big data 6. Introduction to object oriented programming 7. Introduction to Machine Learning 8. Introduction to cloud computing ** Any other relevant course offered by MOOCs approved by internal BoS.	3 * 2	0	0	3 *2 6
TOTAL			**14**		**8**	**18**

- Out of first five Professional Core (PC) Courses First course is mandatory.
- The student needs to choose 2 courses from the rest of the four professional courses (Sno. 2, 3, 4, 5).
- Two courses need to be selected from the professional.
- **Total Theory Courses 5 => total credits 18**

e) Minutes of the BoS in Electronics & Communication Engineering

Board of Studies Meeting 2021

Minutes of the meeting

The Board of Studies meeting of Department of Electronics and Communication Engineering has been convened on 27.03.2021 10:30 am at 'E' Block Auditorium with the following BoS members:-

Dr. K. S. Rao, Director, Chairperson
Dr. S. Satheeskumaran, HOD/ECE, AU
Dr. P. Chandrasekhar, OU
Dr. Gajendranath Choudary, IIT, Hyderabad
Dr. M. Chakravarthy, Scientist -G, DLRL
Dr. Shantha Thoutam, Startup Evangelist
Dr. D. Narendhar Singh, AU

The agenda of the BOS meeting are:

1. To approve the curriculum & Syllabus of R2020 B.Tech. ECE
2. To approve the curriculum structure of R2021 M.Tech. VLSI system design & Embedded Systems
3. To approve Ph.D. coursework subjects
4. To approve the list of Open Electives
5. B.Tech minor degree & Honors Degree
6. Ph.D. entrance exam QP pattern

Agenda No.1:- The Curriculum & Syllabus of R2020 B.Tech. ECE has been approved with few modifications. The resolutions are:

- It is suggested to include the course on "Digital circuits" in II year I semester.
- It is suggested to include the course on "Control System" in II year II semester after completing Signals & Systems.
- In II-Year I-Semester Introduction to Probability Theory and Statistics, the topics related to Data Analytics to be included.
- In II-Year I-Semester Signals & Systems Lab, students should be encouraged to utilize Octave and other open source software to improve their programming skills.
- In II-Year II-Semester Pulse and Linear Integrated Circuits, Unit-V title should be D-A & A-D converters with appropriate syllabus.
- In II-Year II-Semester Electronic Circuit Analysis, the possibility of including few topics based on CMOS transistor and few experiments in the laboratory using Cadence
- In II-Year II-Semester Pulse and ICA lab, an experiment for demonstration of sampling theorem may be included.
- In II-Year II-Semester Pulse and ICA lab, many experiments can be converted into a single experiment covering all the fundamental concepts of Digital Circuits. All the experiments have to be redesigned.
- In II-Year II-Semester Digital Circuits Simulation Lab, Experiments like FPGA implementation of traffic light controller and other similar experiments can be included.

- All the Board members accepted to split the Analog & Digital Communication subject into two courses namely Analog Communication Systems, Digital Communication Systems.
- In III-Year I-Semester Microprocessors and Microcontrollers, BOS members suggested to continue the existing syllabus. The new topics on Arduino is not required to include in the theory. Few experiments on Arduino can be included in the First Electronics Laboratory to enable the students to develop some simple projects.
- Few more experiments related to PIC, ARM may be included in Microprocessor and microcontroller lab.
- Design of current mirror may be included in VLSI design lab.
- The following suggestions are made by BOS members regarding the inclusion of text books / reference books:-

i. In II-Year I-Semester Electronic Devices & Circuits lab, book on “A First Lab in Circuits & Electronics” by Yannis Tsividis has been suggested by Dr. Gajendranath Chowdhary for better understanding laboratory concepts.

ii. In II-Year II-Semester Electronics Measurements & Instrumentation, the book on “Modern Electronic Instrumentation and Measurement Techniques:A.D. Helbincs. W.D. Cooper: PHI” must be included as a text book.

iii. In II-Year II-Semester Electromagnetic Theory and Transmission Lines, the book on Electromagnetic waves & Radiating Systems, by E.C. Jordan & K.G. Balmain must be included as a text book.

iv. In II-Year II-Semester Digital Circuits, the book on “Switching and Finite Automata Theory” by Zvi Kohavi can be moved to reference books section.

v. In II-Year II-Semester Electronic Circuit Analysis, the book on “Integrated electronic- jacob millman & christor c halkias” has to be moved to reference book.

vi. In II-Year II-Semester Electronic Circuit Analysis, book on “Fundamentals of Microelectronics” by Razavi has been suggested to include as a reference book. BOS members suggested to include few topics focused towards MOSFET & CMOS.

vii. In III-Year I-Semester VLSI Design, the book on “CMOS logic circuit Design” by John P.Uyemura, may be included as a text books.

viii. In III-Year I-Semester Computer Organization & Operating Systems, “Computer Organization” by Carl Hamacher, ZvonksVranesic, SafeaZaky should be included as text books.

ix. In III-Year I-Semester Computer Networks, the book written by Andrew S. Tanenbaum on “Computer Networks” may be included as a text books.

Agenda No.2: The curriculum structure of R2021 M.Tech. VLSI system design & R2021 M.Tech Embedded Systems have been approved with minor modifications. The resolutions are:-

- CMOS Analog IC Design related experiments may be included in the I-Semester of M.Tech VLSI Design.
- II-Year M.Tech courses can be offered through NPTEL or Online Mode. However, the examinations should be conducted by Anurag University.

Agenda No.3: The following Ph.D. coursework subjects are approved in addition to M.Tech courses with 3 or 4 credits. BOS members also suggested to include additional course work subjects based on the requirement:-

i. Reconfigurable System Design
ii. Machine Learning & Intelligent Systems
iii. Advanced Biomedical Signal Processing
iv. Internet Protocols
v. Deep Learning
vi. Image Processing And Computer Vision

- Ph.D. Course work subject can also be offered through NPTEL or Online Mode. However, the examinations should be conducted by Anurag University.

Agenda No.4: The following list of Open Electives are approved by BOS:-

(a) List of Open Electives offered by ECE Department

i. Basics of Electronics Engineering
ii. Sensors and Instrumentation
iii. Signal Processing
iv. Introduction to Robotics
v. Digital Image Processing
vi. Electronics and Microprocessors
vii. Embedded Systems & IoT
viii. Introduction to Autonomous Systems
ix. Modeling and Simulation for Engineering Applications

(b) List of Open Electives required for ECE Department

i. Cyber security
ii. Entrepreneurship Development
iii. Robotics & Automation
iv. Mobile Application Development
v. Data Science and Analytics
vi. Industry 4.0 – Smart Manufacturing
vii. Deep Learning
viii. Intellectual Property Rights
ix. Renewable Energy Technologies

Agenda No.5: Regarding B.Tech minor degree & Honors Degree, the board has approved to offer honors & minor degree programmes. The students have to acquire extra 20 credits for completing minor or honor degree programmes. These extra subjects will be circulated to all the BOS members for approval.

Agenda No.6: Regarding Ph.D. entrance exam QP pattern, it is suggested to prepare question paper with different areas of specialization (Part-A Signal Processing, Part-B VLSI Design, Part-C Communication & Networking) may be set for Ph.D. entrance examination. The candidate can choose either Part-A or Part-B or Part-C. It will be discussed with Dean, Examinations for further approval.

Department of Electronics and Communication Engineering

Four years course structure
R20 regulation

B.Tech (ECE) I Year I Semester **4T+5L**

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	A51001	Mathematics–I	3	1	0	4.0
2	BSC	A51006	Applied Physics	3	1	0	4.0
3	ESC	A51007	Basic Electrical Engineering	3	0	0	3.0
4	ESC	A51004	Programming for Problem Solving- I	2	0	0	2.0
5	BSC	A51210	Applied Physics Lab	0	0	3	1.5
6	ESC	A51211	Basic Electrical Engineering Lab	0	0	2	1.0
7	ESC	A51212	Programming for Problem Solving Lab-I	0	0	3	1.5
8	ESC	A51213	Engineering workshop	0	0	3	1.5
9	HSSMC	A51214	English Language Skills Lab	0	0	2	1.0
			Total	**11**	**02**	**13**	**19.5**

B. Tech. (ECE) I Year II Semester **5T+3L**

S. No.		Course Code	Course Title	L	T	P	Credits
1	BSC	A52001	Mathematics–II	3	1	0	4.0
2	HSSMC	A52006	English	2	0	0	2.0
3	BSC	A52007	Engineering Chemistry	3	1	0	4.0
4	ESC	A52003	Programming for Problem Solving-II	2	0	0	2.0
5	ESC	A52008	Engineering Graphics & Design	1	0	3	2.5
6	HSSMC	A52214	English Communication skills Lab	0	0	2	1.0

7	BSC	A52215	Engineering Chemistry Lab	0	0	3	1.5
8	ESC	A52216	Programming and Problem Solving Lab-II	0	0	3	1.5
Total				**11**	**2**	**11**	**18.5**

B. Tech. (ECE) II Year I Semester **5T+ 3L+1MC**

S. No	Course Code	Category	Course Title	L	T	P	Credits
1	EC301	BSC	Mathematics-III	3	0	0	3
2	EC302	ESC	Electronic Devices & Circuits	3	0	0	3
3	EC303	PCC	Signals and Systems	3	1	0	4
4	EC304	BSC	Introduction to Probability Theory and Statistics	2	1	0	3
5	EC305	ESC	JAVA Programming	3	0	0	3
6	EC307	ESC	Electronic Devices & Circuits Lab	0	0	3	1.5
7	EC308	PCC	Signals and systems Lab	0	0	3	1.5
8	EC309	HSS&MC	Soft Skills for Success	0	0	2	1
9	EC310	MC	Environmental Studies	2	0	0	0
Total				**15**	**02**	**10**	**20**

B. Tech. (ECE) II Year II Semester **5T+ 3L+1MC**

S.No	Course Code	Category	Course Title	L	T	P	Credits
1	EC401	PCC	Electronic Measurements and ‘Instrumentation	3	0	0	3
2	EC402	PCC	Electro Magnetic Theory and Transmission ‘Lines	3	1	0	4
3	EC403	PCC	Pulse & Integrated Circuits	3	0	0	3
4	EC404	PCC	Digital Circuits	2	1	0	3

5	EC405	PCC	Electronic Circuit Analysis	3	0	0	3
6	EC406	PCC	Electronic Circuit Analysis Lab	0	0	2	1
7	EC407	PCC	Pulse & Integrated Circuits Lab	0	0	3	1.5
8	EC408	PCC	Digital Circuits Simulation Lab	0	0	3	1.5
9	EC409	MC	Gender Sensitization	2	0	0	0
Total				**16**	**01**	**08**	**20**

B. Tech. (ECE) III Year I Semester **5T+ 4L+1MC**

S.No	Course Code	Category	Course Title	L	T	P	Credits
1	EC501	PCC	Analog Communication systems	3	0	0	3
2	EC502	PCC	Microprocessors and Microcontrollers	2	1	0	3
3	EC503	PCC	Linear Control Systems	2	1	0	3
4	EC504	PCC	VLSI Design	3	0	0	3
5	EC505	PEC	**Open Elective – I** 1. Entrepreneurship Development 2. Introduction to Robotics & Automation 3. Mobile Application Development	3	0	0	3
6	EC506	PCC	Analog Communication systems Lab	0	0	2	1
7	EC507	PCC	Microprocessors and Microcontrollers Lab	0	0	3	1.5
8	EC508	PCC	VLSI Design Lab	0	0	2	1
9	EC509	MC	NSS/NSO	2	0	0	0
10	EC510	ESC	Quantitative Aptitude and reasoning	0	0	3	1.5
Total				**15**	**02**	**10**	**20**

B. Tech. III Year II Semester **5T+3L**

S.No	Course Code	Category	Course Title	L	T	P	Credits
1	EC601	HSS&MC	Project Management	3	0	0	3

2	EC602	PCC	Digital Communication systems	2	1	0	3
3	EC603	PCC	Digital Signal Processing	3	1	0	4
4	EC604	OEC	**Professional Elective-I** 1. CPLD &FPGA Architectures 2. Computer Organization and Operating System 3. Computer Networks	3	0	0	3
5	EC605	PCC	Embedded Systems & IOT	3	0	0	3
6	EC606	PCC	Digital Signal Processing Lab	0	0	3	1.5
7	EC607	PCC	Embedded Systems & IOT Lab	0	0	3	1.5
8	EC608	HSS&MC	Skills Integrated English Lab	0	0	2	1
Total				**14**	**02**	**08**	**20**

B. Tech. (ECE) IV Year I Semester **6T+2L**

S.No	**Course Code**	**Category**	**Course Title**	**L**	**T**	**P**	**Credits**
1	EC701	PCC	Microwave & Radar Engineering	2	1	0	3
2	EC702	PCC	Machine Learning & Artificial Intelligence	2	1	0	3
3	EC703	PEC	**Professional Elective –II** 1. Digital Image Processing 2. Software Defined Radio 3. Low power VLSI	3	0	0	3
4	EC704	PEC	**Professional Elective –III** 1. Cellular & Mobile Communication 2. CAD for VLSI circuits 3. Adaptive Signal Processing	3	0	0	3
5	EC705	PEC	**Professional Elective –IV** 1. Advanced Antenna Theory & Design/ Physical System Design 2. Optical Communication 3. Bio-Medical Signal Processing and Tele Medicine	3	0	0	3
6	EC705	PEC	**Professional Elective-V** 1. Analog VLSI Design 2. Organic and Flexible	3	0	0	3

			Electronics 3. Satellite Communication				
7	EC707	PCC	Microwave & Digital Communication Lab	0	0	2	1
8	EC708	PCC	Machine Learning & Artificial Intelligence ‘Lab	0	0	2	1
9	EC709	PROJ	Mini Project/ Summer Internship	0	0	4	2
Total				**18**	**02**	**04**	**22**

B. Tech. (ECE) IV Year II Semester

S. No	**Course Code**	**Category**	**Course Title**	**L**	**T**	**P**	**Credits**
1	EC801	OEC	**Open Elective –II** 1. Intellectual Property Rights 2. Disaster Management 3. Technical and Business Communication	3	0	0	3
2	EC802	OEC	**Open Elective –III** 1. Deep Learning 2. Data Science and Analytics 3. Industry 4.0 – Smart Manufacturing	3	0	0	3
3	EC803	PROJ	Technical Seminar	-	-	4	2
4	EC804	PROJ	Comprehensive Viva	-	-	-	2
5	EC805	PROJ	Project	-	-	-	10
Total				**12**	**0**	**04**	**20**

List of Open Electives offered by ECE Department

1. Basics of Electronics Engineering (Prerequisite: Applied Physics)
2. Instrumentation and Sensors (Prerequisite: Applied Physics)
3. Fundamentals of Signal Processing (Prerequisite: Mathematics-I)
4. Introduction to Autonomous Systems (Prerequisite: Applied Physics)
5. Digital Image Processing (Prerequisite: Mathematics)
6. Electronics and Microprocessors (Prerequisite: Applied Physics)
7. Embedded Systems & IoT (Prerequisite: Microprocessors)

8. Modeling and Simulation for Engineering Applications (Prerequisite: Applied Physics)

S.No	Category	Credits
1	HSS&MC	9
2	BSC	25
3	ESC	26
4	PCC	60
5	PEC	15
6	OEC	9
7	PROJ	16
	TOTAL	**160**

B.Tech-ECE- II-Year I-Semester	L	T/P/D	C
	3	0/0-	3

ELECTRONIC DEVICES AND CIRCUITS

Prerequisite: APPLIED PHYSICS

Course Objectives:

- To learn the characteristics of diode and how to make use of diode in different applications
- To explain the operation and characteristics of transistors in different modes
- To apply different biasing methods to make transistor stable
- To explain the operation and design of FET amplifiers.
- To analyse feedback amplifiers

UNIT-I:P-N JUNCTION DIODE AND RECTIFIERS:

Review of P-N Junction Diode Volt-Ampere Characteristics, Transition and Diffusion Capacitances, Diode Equivalent Circuits, The P-N Junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Inductor Filters, Capacitor Filters, Voltage Regulation Using Zener Diode. Zener Diode Characteristics.

UNIT-II: BIPOLAR JUNCTION TRANSISTOR AND FIELD EFFECT TRANSISTOR:

The Junction Transistor, BJT Operation, Common Base, Common Emitter and Common Collector Configurations,Transistor as an Amplifier.

The Junction Field Effect Transistor Pinch –Off Voltage –Volt –Ampere Characteristics, MOSFET Operation, MOSFET Characteristics In Enhancement and Depletion Modes.

UNIT-III: TRANSISTOR BIASING AND STABILIZATION:

Operating Point, The DC and AC Load Lines, Need for Biasing, Types of biasing methods: Fixed Bias, Collector Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization Against Variation In V_{BE} and β, Bias Compensation Using Diodes and Transistors. Thermal Runway, Thermal Stability.

UNIT-IV: BJT AND FET AMPLIFIERS:

BJT Hybrid Model, Determination of h-Parameters from Transistor Characteristics, Comparison of CB, CE and CC Amplifier Configurations. The JFET Small Signal Model, FET Common Source Amplifier, Common Drain Amplifier, FET as Voltage Variable Resistor, Comparison of BJT And FET, The Uni junction Transistor

UNIT–V: FEED BACK AMPLIFIERS

Concepts of feedback. Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Problems.

TEXT BOOKS:

1. Integrated Electronics Analog and digital circuits and systems– J. Millman,C.C.Halkias, and SatyabrataJit Tata McGraw Hill, 2nd Ed., 2007.

2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition,2006.

3. Introduction to Electronic Devices and Circuits- Rober T. Paynter PE,2005.

4. Electronic Devices and Circuits – A. P. Godse Technical Publications.2009.

REFERENCE BOOKS:

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.

2. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 2003.

3. Microelectronics – Millman and Grabel, Tata McGraw Hill, 2001.

4. Electronic Devices and Circuits – Dr. K. Lal Kishore,2004,BSP

Course Outcomes:

After completing the course, students should be able to

- Apply the diode concepts in different applications
- Understand the BJT, FET and revolutionary MOSFET that lead to the development of integrated circuits and study their construction and characteristics
- Compare different biasing methods and compensation methods to make transistor stable
- Design and analyse simple basic amplifiers using Hybrid model.
- Design and analyse feedback amplifiers using BJTs

B.Tech-ECE- II-Year I-Semester **L T/P/D C**

3 0/0- 3

SIGNALS AND SYSTEMS

Prerequisite: MATHEMATICS-I

Course Objectives:

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series
- To get the idea of signal representation in Fourier transforms domain and sampling
- To understand operation of linear systems and corresponding responses of system
- To present the concepts of convolution and correlation integrals and make the foundation for advanced courses.
- To analyze the system using Laplace and Z-transforms

UNIT-I: Signal Analysis and Fourier Series:

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

UNIT-II: Fourier Transforms and Sampling

Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function,

Sampling theorem–Graphical and analytical proof for Band Limited Signals,Types of Sampling -Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples.

UNIT-III: Signal Transmission Through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics.

UNIT-IV: Convolution and Correlation of Signals: Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Energy density spectrum, Parseval's Theorem, Power density spectrum, Relation between Auto Correlation function and Energy/Power spectral density function.

UNIT-V: Laplace Transforms and Z-Transforms

Review of Laplace Transforms (L.T), Partial fraction expansion, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various classes of signals, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. Fundamental difference between Continuous and Discrete time signals, Discrete time signal representation using Complex exponential and Sinusoidal components, Periodicity of Discrete time signal using complex exponential signal, Concept of Z-Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

TEXT BOOKS

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.1997.

REFERENCES

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition,2008.

2. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.

3. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson

education.3rd Edition, 2004.Publications, 2nd Edition, 2005.

Course Outcomes:

After completing the course, students should be able to

- Represent any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.
- Express periodic signals and non-periodic signals in terms of Fourier transform and representation of the spectrum and to design a system for sampling a signal.
- Understand the principle of linear system, filter characteristics of a system and its band width,
- Understand the concepts of auto correlation and cross correlation and power Density Spectrum.
- Find Laplace transform and Z-transform of various signals and response of the system using Laplace transform and Z-transform

B.Tech-ECE II-Year -I-Semester **L T/P/D C**

3 0/0- 3

INTRODUCTION TO PROBABILITY THEORY AND STATISTICS

Course Objectives:

- To provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in signal processing and Communication Engineering.
- To introduce students to the basic methodology of "probabilistic thinking" and to apply it to problems;
- To understand basic concepts of probability theory and random variables, how to deal with multiple random variables, Conditional probability and conditional expectation, joint distribution and independence, mean square estimation.
- To learn statistics which is art of learning from data and its analysis
- To apply estimation method to predict unknown population parameter.

UNIT- I: PROBABILITY

Probability Introduced through Sets , Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Introduced through Axioms, Probability Introduced through Relative Frequency, classical definition of Probability, Mathematical Model of Experiments, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.

UNIT II: RANDOM VARIABLE AND OPERATIONS ON SINGLE RANDOM VARIABLE

Definition of a Random Variable, Types of Random Variables, Conditions for a Function to be a Random Variable, Distribution and Density functions, Examples- Binomial, Poisson, Uniform ,Gaussian, Conditional Distribution and Conditional Density function,Expected Value of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Moment Generating Function.

UNIT III: MULTIPLE RANDOM VARIABLES AND OPERATIONS ON MULTIPLE RANDOM VARIABLES

Vector Random Variables, Joint Distribution and Joint Density Functions , Marginal Distribution and Marginal Density Functions, Statistical Independence, Conditional Distribution and Density functions, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Proof not expected),Expected Value of a Function of Joint Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Moment

Generating Function, Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties,

UNIT IV: INTRODUCTION TO STATISTICS:

Introduction to Statistics: Population and Samples, Describing Data sets, Summarizing Data sets, normal data sets, paired data sets and the sample correlation coefficient, mean, mode, median, Sampling Distribution of mean (known and unknown) Proportions, Estimation: Point Estimation, Interval Estimation, Bayesian Estimation

.**UNIT V: TEST OF HYPOTHESIS:**

Null Hypothesis, Hypothesis concerning one mean, Hypothesis concerning two means, Estimation of proportions, Hypothesis concerning one proportion, Hypothesis concerning several proportions, Significance tests: student's T-test, F-test, Goodness of fit, Estimation of Proportions, Curve fitting: The method of least squares, Curvilinear Regression, Multiple Regression, correlation for univariate and bivariate Distributions

TEXT BOOKS

1. Introduction to Probability and statistics for engineers and scientists-Sheldon M.Ross, 5th Edition2014.
2. Introduction to Probability and statistics –J.Susan Milton,Jesse C.Arnold,4th Edition, Tata McGraw Hill2009.
3. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.TMH.
4. Probability, Random Variables and Stochastic Processes – Athanasius Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

REFERENCES

1. Probability and random processes with stochastic processes- Mallikarjuna Reddy Cengae Learning, 4^{th} edition, 2013.
2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 2012.
4. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.
5. Probability and Statistics-Shahnaz Bathul, 2006

Course Outcomes:

After completing the course, students should be able to

- Apply Concepts of probabilities using an appropriate sample space.
- Apply Simple probabilities and expectations from probability density functions (pdfs) Likelihood ratio tests from pdfs for statistical engineering problems. Least -square & maximum likelihood estimators for engineering problems.
- Compute the distribution of a function of several random variables.
- Analyze Statistical Properties such as Mean and variance for sample data.
- Analyze and minimize the residuals between actual data and observed data

B.Tech-ECE- II-Year I-Semester **L T/P/D C**

0 0/3- 1.5

ELECTRONIC DEVICES AND CIRCUITS LAB

Course Objectives:

- To operate and characterize the behavior of devices and circuits.
- To understand the functionality of semiconductor devices.
- To design and test rectifiers with and without filters
- To design and test amplifiers circuits.
- Implementation of a few experiments using Arduino.

PART A:

ELECTRONIC WORKSHOP PRACTICE:

Identification, Specifications, Testing of R, L, C, Components (Color Codes),

1. Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays,

   Bread Boards, PCB's
2. Identification, Specification and Testing of Active Devices, Diodes, BJT's LOW power

   JFET's, MOSFET's, Power Transistors, LED's, Arduinos, UJT.
3. Study and operation of
   - Multi-meters (Analog and Digital)
   - Regulated Power Supplies
   - Function Generator
   - CRO

PART B (For Laboratory Examination – Minimum of 10 experiments)

List of Experiments:

1. Forward & Reverse Bias Characteristics of PN Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Half Wave Rectifier with & without filters.
4. Full Wave Rectifier with & without filters
5. Input & output characteristics of Transistor in CB Configuration.
6. Input & output Characteristics of Transistor in CE Configuration.
7. FET characteristics.

8. Measurement of h- parameters of transistor in CB, CE, CC configurations
9. MOS characteristics
10. Current Shunt and Voltage Series Feedback Amplifiers.
11. Frequency Response of FET Amplifier (Common source).
12. Arduino based voltage regulator.
13. Switching circuit with Arduino to control LED
14. UJT Characteristics.

Requirements:

1.Regulated power supplies (RPS)		
2.CRO's	:	0-20MHZ
3.Function Generator	:	0-1 MHZ
4.Multimeters		
5.Decade Resistance Boxes / Rheostats		
6.Decade Capacitance Boxes		
7.Ammeters (Analog or Digital)	:	0-20µA, 0-50µA, 0-100µA, 0-200µA,0-10 mA
8.Voltmeters (Analog or Digital)	:	0-50V,0-100V, 0-250V
9.Electronic Components	:	Resistors, Capacitors, BJTs, LCDs, Arduinos, UJTs, FETs, LEDs, MOSFETs, diodes Ge& Si type, Transistors NPN, PNP type

Course Outcomes:

After completing the course, students should be able to

- Understand electronic test equipment to characterize the behaviour of devices and circuits.
- Plot the characteristics of semiconductor devices to understand their functionality.
- Design and test rectifiers with filters
- Design and test amplifier circuits and interpret the results.
- Design and test of Feedback amplifiers circuits and interpret the results.

B.Tech-ECE- II-Year I-Semester **L T/P/D C**

0 0/3- 1.5

SIGNALS AND SYSTEMS LAB

List of Experiments (12 Experiments to be done):

Course Objectives:

- To be able to describe signals mathematically and understand how to perform mathematical operations on signals. The operations should include operations on the dependent as well as independent variables.
- To understand system properties - linearity, time invariance, presence or absence of memory, causality, bounded-input bounded-output stability, and invertability. Be able to identify whether a given system exhibits these properties and its implication for practical systems.
- To be able to perform the process of convolution between signals and understand its implication for analysis of linear time-invariant systems. Understand the notion of an impulse response.
- To be able to solve a linear constant coefficient differential equation using Laplace transform techniques.
- To develop basic problem-solving skills and become familiar with formulating a mathematical problem from a general problem statement.

List of Experiments:

1. Basic operations on matrices.
2. Generation of various signals and sequences(periodic),such as unit impulse, unit step, square, sawtooth, triangular, sinusoidal, ramp, sinc.
3. Operation on signal and sequence such as addition, multiplication, scaling, folding, shifting, computation of energy and average power.
4. Finding the even and odd parts of continuous signals/sequences, real and imaginary part of continuous signals/sequences.
5. Convolution between two signals and any two sequences.
6. Auto correlation and cross correlation between two signals and any two sequences.
7. Verification of linearity and time invariance properties of a given continuous /discrete system.
8. Computation of unit sample, unit step and sinusoidal response of the given LTI system and verifying its physical realization and stability properties.
9. Gibbs phenomenon.
10. Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform synthesis using Laplace transform.
12. Locating the zeros and poles and plotting the pole zero maps in s-plane and z-plane for the given transfer function..
13. Sampling theorem verification.
14. Removal of noise by auto correlation/ cross correlation.

Requirements:

For the basic simulation lab.

1. Computer System with latest specifications.
2. Connected in LAN (Optional)
3. Operating system (Windows XP or higher)
4. MATLAB or SCILAB

Course Outcomes:

After completing the course, students should be able to

- Describe the basics of MATLAB/SCILAB syntax, functions and programming.
- Generate and characterize various continuous and discrete time signals.
- Perform the basic operations on the signals.
- Design and analyze linear time-invariant (LTI) systems and compute its response.
- Analyze the spectral characteristics of signals using Fourier analysis, Laplace transform and Z-transform.

B.Tech ECE II-Year -II-Semester			
	L	**T/P/D**	**C**
	3	**0/0-**	**3**

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Prerequisite: Applied Physics

Course Objectives:

- To develop an awareness to various electronic measurement Concepts
- To know the operation and design of different electronic instruments
- To learn the operation of various generators and analyzers
- To measure using AC and DC bridges
- To Familiarize with different types of transducers.

UNIT-I

Proposed:

Block Schematics of Measuring Systems, Performance Characteristics: Static Characteristics: Accuracy, Resolution, Precision, Gauss Error, Types of Errors. Dynamic Characteristics: Repeatability, Reproducibility, Fidelity, Lag.

Analog Measuring Instruments: D' Arsonval Movement, DC Voltmeter and Ammeter, rectifier type AC Voltmeters, Ohmmeters, Multimeter, Extension of Range of voltmeter and ammeter , True RMS Responding Voltmeters. Ramp type DVM, Digit display.

UNIT-II

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Delay lines, Dual Beam CRO. Applications, Specifications.

Special purpose oscilloscopes: Sampling oscilloscopes, Storage oscilloscopes, digital Storage CROs, Frequency and Period Measurements. Lissajous Figures, CRO Probes.

UNIT-III

Signal Generators: AF Signal Generator, RF Signal Generator, Function Generator, Specifications.

Signal Analyzers: AF Wave Analyzers, HF Wave Analyzers, Heterodyne wave Analyzers, Harmonic Distortion Analyzers, and Spectrum Analyzers.

UNIT-IV

Measurements using DC and AC Bridges: Detectors and Generators for bridges. Wheatstone Bridge, Kelvin Bridge, Maxwell, Hay, Anderson Bridges, Schering, Wagner's ground connection.

UNIT –V

Transducer: Classification, Piezoelectric Transducer, Thermocoupler, Resistance Thermometers, Strain gauges: Bonded, unbounded, LVDT, Variable Capacitance Transducers, MEMS.

Measurement of Physical Parameters: Flow, displacement, Pressure, temperature, pH, gases. Data Acquisition Systems.

TEXT BOOKS:

1. Electronic Instrumentation: H.S.Kalsi - TMH. Z'a Edition 2004.
2. Modern Electronic Instrumentation and Measurement Techniques:A.D. Helbincs. W.D.Cooper: PHI 56 Edition 2003.

REFERENCE BOOKS:

1. Electronic Measurements and Instrumentation- K. Lal Kishore, Pearson Education 2010.
2. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

Course Outcomes:

After completing the course, students should be able to

- Describe the measuring concepts and instrumentation systems.
- Explain the operation of oscilloscopes
- Use and various generators and analyzers
- Apply the measuring concepts using AC and DC bridges
- Calculate physical parameters.

B.Tech-ECE II-Year -II-Semester **L T/P/D C**

3 1/0- 4

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

UNIT – I

Sources of electromagnetic fields- Review of Vector calculus, Static electric fields: Coulombs law, Gauss law, electrostatic potential, Magnetostatics: Ampere’s law, Magnetic vector potential, self and mutual inductance, Time varying fields, Maxwell's Equations, Boundary conditions at Media Interface.

UNIT – II

Electromagnetic Waves: Wave Equation, Uniform plane electromagnetic waves, Propagation of electromagnetic waves in different media, polarization, Continuity equation, Poynting theorem.

UNIT-III

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary

UNIT-IV

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

UNIT-V

Antennas **:** Introduction, Basic Antenna Parameters-patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain - Resolution, Antenna Apertures, Effective Height, Fields from oscillating dipole, Field zones, shape-impedance considerations, Antenna Temperature, Front to back ratio, Antenna Theorem.Wave Propagations **-** Introduction, Definitions, categorizations and general classifications, different modes of wave propagation

Text Books:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 4th ed., 2001.
2. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
3. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Pearson, 2nd Edition 2015

4. Antennas and wave propagation – John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, TMH 4th Edn.,(Special Indian edition) 2010.

Reference Books:

1. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech.India Publications), New Delhi, 2001.
2. Narayana Rao, N: Elements of Engineering Electromagnetics, Pearson, 6thEdition 2006.
3. Engineering Electromagnetic – Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2nd ed., 2005.
4. Networks, Lines and Fields – John D. Ryder, PHI, 2nd ed.,2003.
5. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.

Course Outcomes:

After completing the course, students should be able to

- Apply Maxwell's equations to solve equations of EM fields
- Characterize uniform plane waves and wave propagation
- Calculate reflection and transmission of waves at media interface
- Explain the characteristics and wave propagation on high frequency transmission lines
- Describe the principle of radiation and radiation characteristics of an antenna

B.Tech, ECE II Year.-II Sem **L T/P/D C**

3 1/0- 4

PULSE AND INTEGRATED CIRCUITS

UNIT I: LINEAR AND NONLINEAR WAVE SHAPING

Linear Wave Shaping:High pass & Low pass RC circuits and their responses for sinusoidal, step voltage, pulse, square wave, and ramp inputs. High pass RC circuit as Differentiator, Low pass RC circuit as an Integrator, Nonlinear Wave Shaping: Diode clippers, clipping at two independent levels, Clamping operation, Clamping circuits using diodes, Clamping circuit theorem, comparator circuit.

UNIT II: MULTIVIBRATORS

Multivibrators: Transistor as a switch,Transistor- switching times. Analysis and Design of Bistable, Monostable and Astable Multivibrator using Transistors, Schmitt trigger using transistors.

UNIT III: INTEGRATED CIRCUITS

Classification, Chip Size and Circuit Complexity, Ideal and Practical Op-Amp, Op-amp characteristics-DC and AC Characteristics. 741 Op-Amp and its Features, Modes of operation-inverting, non-inverting, differential. Applications- Basic Applications of Op-Amp, Sample & Hold Circuits, Differentiators and Integrators, Comparators, Schmitt Trigger.

UNIT IV: ACTIVE FILTERS, TIMERS & PHASE LOCKED LOOPS

Active Filters: First Order and Second Order Low Pass, High Pass filters, Band Pass, Band Reject and All Pass Filters.**555 Timers:** Functional Diagram, Monostable, Astable Operations and Applications, Schmitt Trigger.**Phase Locked Loop (PLL):** Block Schematic, Principles and Description of Individual Blocks of 565, VCO.

UNIT V: DATA CONVERTERS

Converters: D-A & A-D Converters- Introduction, Basic DAC Techniques - Weighted Resistor Type, R-2R Ladder Type, Inverted R-2R Type. Different types of ADCs - Parallel Comparator Type, Counter Type, Successive Approximation Register Type and Dual Slope Type, DAC/ADC Specifications.

TEXTBOOKS.

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, and Mothiki S. Prakash Rao, 2ed., 2008, TMH.
2. Linear Integrated Circuits -D. Roy Choudhury, New Age International (p)Ltd, 3" Ed., 2008.
3. Op-Amps and Linear Integrated Circuits - Concepts and Applications by James M. Fiore, Cengage/ Jaicc, 2/e, 2009.

REFERENCE BOOKS:

1. Pulse and Digital Circuits-A. Anand Kumar, PHI, 2005.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.
3. Modern Digital Electronics - RP Jain - 4/e - TMH, 2010.
4. Digital Fundamentals - Floyd and Jain, Pearson Education, 8th Edition, 2005.

B.Tech-ECE II-Year -II-Semester **L T/P/D C**

3 0/0- 3

DIGITAL CIRCUITS

Prerequisite: ANALOG DEVICES & CIRCUITS

Course Objectives:

This course provides in-depth knowledge of digital logic and its Verilog representation. which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To verify and design the digital circuit by means of Computer Aided Engineering tools which involves programming with the help of Verilog HDL.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

UNIT-1:

NUMBER SYSTEMS AND CODES: Review of number systems binary arithmetic, binary weighted and non-weighted codes. Error detecting and error correcting codes.**BOOLEAN ALGEBRA:** Postulates and theorems: representation of switching functions, SOP and POS forms Karnaugh Map representations, minimization using K Maps. Tabular minimization – design of single output and multi output functions design using conventional AND, OR, NOT, NAND, NOR & EX-OR gates.

UNIT-II: INTRODUCTION TO VERILOG HDL: Verilog as HDL, Levels of Design Description, Simulation & Synthesis, Language Constructions. Gate Level Modeling: AND, OR, INVERTER and Other Gate Primitives.

UNIT- III:

COMBINATIONAL CIRCUITS: Adders,Subtractors Encoder,Decoder,multiplexer, demultiplexer, code converters, Comparator, parity bit generators/checkers. 4 bit adder and carry look-ahead adder Logic implementations using ROM, PAL & PLA Design of Basic Combinational Circuits through Verilog HDL.

UNIT-IV: SEQUENTIAL CIRCUITS AND MACHINES:

Asynchronous versus synchronous circuits, state table and state diagram, state assignment, memory elements and their excitation functions, flip flop: RS, D, JK, T and their excitation requirements. Design of synchronous sequential circuits: binary counters, shift registers. Melay and Moore machines, state equivalence and machine minimization, Introduction to ASM chart.Design of Basic Sequential Circuits through Verilog HDL.

UNIT V: DIGITAL INTEGRATED CIRCUITS INTRODUCTION: Classification of Integrated Circuits, Standard TTL NAND Gate-Analysis & Characteristics, Tristate TTL, MOS & CMOS Open Drain and Tristate outputs, Comparison of Various Logic Families. IC interfacing- TTL driving CMOS & CMOS driving TTL.

Text Books:

1. Digital Logic Computer Design – By M. Morris Mano, PHI.1979
2. Digital Logic Design Principles – By Norman Balbamian and Breadly, John Wiley,2001.
3. S. Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson, 2003.
4. Digital Fundamentals - Floyd and Jain, Pearson Education,8th Edition, 2005.

References:

1. Introduction to Switching Theory and Logic Design- By F. J. Hill and Peterson, John Wiley Publications,1974.
2. Digital Logic – Applications & Design – By- John M. Yarbroough, Vikas Publications, 1997.
3. Digital Systems Principles, Applications– By Ronald J. Tocci, Pearson Education/Phil,2011.
4. Switching And Finite Automata Theory – By Zvi Kohavi, TMH Edition,3rd edition, 2009.
5. VerilogHDL Primer -By J.Bhasker BSpublications 2008.

Course Outcomes:

After completing the course, students should be able to

- Understand numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.

- Understand Verilog programing in three different modelling and apply it for combinational and sequential circuit.
- Apply simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Design sequential circuits by using sequential functions/building blocks to build larger more complex circuits.
- Design and analyze the circuits using Finite state machines and minimization of state machines.

B.Tech-ECE II-Year -II-Semester **L T/P/D C**

3 0/0- 3

ELECTRONIC CIRCUIT ANALYSIS

Prerequisite: ELECTRONIC DEVICES AND CIRCUITS

Course objectives:

- To classify the single stage amplifiers and to understand the distortion in amplifiers and to analyse the amplifiers at Low Frequencies using Approximate Hybrid Model.
- To learn the concepts of frequency response and analyse the BJT and MOS Amplifiers at Low and High Frequencies. To analyse the CE amplifier with SC current gain and resistive loads at High frequencies using Hybrid-Pi Model.
- To classify and Analyse the multistage amplifiers.
- To classify the Large signal amplifiers and determine the efficiency of each one.
- To classify and analyse the Tuned amplifiers and Oscillators.

Unit-I : SINGLE STAGE AMPLIFIERS : Classification Of Amplifiers, Distortion In Amplifiers, Analysis Of CB, CE And CC Amplifiers Using Exact and Approximate Hybrid Model, Millers Theorem And Its Dual, Design Of CE Amplifier.

Unit-II: FREQUENCY RESPONSE OF BJT AND MOS AMPLIFIERS -: Frequency Response of BJT and MOS Amplifiers, Analysis At Low And High Frequencies. Hybrid Pi Model of BJT and MOS, CE Short Circuit Current Gain, Alpha, Beta Cut-Off Frequencies.

Unit-III : MULTI STAGE AMPLIFIERS: Different Coupling Schemes Used In Amplifiers- RC Coupled Amplifiers, Transformer Coupled Amplifiers And Direct Coupled Amplifiers. Analysis Of Cascaded RC Coupled BJT Amplifiers, Cascode Amplifiers, Darlington Pair, Effect of cascading on Gain and Bandwidth .

Unit – IV: LARGE SIGNAL AMPLIFIERS: Classification, Class A Large Signal Amplifiers, Transformer Coupled Class A Audio Power Amplifiers, Efficiency of Class A Amplifier, Class B Amplifier, Efficiency of Class B Amplifier, Class B Push-Pull Amplifier, Complementary Symmetry Class B Push-Pull Amplifier, Cross-Over Distortion, Heat Sinks.

Unit –V: TUNED AMPLIFIERS AND OSCILLATORS: Classification of Tuned Amplifiers, Quality Factor, Analysis of Single Tuned Amplifiers. OSCILLATORS: Conditions for oscillations, Principle of operation: RC Oscillators (RC Phase Shift Oscillator and Wein Bridge Oscillator), LC Oscillators (Hartley Oscillator and Colpitts Oscillator) and Crystal Oscillator.

TEXT BOOKS:

1.Fundamentals of Micro Electronics by Behzad Razavi, 2nd ed.,2013, Wiley.

2.Electronic devices and circuits - -S.Salivahana, N. Suresh kumar, A vallavaraj, 2^{nd} ed.,2011.

3.Integrated electronic- Jacob Millman & Christor C Halkias, 2 ed.,2008, TMH.

References:

1. Introductory electronic devices and circuits- Robert T. Paynter, 7^{th} ed.,2009, Pearson Education India.

2. Electronic circuit analysis- K.Lal Kishore , 2004, BSP Publication.

3. Electronic devices & circuit David A Bell-5^{th} ed,.Oxford university press,1999.

4. Design of Analog CMOS Integrated Circuits – Behzad Razavi, 2008, TMH.

Course outcomes:

After completing the course, students should be able to

- Design and analyse the single stage amplifiers at Low Frequencies using Approximate Hybrid Model.
- Analyze the BJT Amplifiers at High Frequencies using Hybrid –Pi Model and determine α and β cutoff frequencies.
- Describe the importance of Multi stage amplifiers and to analyze them to find frequency parameters.
- Explain the application of Large signal amplifier and the usage of heat sinks.
- Analyze the effect of cascading Single tuned and double tuned amplifiers on Bandwidth and understand the stability of the tuned amplifiers.

B.Tech-ECE- II-Year II-Semester	**L T/P/D C**
	0 0/2- 1

ELECTRONIC CIRCUIT ANALYSIS LAB

List of Experiments (12 Experiments to be done):

Objectives:

- To design and test the various amplifier circuits.
- To understand the operation of the amplifier circuits by plotting the frequency response curve.
- To operate and test the feedback amplifier circuits and interpret the results.
- To generate the signals for the desired frequency using oscillator circuits.
- To operate the large signal amplifiers and find the efficiency.

I) Design verification using Simulation tools (Any 6 Experiments):

1. Common Emitter Amplifier.
2. Common Base Amplifier.
3. Two Stage RC Coupled Amplifier.
4. Colpitts Oscillator.
5. Cascode Amplifier.
6. Wien Bridge Oscillator using Transistors.
7. RC Phase Shift Oscillator using Transistors.
8. Class A Power Amplifier (transformer less).
9. Class B Complementary Symmetry Amplifier.
10. Common Gate (JFET) Amplifier.

II. Testing in the Hardware Laboratory (6 Experiments)

A) Any Three circuits simulated in simulation laboratory

B) Any Three of the following

1. Class A Power Amplifier (with transformer load)
2. Class C Power Amplifier.
3. Single Tuned Voltage Amplifier.
4. Hartley Oscillators.

5. Darlington Pair.
6. Common Collector Amplifier.

Requirements:

1. For software simulation of Electronic circuits.
   (i) Computer System with latest specifications.
   (ii) Connected in LAN (Optional)
   (iii) Operating system (Windows XP)
   (iv) Suitable Simulations Software.
2. For Hardware simulations of Electronic Circuits
   (i) Regulated Power Supply (0-30V)
   (ii) CRO's
   (iii) Function Generators
   (iv) Multimeters
   (v) Components.

Course outcomes:

After completing the course, students should be able to

- Design and test various amplifier circuits and to find the gain.
- Calculate the lower and upper 3 dB frequencies and Bandwidth of the amplifier circuits.
- Design and test the feedback amplifier circuits and interpret the results.
- Design and test the oscillator circuits and interpret the results.
- Design and test the large signal amplifier circuits and interpret the results.

B. Tech-ECE II-Year -II-Semester **L T/P/D C**

0 0/3- 1.5

PULSE & INTEGRATED CIRCUITS LAB

Course Objectives:

- To design the various wave shaping circuits.
- To demonstrate generation of various non-sinusoidal waveforms.
- To analyze the operational amplifiers, timers and their applications in electrical and
electronics circuits.
- To acquire the knowledge on Digital IC families, its specifications and applications.
- To distinguish linear and digital ICs for different applications

Minimum 12 experiments to be conducted:

List of Experiments

PART –I DESIGN VERIFICATION OF THE FOLLOWING CIRCUITS.

1. Linear wave shaping. (Using LabVIEW/Multisim software)
2. Non-Linear wave shaping- Clippers. (Using LabVIEW/Multisim software)
3. Non-Linear wave shaping –Clampers. (Using LabVIEW/Multisim software)
4. Transistor as a switch. (Using LabVIEW/Multisim software)
5. Astable Multivibrator.
6. Monostable Multivibrator.
7. Bistable Multivibrator.
8. Sampling gates

PART –II TO VERIFY THE FOLLOWING FUNCTIONS USING IC 741, IC 555, 74 SERIES TTL IC'S, CMOS IC'S

9. Adder, Subtractor, Comparator using IC 741 Op-Amp.
10. Integrator and Differentiator using IC 741 Op-Amp.
11. Active Low Pass & High Pass Butterworth (second order).
12. IC 555 timer in Monostable operation.
13. Schmitt trigger circuits using IC 741 & IC 555
14. 4 bit comparator 74LS85.

15. 8X1 Multiplexer- 74151 and 2X4 Demultiplexer-74155.
16. 3-8 decoder – 74LS138.
17. D Flip (74LS74) and JK Master-Slave Flip-Flop (74LS73).
18. Decade counter (74LS90) and UP –Down Counter (74LS192).
19. Universal Shift registers – 74LS194/195.

Equipment required for Laboratories:

1. Regulated Power Supply - 0-30 V
2. CRO - 0-20 M Hz
3. Function Generators - 0- 1 M Hz
4. Components
5. Multimeters

Course Outcomes:

- *After completing the course, students should be able to*
- *Design linear and nonlinear wave shaping circuits.*
- *Create various waveforms such as Square, Pulse and Sweep.*
- *Design electronic switch.*
- *Use of operational Amplifier (IC 741).*
- *Design circuits using operational amplifiers for various applications.*
- *Design various combinational circuits using various Digital Integrated IC's.*
- *Describe the differences between Linear and Digital Integrated IC's.*
    -

B.Tech-ECE- II-Year II-Semester **L T/P/D C**

0 0/3- 1.5

DIGITAL CIRCUITS SIMULATION LAB

Course Objectives:

- To learn basic digital circuit equipments.
- To design and verify basic gates.
- To implement combinational logic circuits.
- To implement sequential logic circuits.
- To design and verify FSM

I. Design all the experiment and verify by using hardware Trainer kits/equipment (Any Six)

1. Introduction to Digital Laboratory equipments and tools
2. Design basic gates and verify their truth tables.
3. Design and implement a multiplexer.
4. Design and implement encoder and decoder
5. Design a Half adder, full adder & verify its truth table.
6. Design and construct basic flip-flops.
7. Design and construct of 4bit binary Counter.
8. Design and construct universal 4-bit shift register.
9. Finite State Machine design

II. Write a Verilog HDL for any 8 experiments and simulate the same using Cad tools.

1. Verilog HDL code to realize all the logic gates.

2.Verilog HDL code to realize 3 to 8 decoder and 8 to 3 encoder .

3.Verilog HDL code to realize 8 to 1 multiplexer and1 to 8 demultiplexer. .

4.Verilog HDL code to realize a half adder, full adder.

5.Verilog HDL code to realize 4 bit comparator.

6.Verilog HDL code to realize basic flip-flops.

7.Verilog HDL code to realize a 4-bit binary Counter.

8.Verilog HDL code to realize a universal 4-bit shift register.

9.Design and Implementation of Digital Lock.

10.Design and Implementation of Traffic Light controller.

11.Design and Implementation of 4 Bit ALU.

12. Design and Implementation of Vending Machine.

Requirements:

1. Hardware Trainer Kits
2. FPGA Trainer Kits
3. Computer System with latest specifications
4. Software HDL Verilog (Xilinx- Vivado)

Course Outcomes:

After completing the course, students should be able to

- Explain the basic digital circuit equipment.
- Design and verify basic gates.
- Implement combinational logic circuits.
- Implement sequential logic circuits.
- Design and verify FSM

Department of Electronics and Communication Engineering

R 2021 M.Tech. Embedded Systems

Semester-I

S. No.	Category	Course	Scheme of Studies per Week			Credits
			L	T	P	
1.	PC	Microcontrollers & Embedded System Design	3	0	0	3
2.	PC	Embedded Real Time Operating System	3	0	0	3
3.	PE	Embedded C Programming with Scripting Languages Network Security and Cryptography	3	0	0	3
4.	PE	Advanced Digital System Design MEMS Technology Network Embedded Processors	3	0	0	3
5.	PE	Advanced Digital Signal Processing Communication Buses and Interfaces SOC Architecture	3	0	0	3
6.		Research Methodology	2	0	0	2
7.	PC	Embedded system Lab-1	0	0	4	2
8.	PC	Embedded system Lab-2	0	0	4	2
Total			**17**	**0**	**8**	**21**

Semester-II

S. No.	Category	Subject	Scheme of Studies per Week			Credits
			L	T	P	
1.	PC	IOT and its Applications	3	1	0	4
2.	PC	Embedded Programming	3	1	0	4
3.	PE	Wireless Sensor Networks AI & Machine Leaning Robotics and Automation	3	0	0	3
4.	PE	Smart System Design Network Security and Cryptography VLSI and DSP Architectures	3	0	0	3
5.	OE	Open Elective	3	0	0	3
6.		Audit Course	2	0	0	0
7.	PC	Embedded system Lab-3	0	0	4	2
8.		Seminar	0	0	4	2
Total			**17**	**0**	**8**	**21**

Semester-III

S.No.	Subject	Scheme of Studies per Week			Credits
		L	T	P	
1.	Project Review I	0	0	24	12
Total		**0**	**0**	**24**	**12**

Semester-IV

S.No.	Subject	Scheme of Studies per Week			Credits
		L	T	P	
1.	Project Review II	0	0	28	14
Total		**0**	**0**	**28**	**14**

Audit Courses:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

Open Electives:

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy
7. Intellectual Property Rights

Department of Electronics and Communication Engineering

R 2021 M.Tech. VLSI System Design

Semester-I

S. No.	Category	Course	Scheme of Studies per Week			Credits
			L	T	P	
9.	PC	VLSI design verification and testing	3	0	0	3
10.	PC	CMOS Analog IC Design	3	0	0	3
11.	PE	CMOS Digital IC Design Hardware Software Co-Design CPLD and FPGA Architectures and Applications	3	0	0	3
12.	PE	Algorithms for VLSI Design Automation Embedded System Design Advanced Computer Architecture	3	0	0	3
13.	PE	VLSI Technology Advanced Digital System Design Device modeling	3	0	0	3
14.		Research Methodology	2	0	0	2
15.	PC	HDL Programming Lab	0	0	4	2
16.	PC	CMOS Digital IC Design Lab	0	0	4	2
Total			**17**	**0**	**8**	**21**

Semester-II

S. No.	Category	Subject	Scheme of Studies per Week			Credits
			L	T	P	
9.	PC	Low Power VLSI Design	3	1	0	4
10.	PC	Full custom IC Design	3	1	0	4
11.	PE	VLSI and DSP Architectures CMOS Mixed Signal Circuit Design Device modeling	3	0	0	3
12.	PE	RF IC Design System on Chip Architecture Scripting Languages	3	0	0	3
13.	OE	Open Elective	3	0	0	3
14.		Audit Course	2	0	0	0
15.	PC	ASIC CAD Lab	0	0	4	2
16.		Seminar	0	0	4	2
Total			**17**	**0**	**8**	**21**

Semester-III

S.No.	Subject	Scheme of Studies per Week			Credits
		L	T	P	
2.	Project Review I	0	0	24	12
Total		**0**	**0**	**24**	**12**

Semester-IV

S.No.	Subject	Scheme of Studies per Week			Credits
		L	T	P	
2.	Project Review II	0	0	28	14
Total		**0**	**0**	**28**	**14**

Audit Courses:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

Open Electives:

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy
7. Intellectual Property Rights

Department of Electronics and Communication Engineering

HONORS DEGREE

I. AI for Signal Processing

S. No	Course Code	Category	Course Title	L	T	P	Credits	Course to be handled
1			Statistical signal processing	3	0	0	3	NPTEL
2			Machine Learning & AI	3	0	0	3	University faculty
3			Deep learning for Image processing	3	0	0	3	NPTEL
4			Signal processing algorithms using Matlab / Python	3	0	0	3	University faculty
5			Project	-	-	-	6	
Total				**12**	**00**	**00**	**18**	

II. Circuits and VLSI

S. No	Course Code	Category	Course Title	L	T	P	Credits	Course to be handled
1			Analog CMOS Circuit Design	3	0	0	3	NPTEL
2			Mixed Signal Design	3	0	0	3	University faculty
3			System on Chip Design and Test	3	0	0	3	University faculty
4			RF Integrated Circuits	3	0	0	3	NPTEL
5			Project	-	-	-	6	
Total				**12**	**00**	**00**	**18**	

III. Embedded Systems & IoT

S. No	Course Code	Category	Course Title	L	T	P	Credits	Course to be handled
1			Embedded Software and Hardware Architecture	3	0	0	3	University faculty
2			Introduction to Architecting Smart IoT Devices	3	0	0	3	University faculty
3			Advanced Microcontrollers	3	0	0	3	NPTEL
4			Computer Network and Internet Protocols	3	0	0	3	NPTEL
5			Project	-	-	-	6	
Total				**12**	**00**	**00**	**18**	

Department of Electronics and Communication Engineering

MINOR DEGREE

Robotics

S.No.	Course Code	Category	Course Title	L	T	P	Credits	Course to be handled
1			Robotics & Automation	3	0	0	3	University faculty
2			Micro-Processors and Microcontrollers	3	0	0	3	NPTEL
3			Introduction to Robot Operating System	3	0	0	3	University faculty
4			Computer Vision	3	0	0	3	NPTEL
5			Embedded Systems & Robotics	3	0	0	3	NPTEL
6			Sensors & IoT	-	-	6	3	University faculty
Total				**12**	**00**	**00**	**18**	

f) Minutes of the BoS in Electrical & Electronics Engineering

Minutes of Meeting

The BOS meeting of the Department of EEE, AU was held on 20-03-21 in the Electrical simulation lab of the department. The meeting started at 10.00 AM. The following members attended the meeting.

List of BoS members present

1.	Prof.P.V.N.Prasad	Chairman
2.	Dr. T. Anil Kumar	HOD & Member
3.	Dr. G. Yesuratnam	Member
4.	Dr. P. Chow Reddy	Member
5.	Dr.Radhika Sudha	Member
6.	Dr.Shiva kumar keerthiparti	Member
7.	Dr.D.M.Vinod Kumar	Member
8.	Dr. G. Venu Madhav	Member
9.	Dr. C. Nagamani	Member
10.	Mr.CH.Srinivasa Rao	Member
11.	Mrs.S.Saraswathi	Member
12.	Mr. Md.Yaseen	Member
13.	Mr.T.Dinesh	Member

The chairman welcomed the members, after fruit full deliberations the following decisions were taken in the meeting.

1. The course structure of B.Tech (EEE) II, III, IV Year of R-20 was approved with certain modifications.
   - Suggested to move III-I Sem Subject (Electrical Measurements) to II-II Sem.
2. The syllabus of the B.Tech (EEE) II Year I & II Semister subjects were approved with certain modifications.
   - Suggested to add applications of DC Motors in EM-I course.
3. The course structure & syllabus of B.Tech (Hons) in Smart Grids and Electric Vehicles were approved.
4. The course structure & syllabus of B.Tech (Minor) in Electric Vehicles were approved.

5. The course structure & syllabus of M.Tech (PEED & EPS) of R-21 were approved.
6. The syllabus for Ph.D Eligibility Exam was approved.

Finally the Chairman thanked to all the members for their valuable suggestions.

Electrical & Electronics Engineering (B.Tech)

B.Tech (EEE) II Yr. I Sem. (3rd Semester) **6T+2L+1MC**

S.No.	Category	Course Title	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics-III	3	0	0	3
2	PCC	Network Theory	3	0	0	3
3	ESC	Fluid Mechanics and Hydraulic Machines	2	0	0	2
4	PCC	Electrical Machines – I	3	0	0	3
5	ESC	Electromagnetic Fields	3	0	0	3
6	PCC	Electronics Devices and Circuits	3	0	0	3
7	PCC	Electrical Networks & Simulation Lab	0	0	3	1.5
8	PCC	Electronics Devices and Circuits Lab	0	0	3	1.5
9	MC	Gender Sensitization	2	0	-	0
TOTAL						**20**

B.Tech (EEE)II Yr.II Sem. (4th Semester) **6T+2L+1MC**

S.No.	Category	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	Digital Circuits	3	0	0	3
2	PCC	Electrical Machines – II	3	0	0	3
3	PCC	Power Systems-I	3	0	0	3
4	PCC	Control Systems	3	0	0	3
5	ESC	Python Programming	2	0	0	2
6	HSMC	Managerial Economics & Financial Analysis	3	0	0	3
7	PCC	Electrical Machines Lab- I	-	0	3	1.5
8	PCC	Control Systems Lab	-	0	3	1.5
9	MC	Environmental Studies	2	0	0	0
TOTAL						**20**

B.Tech (EEE)III Yr.I Sem. (5th Semester) **6T+2L+1MC**

S.No.	Category	Course Title	Hours per week			Credits
			L	**T**	**P**	
1	PCC	Power Systems-II	3	0	0	3
2	PCC	Power Electronics	3	0	0	3
3	PCC	Electrical Machines –III	3	0	0	3
4	PCC	Integrated Circuits & Applications	3	0	0	3
5	PEC-I	1. Renewable Energy Technology 2. Electrical Machine Design 3. Control System Design	3	0	0	3
6	OEC-I	1. Entrepreneurship Development 2. Disaster Management &Mitigation 3. Java Programming	3	0	0	3
7	PCC	Electrical Machines Lab -II	-	0	3	1
8	HSMC	Advanced Communication Skills Lab	-	0	2	1
9	MC	NSS/NSO	2	0	-	0
TOTAL			**18**	**00**	**08**	**20**

B.Tech (EEE) III Yr.II Sem. **(6th Semester)** **6T+3L**

S.No.	Category	Course Title	Hours per week			Credits
			L	**T**	**P**	
1	PCC	Switch Gear & Protection	3	0	0	3
2	PCC	Power System Operation & Control	3	0	0	3
3	PCC	Micro Processor & Micro Controllers	3	0	0	3
4	PCC	Electrical Measurements & Instrumentation	3	0	0	3
5	PEC-II	1. Signals & Systems 2. Advanced Power Electronics Converters 3. Industrial Electrical Systems	3	0	0	3
6	ESC	Introduction to AI & ML	2	0	0	2
7	ESC	Quantity Aptitude and Logical Reasoning	0	0	3	1.0
8	PCC	Power Electronics & Simulation Lab	0	0	3	1.0
9	PCC	Measurements and Instrumentation Lab	0	0	3	1.0
TOTAL			**17**	**00**	**09**	**20**

B.Tech (EEE)IV Yr.I Sem. (7th Semester) **6T+2L+1Mini Project**

S.No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	PCC	Power System Analysis	3	0	0	3
2	PCC	Power Semiconductor drives	3	0	0	3
3	PEC-III	1. Electrical Distribution Systems 2. Flexible Alternating Current Transmission System 3. Electromagnetic Waves	2	0	0	2
4	PEC-IV	1. Electrical and Hybrid Vehicles 2. Power System Dynamics and Control 3. HVDC Transmission Systems	3	0	0	3
5	PEC-V	1. High Voltage Engineering 2. Smart Grid Technologies 3. AI Techniques in Electrical Engineering	3	0	0	3
6	PEC-VI	1. Utilization of Electrical Energy 2. Electrical Energy Conservation and Auditing 3. Digital Control Systems	3	0	0	3
7	PCC	Power Systems and Simulation Lab	0	0	2	1.5
8	PCC	Micro Processor & Micro Controllers Lab	0	0	2	1.5
9	PROJ	Mini Project / Summer Internship	0	0	3	2
TOTAL			**17**	**00**	**10**	**22**

B.Tech (EEE) IV Yr. II Sem. (8th Semester) **2T+Proj +sem**

S.No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	OEC-II	1. Project Management 2. Technical and Business Communication 3. Database Management System	3	0	0	3
2	OEC-III	1. Intellectual Property Rights 2. Internet of Things 3. Nano Science and Nano Technology	3	0	0	3
3	PROJ	Major Project	0	0	20	10
4		Comprehensive Viva Voce	0	0	0	2
5	PROJ	Technical Seminar	0	0	4	2
TOTAL			**06**	**00**	**24**	**20**

B.Tech. EEE II Year I Semester **L T C**
3 0 3

Mathematics-III

Numerical Methods & Partial Differential Equations

Course Objectives:

1. To determine the approximate solution of algebraic and transcendental equations using iterative methods and interpolate the values for the given data.
2. To know the concepts of Numerical Differentiation to find the higher order derivatives for the tabulated values and finding integration of given data points with various step sizes by using Numerical methods.
3. To determine the solution of linear first order initial value problems using single and multi step methods.
4. To know the formation of PDE's and solution of linear and non-linear PDE's using various methods.
5. To classify PDE's and Solve One Dimensional Heat & Wave equations.

Unit-I: Solution of Non- linear Equations
Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – Newton-Raphson Method.
Interpolations:
Introduction- Finite differences (Forward Differences, Backward differences and divided difference) Lagrange's Interpolation formula, Newton divided, Newton's forward and backward difference interpolation formulae - Problems.

Unit-II: Numerical Differentiation using interpolation formulae.
Numerical integration: Newton's cotes qudratureformulae,Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.

Unit-III: Numerical solution of Ordinary Differential Equations
Solution by Taylor's series-Picard's Method of successive Approximations- Euler and modified Euler's methods -Runge-Kutta Method.

Unit-IV: Partial differential equations of First Order
Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations, Charpits Method.

Unit-V: Partial differential equations of Second Order
Method of separation of Variables for second order equations. Classification of general second order partial differential equations. Applications of Partial Differential Equations-One dimensional wave equation, Heat equation.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010
3. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

References Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Solve the algebraic and transcendental equations using numerical methods and also find the polynomial using given set of tabulated values and estimation of the functional value within the data by Interpolation.
2. Apply the method of Numerical Differentiation and Numerical Integration for engineering problems.
3. Solve the first order initial value problems using Taylors, Euler and Runge-Kutta methods.
4. Use concepts of partial differential equations to solve linear and non-linear problems.
5. Solve Heat conduction and wave equations by using method of separation of variables and identify the consistent solution.

B.Tech EEE II Year I Semester **L T C**
3 0 3

Network Theory

COURSE OBJECTIVES:

1. To prepare the students to have a basic knowledge in the analysis of electric networks.
2. To solve the given circuit with various theorems and methods.
3. To analyse the various three phase circuits using star and delta connections.
4. To distinguish between tie set and cut set methods for solving various circuits

Unit –I:NETWORK TOPOLOGY: Definitions - Graph - Tree, Basic cut-set and Basic Tie-set matrices for planar networks - Duality & Dual networks.

THREE PHASE CIRCUITS: Phase sequence- Star and delta connection-Relation between line and phase voltages and currents in balanced systems- Analysis of balanced and unbalanced three phase circuits-Measurement of active and reactive power.

Unit-II: D.C AND A.C TRANSIENT ANALYSIS
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms .
Transient response of R-L, R-C, R-L-C circuits (series only) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms .

Unit-III: NETWORK FUNCTIONS
The concept of complex frequency, Physical interpretation of complex frequency, Transform impedance and Transform circuits, Series and Parallel combination of elements, Terminal pairs or ports, Network functions for the one port and two port, poles and zeros of network functions, Significance of poles and zeros, Properties of driving point functions, Properties of transfer functions, Necessary conditions for driving point function, Necessary conditions for transfer functions, Time domain response from pole zero plot.

Unit-IV: NETWORK PARAMETERS
Two port network parameters- Z, Y, A, B, C, D and Hybrid parameters and their relations.
Cascaded networks, Concept of transformed network- Two port network parameters using transformed variables.

Unit-V: FILTERS AND FOURIER ANALYSIS OF A.C CIRCUITS
Low pass, High pass, Band pass, Band Elimination, Prototype filter design. The Fourier theorem, Fourier series consideration of symmetry, exponential form of Fourier series.

TEXT BOOKS:

1. *A.Chakrabarthy*, Dhanpat Rai & Sons, Electric circuits 2006.
2. *A.Sudhakar and ShyammohanS.Palli*, Circuits & Networks- Tata McGraw-Hill, 2012.

REFERENCE BOOKS:

1. *B.Subrahmanyam* -Electric Circuit analysis, I.K International

2. <u>*Mahmood Nahvi*</u>, *Joseph Edminister*, Schaum's *Network* analysis Outlines, 4th Edition, McGraw-Hill Companies,Incorporated, 2003.
3. *M.E Van Valkenberg.* Network Analysis- Prentice-Hall, 1974.
4. *C.L.Wadhwa*, Electric circuit analysis - New Age International, 2006.
5. K.*Rajeswaran,* Electrical circuits theory- Pearson Education, 2004.
6. *D.R Cunningham. & J.A. Stuller*, Basic circuits analysis - Jaico Publications, 1993.

COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to

1. Understand and remember the basic concepts of power measurement methods in balance and unbalance load circuits, Two port networks, and filters networks.
2. Analyze basic concepts of filters, Tie-set and Cut-set Matrix techniques in networks.
3. Analyze of two port networks impedance, admittance, transmission lines and hybrid parameters.
4. Evaluate the transient response in ac and dc Networks, two port networks and design of filter circuits to eliminate harmonics and ripples in the networks.

B.Tech EEE II Year I Semester

	L	T	C
	2	**0**	**2**

Fluid Mechanics and Hydraulic Machinery

Course Objectives:

1. To understand the concept of fluid and its properties, hydrostatic forces.
2. To Study the basic laws of fluids, flow patterns and their corresponding problems.
3. To outline the concepts of boundary layer theory, flow separation, concepts of dimensional analysis.
4. To explain the hydrodynamic forces acting on vanes and their performance evaluation.
5. To summarize the importance, function and performance of hydraulic systems.

Unit – I: Fluid Statics

Definition of fluid, physical properties of fluids-specific gravity, viscosity, surface tension, vapor pressure. Atmospheric pressure, gauge and vacuum pressures, measurement of pressure – Piezometer, U-tube manometer, differential and inverted manometers.

Unit – II: Fluid Kinematics

Steam line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational &irrotational flows. Continuity equation for one dimensional flow and three dimensional flows.

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for fluid flow along a stream line.Momentum equation and its application on force on pipe bend.

Measurement of Flow: Venturimeter, Orificemeter, Pitot tube.

Unit – III: Closed Conduit Flow

Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes – pipes in series and pipes in parallel, equivalent pipes, total energy line&hydraulic gradient line.

Boundary Layer Concepts: Definition, thickness, characteristics along the thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Unit – IV: Basics of Turbo Machinery

Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design. Draft tube theory, functions and efficiency.

Unit – V: Performance of Hydraulic Turbines

Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Centrifugal Pumps: Classification, working, works done, barometric head, losses and efficiencies, specific speed, performance characteristic curves, NPSH.

Reciprocating Pumps: Discharge, work done, power, slip, indicator diagrams.

Text Books:

1. MODI and SETH Hydraulics, fluid mechanics and Hydraulic machinery- Rajsons Publications
2. Rajput, Fluid Mechanics and Hydraulic Machines- S Chand Publications
3. Dr.R.K.Bansal ,Fluid Mechanics and Hydraulic Machines- Laxmi Publications.

Reference Books:

1. D.S Kumar, S.K. Kataria& amp; Sons -Fluid Mechanics and fluid power Engineering
2. D. Rama Durgaiah-Fluid Mechanics and machinery- New Age International Publishers
3. Banga&; Sharma- Hydraulic Machines- Khanna Publishers.
4. R.S.Khurmi -Hydraulics, Fluid Mechanics and Hydraulic Machines- S.Chand Publications
5. SukumarPati -Fluid Mechanics and Hydraulic Machines - McGraw Hill Publication

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Classify the properties of fluids and its measurement.
2. Analyze the flows and identify the fluids behavior in motion.
3. Develop the expression for Bernouli expression and to study the laws
4. Explain the performance of vanes and design the turbines.
5. Analyze the performance of hydraulic turbines, understand the basics of pumps, their types and efficiencies

B.Tech EEE II Year I Semester	L	T	C
	3	0	3

Electrical Machines-I

Course Objectives:

1. To get basic knowledge of DC Generators
2. To understand necessity and conditions of parallel operation of DC Generators
3. To acquire basic knowledge of DC Motors
4. To know the various Speed control and methods of starting DC motors
5. To determine efficiencies of DC machines by various methods of testing

Unit- I: D.C. Generators – Construction & Operation

D.C. Generators – Principle of operation – Action of commutator – constructional features classification of DC generators – separately excited and self excited generators – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature –E.M.F Equation – Problems – Armature reaction – cross magnetizing and demagnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation.

Unit- II: Operating Characteristics of D.C. Generators

Build up of EMF – magnetization curve/OCC characteristics – critical field resistance and critical speed – causes of failure to self excite – remedial measures – load characteristics of D.C shunt, series and compound generators – parallel operation of D.C series generators – use of equalizer bar and cross connection of field windings – load sharing – problems and applications.

Unit- III: D.C. Motors

D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation – application of DC Motors- speed control of D.C. Motors: armature voltage and field flux control methods – Ward-Leonard system.

Unit- IV: Losses and Efficiency of DC Machines

Principle of 3 point and 4 point starters – protective devices.
Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency, numerical problems.

Unit- V: Testing of D.C. Machines

Testing of D.C. machines: Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne’s test – Hopkinson’s test – Field’s test – Retardation test – separation of stray losses in a D.C. motor test.

Text Books:

1. JB Gupta, SK kataria and sons -Theory and performance of Electrical Machines- 14th Edition
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

References Books:

1. E. Fitzgerald and C. Kingsley -Electric Machinery- New York, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain basic concepts of DC generator
2. Obtain performance characteristics and perform parallel operation of DC generators
3. Explain basic concepts of DC motor
4. Apply various Speed control methods of DC motors
5. Test DC machines and determine their efficiency

B.Tech EEE II Year I Semester

	L	T	C
	3	**0**	**3**

Electromagnetic Fields

Course Objectives:

1. To gain basic concepts of vector algebra and vector calculus useful for comprehensive introduction and knowledge of vector calculus for electromagnetic fields and its application
2. To understand various laws of electromagnetism.
3. To understand the behavior of conductors, dielectrics and capacitance in static electric filed.
4. To understand the concepts of static magnetic fields.
5. To study time varying fields and Maxwell's equation.

Unit - I: Review of Vector Calculus

Vector algebra addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator-del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

Unit - II: Static Electric Field

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line and Surface charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Unit - III: Conductors, Dielectrics and Capacitance

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Unit - IV: Static Magnetic Fields, Magnetic Forces, Materials and Inductance

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.
Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Unit - V: Time Varying Fields and Maxwell's Equations

Faraday's law for Electromagnetic induction, Motional Electromotive forces, Displacement current, Point form of Maxwell's equations, Integral form of Maxwell's equations,. Poynting theorem.

Text Books:

1. M. N. O. Sadiku, “Elements of Electromagnetics”, Oxford University Publication, 2014.
2. W. Hayt,“Engineering Electromagnetics”, McGraw Hill Education, 2012

References Books:

1. W. J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
2. W. J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968
3. Dr. TVS Aruna Murthy “Electro- Magnetic Fields (Theory and Problems), S Chand Publications.2011

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Explain the basic concept of vector algebra.
2. Apply the basic laws of electromagnetism.
3. Analyze and drive expressions for behavior of conductors, Dielectrics and capacitance in electric fields.
4. Analyze the magnetic materials & magnetic fields.
5. Derive Maxwell’s equation in various forms.

B.Tech EEE II Year I Semester **L T C**
3 0 3

ELECTRONIC DEVICES AND CIRCUITS

Prerequisite: APPLIED PHYSICS

Course Objectives:

1. To learn the characteristics of diode and how to make use of diode in different applications
2. To explain the operation and characteristics of transistors in different modes
3. To apply different biasing methods to make transistor stable
4. To explain the operation and design of FET amplifiers.
5. To analyze feedback amplifiers

Unit-I:P-N JUNCTION DIODE AND RECTIFIERS:

Review of P-N Junction Diode Volt-Ampere Characteristics, Transition and Diffusion Capacitances, Diode Equivalent Circuits, The P-N Junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Inductor Filters, Capacitor Filters, Voltage Regulation Using Zener Diode. Zener Diode Characteristics.

Unit-II: BIPOLAR JUNCTION TRANSISTOR AND FIELD EFFECT TRANSISTOR:

The Junction Transistor, BJT Operation, Common Base, Common Emitter and Common Collector Configurations,Transistor as an Amplifier.

The Junction Field Effect Transistor Pinch –Off Voltage –Volt –Ampere Characteristics, MOSFET Operation, MOSFET Characteristics In Enhancement and Depletion Modes.

Unit-III: TRANSISTOR BIASING AND STABILIZATION:

Operating Point, The DC and AC Load Lines, Need for Biasing, Types of biasing methods: Fixed Bias, Collector Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization Against Variation In V_{BE} and β, Bias Compensation Using Diodes and Transistors. Thermal Runway, Thermal Stability.

Unit-IV: BJT AND FET AMPLIFIERS:

BJT Hybrid Model, Determination of h-Parameters from Transistor Characteristics, Comparison of CB, CE and CC Amplifier Configurations. The JFET Small Signal Model, FET Common Source Amplifier, Common Drain Amplifier, FET as Voltage Variable Resistor, Comparison of BJT And FET, The Unijunction Transistor

Unit–V: FEED BACK AMPLIFIERS

Concepts of feedback. Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Problems.

TEXT BOOKS:

1. J. Millman,C.C.Halkias, and SatyabrataJit- Integrated Electronics Analog and digital circuits and systems–Tata McGraw Hill, 2nd Ed., 2007.
2. R.L. Boylestad and Louis Nashelsky - Electronic Devices and Circuits – Pearson/Prentice Hall, 9th Edition,2006.
3. Rober T. Paynter -Introduction to Electronic Devices and Circuits- PE,2005.
4. A. P. Godse -Electronic Devices and Circuits – Technical Publications.2009.

REFERENCE BOOKS:

1. T.F. Bogart Jr., J.S.Beasley and G.Rico, Electronic Devices and Circuits – Pearson Education, 6th edition, 2004.
2. S.G.Burns and P.R.Bond, Principles of Electronic Circuits – Galgotia Publications, 2nd Edn.., 2003.
3. Millman and Grabel, Microelectronics –Tata McGraw Hill, 2001.
4. Dr. K. Lal Kishore, Electronic Devices and Circuits – 2004,BSP

Course Outcomes:

After completing the course, students should be able to

- Apply the diode concepts in different applications
- Understand the BJT, FET and revolutionary MOSFET that lead to the development of integrated circuits and study their construction and characteristics
- Compare different biasing methods and compensation methods to make transistor stable
- Design and analyse simple basic amplifiers using Hybrid model.
- Design and analyse feedback amplifiers using BJTs

B.Tech EEE II Year I Semester

	L	P	C
	0	**3**	**1.5**

Electrical Networks and Simulation Lab

Course Objectives:

1. To verify various network theorems.
2. To study Series and Parallel resonance Phenomena
3. To understand basic concepts of Inductances.
4. To study various types of network parameters.
5. To simulate DC and AC circuits using suitable software.

<u>List of Experiments:</u>

1) Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
2) Verification of Ohm's Law, KCL & KVL .
3) Application of Mesh & Nodal analysis for Complex Networks
4) Application of Super Mesh & Super Node analysis for Complex Networks
5) Verification of Network Theorems i) Superposition theorem. ii) Thevenin's theorem. iii) Maximum power transfer theorem.
6) Verification of Network Theorems i) Compensation theorem. ii) Millimans theorem.
7) Steady State Analysis of RL Series and Parallel circuit with sinusoidal excitation.
8) Steady State Analysis of RC Series and Parallel circuit with sinusoidal excitation
9) Steady State Analysis of RLC Series and Parallel circuit with sinusoidal excitation
10) Locus Diagram of RL &RC series and parallel circuits using Matlab/Simulink
11) Locus Diagram of RL &RC series and parallel circuits using Matlab/Simulink
12) Determination of Resonance Frequency, Band Width & Q-Factor of Series and Parallel Resonance Circuit.
13) Determination of Reactance, Impedance, Susceptance and admittance of serial and parallel networks.
14) Determination of Phase difference and Power factor of RL, RC, RLC circuits with Sinusoidal Excitation.
15) Fourier Analysis of Square wave, half wave rectified and full wave rectified sine wave using Matlab/Simulink..

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Apply the various network theorems to simplify given electrical circuits.
2. Determine electrical resonance frequency for series and parallel circuits.
3. Determine network parameters.
4. Connect and perform experiments with various electrical components and instruments.
5. Apply suitable software for simulating and analyzing various electrical circuits

B.Tech EEE II Year I Semester

	L	P	C
	0	**3**	**1.5**

ELECTRONIC DEVICES AND CIRCUITS LAB

Course Objectives:

1. To operate and characterize the behavior of devices and circuits.
2. To understand the functionality of semiconductor devices.
3. To design and test rectifiers with and without filters
4. To design and test amplifiers circuits.
5. Implementation of a few experiments using Arduino.

PART A:

ELECTRONIC WORKSHOP PRACTICE:

Identification, Specifications, Testing of R, L, C, Components (Color Codes),

1. Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specification and Testing of Active Devices, Diodes, BJT's LOW power JFET's, MOSFET's, Power Transistors, LED's, Arduinos, UJT.
3. Study and operation of
   - Multi-meters (Analog and Digital)
   - Regulated Power Supplies
   - Function Generator
   - CRO

PART B (For Laboratory Examination – Minimum of 10 experiments)

List of Experiments:

1. Forward & Reverse Bias Characteristics of PN Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Half Wave Rectifier with & without filters.
4. Full Wave Rectifier with & without filters
5. Input & output characteristics of Transistor in CB Configuration.
6. Input & output Characteristics of Transistor in CE Configuration.
7. FET characteristics.
8. Measurement of h- parameters of transistor in CB, CE, CC configurations
9. MOS characteristics
10. Current Shunt and Voltage Series Feedback Amplifiers.

11. Frequency Response of FET Amplifier (Common source).
12. Arduino based voltage regulator.
13. Switching circuit with Arduino to control LED
14. UJT Characteristics.

Requirements:

1.Regulated power supplies (RPS)		
2.CRO's	:	0-20MHZ
3.Function Generator	:	0-1 MHZ
4.Multimeters		
5.Decade Resistance Boxes / Rheostats		
6.Decade Capacitance Boxes		
7.Ammeters (Analog or Digital)	:	0-20µA, 0-50µA, 0-100µA, 0-200µA,0-10 mA
8.Voltmeters (Analog or Digital)	:	0-50V,0-100V, 0-250V
9.Electronic Components	:	Resistors, Capacitors, BJTs, LCDs, Arduinos, UJTs,FETs, LEDs, MOSFETs, diodes Ge& Si type,Transistors NPN, PNP type

Course Outcomes:

After completing the course, students should be able to

- Understand electronic test equipment to characterize the behaviour of devices and circuits.
- Plot the characteristics of semiconductor devices to understand their functionality.
- Design and test rectifiers with filters
- Design and test amplifier circuits and interpret the results.
- Design and test of Feedback amplifiers circuits and interpret the results.

B.Tech EEE II Year I Semester **L T C**

2 0 0

Gender Sensitization
(Mandatory Course)

Course Objectives:

1. To develop students sensibility with regard to issues of gender in contemporary India
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.

Unit-I: **Understanding Gender:**
Gender: Why should we study it? (Towards a world of equals: Unit-1)
Socialization: Making Women, Making Men (Towards a world of equals: Unit-2)
Introduction, Preparing for womanhood. Growing up male. First lesson in caste. Different Masculinities.
Just Relationships: Being Together as Equals (Towards a world of equals: Unit-12)
Mary Kom and Onler. Love and acid just do not mix. Love Letters. Mothers and Fathers. Further reading: Rosa Parks-The Brae Heart.

Unit-II: **Gender and Biology**
Missing Women: Sex Selection and its Consequences (Towards a world of equals: Unit-4)
Declining Sex Ration. Demographic Consequences.
Gender Spectrum: Beyond The Binary (Towards a world of equals: Unit-10)
Two or many? Struggles with Discrimination.
Additional Reading: Our Bodies, Our Health (Towards a world of equals: Unit-13)

Unit-III: **Gender and Labour**
Housework: The invisible Labour (Towards a world of equals: Unit-3)
"May Mother doesn't work". "Share the Load".
Women's work: its politics and economics (Towards a world of equals: Unit-7)
Fact and Fiction. Unrecognized and unaccounted work. Further Reading: Wages and Conditions of Work.

Unit-IV: **Issues of Violence**
Sexual Harassment: Say No! (Towards a world of equals: Unit-6)
Sexual Harassment, not Eve-teasing-coping with everyday Harassment-Further Reading: "Chupulu".
Domestic Violence: Speaking out (Towards a world of equals: Unit-8)
Is Home a Safe Place? – When Women Unite [Film]. Rebuilding Lives. Further Reading: New Forums for Justice.
Thinking about sexual Violence (Towards a world of equals: Unit-11)
Blaming the Victim- "I Fought for my life….." – Further reading: The Caste Face of Violence.

Unit-V: **Gender Studies**
Knowledge: Through the lens of gender (Towards a world of equals: Unit-5)

Point of View. Gender and the Structure of Knowledge. Further Reading: unacknowledged Women artists of Telangana.
Whose History? Questions for Historians and others (Towards a world of equals: Unit-9) Reclaiming a past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Text Books:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasantha, Rama Melkote, VasudhaNagaraj, AsmaRasheed, GoguShyamala, Deep Sreenivas and Susie Tharu. " Towards a world of Equals; A Bilingual Textbook on Gender"
2. Sen, Amartya. "More than one million Women are Missing". New York review of books 37.20 (20 December 1990). Print. ' We Were Making History….' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women 1989.

References Books:

1. TriptiLahari. "By the numbers: Where Indian Women Work. "Women's studies journal (14 November 2012) Available online at: http://blogs.wsj.com/indiarealtime/2012/11/14/ by the numbers where Indian women work/ >.
2. K. Satyanarayana& Susie Tharu (ed.) Steel are sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada hhttp://herpercollins.co.in/Bookdetail.asp? Book _code = 3732.
3. Monon, Nivedita, Seeing like a Feminist, New Delhi: Zubaan-Penguin Bokks, 2012.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Develop better understanding of important issues related to gender in contemporary India.
2. Identify the basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Analyze a finer grasp of how gender discrimination works in our society and how to counter it.
4. Acquire insight into the gendered division of labour and its relation to politics and economics.
5. Work, respect and live together with all men, women and others and treat them as equal human beings

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DIGITAL CIRCUITS

Prerequisite: ANALOG DEVICES & CIRCUITS

Course Objectives:

This course provides in-depth knowledge of digital logic and its Verilog representation. which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To verify and design the digital circuit by means of Computer Aided Engineering tools which involves programming with the help of Verilog HDL.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

Unit-1: Number Systems And Codes:
Review of number systems binary arithmetic, binary weighted and non-weighted codes. Error detecting and error correcting codes.
Boolean Algebra:
Postulates and theorems: representation of switching functions, SOP and POS forms Karnaugh Map representations, minimization using K Maps. Tabular minimization – design of single output and multi output functions design using conventional AND, OR, NOT, NAND, NOR & EX-OR gates.

Unit-II: Introduction To Verilog Hdl:
Verilog as HDL, Levels of Design Description, Simulation & Synthesis, Language Constructions. Gate Level Modeling: AND, OR, INVERTER and Other Gate Primitives.

Unit- III: Combinational Circuits:
Adders, Subtractors Encoder, Decoder, multiplexer, demultiplexer, code converters, Comparator, parity bit generators/checkers. 4 bit adder and carry look-ahead adder Logic implementations using ROM, PAL & PLA Design of Basic Combinational Circuits through Verilog HDL.

Unit-IV: Sequential Circuits and Machines:
Asynchronous versus synchronous circuits, state table and state diagram, state assignment, memory elements and their excitation functions, flip flop: RS, D, JK, T and their excitation requirements. Design of synchronous sequential circuits: binary counters, shift registers. Melay and Moore machines, state equivalence and machine minimization, Introduction to ASM chart.Design of Basic Sequential Circuits through Verilog HDL.

Unit V: Digital Integrated Circuits Introduction: Classification of Integrated Circuits, Standard TTL NAND Gate-Analysis & Characteristics, Tristate TTL, MOS &CMOS Open Drain and Tristate outputs, Comparison of Various Logic Families.IC interfacing- TTL driving CMOS & CMOS driving TTL.

Text Books:

3. M. Morris Mano, Digital Logic Computer Design –PHI.1979
4. Norman Balbamian and Breadly, John Wiley, Digital Logic Design Principles – 2001.
3. S. Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson, 2003.
4. Floyd and Jain, Pearson Education, Digital Fundamentals - 8th Edition, 2005.

References:

6. F. J. Hill and Peterson, Introduction to Switching Theory and Logic Design- John Wiley Publications,1974.
7. John M. Yarbroough, Digital Logic – Applications & Design – Vikas Publications, 1997.
8. Ronald J. Tocci, Digital Systems Principles, Applications–Pearson Education/Phil,2011.
9. By ZviKohavi, Switching And Finite Automata Theory – TMH Edition,3rd edition, 2009.
10. J.Bhasker Verilog HDL Primer -BS publications 2008.

Course Outcomes:

After completing the course, students should be able to

- Understand numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Understand Verilog programming in three different modeling and apply it for combinational and sequential circuit.
- Apply simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Design sequential circuits by using sequential functions/building blocks to build larger more complex circuits.
- Design and analyze the circuits using Finite state machines and minimization of state machines.

B.Tech EEE II Year II Semester	L	T	C
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Electrical Machines –II

Course Objectives:

1. To understand theory & operation of 1 phase Transformers
2. To understand theory & operation of 3 phase Transformers
3. To learn constructional and operation of 3phase induction motors
4. To analyze, the performance of 3 phase Induction Motor.
5. To learn construction &principle of operation of 1 phase Induction Motor.

Unit- I: Single Phase Transformers

Types: - core and shell type - constructional details- minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams. Equivalent circuit - losses and efficiency-regulation. All day efficiency - effect of variations of frequency & supply voltage on iron losses.

Performance of transformers : OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test.

Auto transformers- auto transformers- equivalent circuit - comparison with two winding transformers.

Unit- II: Three Phase Transformers

Poly-phase connections - Y/Y, Y/□, □/Y, □/□□and open □, Third harmonics in phase voltages-three winding transformers-tertiary windings. off load and on load tap changing; conversion of 3 Phase to 2 phase and vice- versa (Scott connection.)

Parallel Operation of Transformers

Parallel operation single phase transformers with equal and unequal voltage ratios – Problems-

Parallel operation of three phase transformers (Basic concepts only).

Unit- III: Three Phase Induction Motors

Construction details of cage and wound rotor machines-production of a rotating magnetic field -principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and p.f at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors -equivalent circuit - phasor diagram - crawling and cogging.

Unit- IV: Performance of Three Phase Induction Motors

Circle diagram-no load and blocked rotor tests-predetermination of performance.

Methods of starting DOL, star-delta, auto transformer, starting current and torque calculations of Induction Motors.

Speed control-change of frequency- change of poles and methods of consequent poles; cascade connection. Injection of an emf in to rotor circuit (qualitative treatment only)- induction generator principle of operation. Applications.

Unit- V: Single Phase Induction Motors

Single phase Induction motor – Constructional features- Double revolving field theory Equivalent circuit- spilt –Phase motors- Capacitor start- Capacitor start capacitor run motors. applications.

Text Books:

1. JB Gupta, SK Kataria and sons, Theory and performance of Electrical Machines- 14th Edition
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

References Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Describe the constitutional details and theory of operation of 1 phase Transformers
2. Evaluate the performance of 3phase Transformers and operate transformers when connected in parallel
3. Describe the constructional details and principle of operation of 3 phase Induction Motor
4. Inferthe performance of 3 phase Induction Motor by theoretical calculations
5. Describe the constructional details and principle of operation of 1 phase Induction Motor

B.Tech EEE II Year II Semester	L	T	C
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POWER SYSTEMS – I

Course Objectives:

1. To understand the process of Hydel and Thermal Power Generations.
2. To understand the process of Nuclear and Gas-Power Generators.
3. To understand the basic concepts of various substations and their components.
4. To familiarize with DC and AC Distribution systems.
5. To gain knowledge on economic aspects of Power Generation and Tariff methods

Unit- I: Hydel and Thermal Power Stations

Hydel Power Stations: Classification Hydro Electric Power Stations: Layout of Hydro station- selection of site – classification of hydro plants – classification of turbines – constituents of hydro station –Equation of power generation - numerical problems.

Thermal Power Stations: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses.- Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers, numerical problems.

Unit- II: Nuclear Power Stations and Gas Power stations

Nuclear Power Stations: Nuclear Fission and Chain reaction - Nuclear fuels – Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants - Radiation hazards: Shielding and Safety precautions. - Types of Nuclear reactors and brief description of PWR, BWR and FBR.

Gas Power Stations: Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only)

Unit- III: Substations and Gas Insulated Substations

Substations: Classification of substations, Air insulated substations - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub- Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas insulated substations (GIS): Advantages of Gas insulated substations, single line diagram of gas insulated substations, bus bar, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations...

Unit- IV: DC and AC Distribution Systems

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over -Head Distribution Systems- Requirements and Design features of Distribution Systems.

D.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

A.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

Unit- V: Economic Aspects of Power Generation and Tariff Method
Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.
Tariff Methods: Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method - Tariff Methods: Flat Rate, Block-Rate, two-part, three – part, and power factor tariff methods and Numerical Problems.

Text Books:

1. J.B. Gupta, A course in power systems - S. K. Kataria& Sons, 2009.
2. V.K Mehta and Rohit Mehta, Principles of Power Systems - S.Chand Company Ltd., New Delhi 2004.

References Books:

1. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, A Text Book on Power System Engineering - Dhanpat Rai & Co. Pvt. Ltd., 1999
2. PP Wals, P.Fletcher, Gas turbine performance- Blackwell Publisher, 2004
3. C.L.Wadhawa, Generation, distribution and utilization of Electrical energy- New age International (P) Limited, Publishers 1997.

Course Outcomes:

At the end of this course, students will demonstrate the ability to
1. Apply the knowledge of various sources of power generation
2. Design the Layout of Various Generating Power Stations.
3. Discuss functions of Substations.
4. Determine various parameters for AC &DC Distribution systems
5. Analyze economic aspects of Power Generations and Tariff Methods.

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Control Systems

Course Objectives:

1. To study mathematical models of physical system
2. To study the response of different order systems using standard test signals
3. To analyze the stability of the system in time domain and in frequency domain
4. To study the controllers used for various control system applications
5. To determine the stability analysis of the system using State Space Analysis

Unit -I: Introduction to Control System

Industrial Control examples. Mathematical models of physical systems (Mechanical Translation System & Rotational Systems). Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.– Representation by Signal flow graph - Reduction using Mason's gain formula

Unit -II: Time Response Analysis

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Steady state errors, error constants.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Unit- III: Frequency-Response Analysis

Frequency domain specifications, relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Unit – IV: Classical Control Compensation Design Techniques

P,PI,PD and PID controllers determination of coefficient's.

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain

Unit- V: State Variable Analysis

Concept of state, state variables and state space model. Solution of state equations. Eigen values, eigen vectors and State transition matrix, Diagonalization of State Matrix. Stability Analysis. Concept of controllability and observability.

Text Books:

1. I.J.Nagrath and M.Gopal, Control Systems Engineering – New Age International (P) Limited, Publishers, 2nd edition, 2009.
2. B. C. Kuo, Automatic Control Systems - John wiley and son's., 8th edition, 2003.

Reference Books:

1. Katsuhiko Ogata – Modern Control Engineering –Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. N.K.Sinha, Control Systems - New Age International (P) Limited Publishers, 3rd Edition, 1998.
3. A. Nagoorkani, Control Systems – Published June 2006 by RBA Publications

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Model linear-time-invariant systems using transfer function
2. Analyze state-space representations.
3. Apply the concept of stability and its assessment for linear-time invariant systems.
4. Design simple feedback controllers.
5. Describe the concept of simple compensators

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PYTHON PROGRAMMING

Course Objectives:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

Unit – I:
Introduction to Python:
Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations.
Functions and Modules:
Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Unit – II:
Strings and Regular Expressions:
String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.
Sequence:
List, Tuples, Dictionaries, Sets.

Unit – III:
Introduction to Object Oriented Programming: Features of OOP,Merits and demerits of Object Oriented Programming Languages,Applications of OOP
Implementation of classes and objects in Python:
Classes and Objects, Class Method and Self Argument. The __init__Method, Class Variables and Object Variables, The __del__Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Unit – IV:
Implementation of Inheritance in Python: Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class,
Implementation of Operator Overloading in Python: Introduction, Implementing Operator Overloading, Overriding Methods
Exception Handling in Python: Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

UNIT V:

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy
Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the

Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.
Introduction to Matplotlib :, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages.

Text Book

1.ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017

2.James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Suggested / Reference Books

1.Charles Dierach, Introduction to Computer Science using Python,2013

2. https://www.programiz.com/python-programming

3. https://www.javatpoint.com/python-tutorial

4.. https://www.geeksforgeeks.org/python-programming-language/

Course Outcomes:

1. Apply control structures, functions and packages in Problem Solving.
2. Analyze various String handling functions and data structures.
3. Model the object-oriented problems with classes and objects.
4. Solve the problems by using Inheritance and polymorphism.
5. Illustrate programs on Exception Handling and various packages.

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Managerial Economics and Financial Analysis

Course Objectives:

1. To explain the fundamentals of the key elements of a business organization.
2. To learn practical approach to various functional areas of decision making.
3. To compare different pricing Strategies.
4. To enhance a knowledge of capital Budgeting Techniques.
5. To solve the problems using Rations analysis.

Unit – I: Introduction to Managerial Economics

Definition, Nature and scope of Managerial Economics, Demand Analysis- Demand Determinants, Law of Demand and its exceptions.

Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Methods of Demand Forecasting (Survey Methods, Statistical Methods, Expert Opinion Method, Test Marketing, Controlled Experiments, Judgmental Approach to Demand Forecasting)

Unit – II: Theory of Production and Cost Analysis

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs.

Cost Analysis: Cost concepts, Opportunity Cost, Out of Pocket Costs vs. Imputed Costs. Breakeven Analysis (BEA) – Determination of Breakeven Point (simple problems), Managerial Significance and limitations of BEA.

Unit – III: Market Structures& Pricing Policies

Market structures: Types of Competition, Features of Perfect Competition, Monopoly and Monopolistic Competition, Price - Output determination in Perfect Competition and monopoly.

Objectives and Policies of Pricing: Objectives of pricing**,** Methods of Pricing - Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two - Part Pricing, Block Pricing, Peak Load Pricing, Cross Subsidization.

Unit – IV: Introduction to Financial Accounting

Accounting, Double-Entry Book Keeping, Journal, Ledger, and Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Unit – V: Financial Analysis through ratios

Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and Quick Ratio), Activity Ratios (Inventory Turnover Ratio and Debtor Turnover Ratio), Capital Structure Ratios (Debt – Equity, Interest Coverage Ratio), and Profitability Ratios (Gross Profit Ratio, Net Profit Ratio, Operating Profit Ratio, P/E Ratio and EPS).

Text Books:

1. Varshney & Maheshwari, Managerial Economics, Sultan Chand & Sons, 2014.
2. S.A. Siddiqui and A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013

References Books:

1. R. K. Sharma & Shashi K Gupta, Financial and Management Accounting, 4^{th} Ed., Sultan Chand.
2. S. N. Maheshwari& S. K. Maheshwari, Financial Accounting, Vikas 2012.
3. M. Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, PHI, 2012.

Course Outcomes:

At the end of this course, students must have knowledge and ability to

1. Describe the concept of demand and its determinants in Managerial decisions.
2. Analyze the cost concepts and breakeven analysis in production.
3. Evaluate the market structures and different Pricing Strategies.
4. Apply the capital budgeting techniques in financial decisions.
5. Explain application of ratios in solving of business problems and taking correct decisions

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Electrical Machines Lab- I

Course Objectives:

1. To obtain magnetization characteristics of DC Generator
2. To understand characteristics of DC Machines by conducting load tests
3. To determine losses and efficiency of DC machines
4. To study methods of speed control of DC shunt motors.
5. To study separation of losses in DC machines.

List of Experiments:

1. Magnetization characteristics of DC shunt generator.
2. Load test on DC shunt generator.
3. Load test on Dc series generator.
4. Load test on DC compound generator.
5. Hopkinson's tests on DC shunt machines.
6. Fields test on DC series machines.
7. Swinburne's test on DC shunt machine.
8. Speed control of DC shunt motor.
9. Brake test on DC shunt motor.
10. Brake test on DC compound motor.
11. Separation of losses in DC shunts motor.
12. Retardation test on DC shunt motor.

Note: Any 10 experiments are required to be conducted.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Determine efficiency by conducting load tests on DC machines
2. To determine the efficiency of DC Generators by conducting load tests
3. To determine the efficiency of DC motor by conducting appropriate Tests
4. Distinguish between speed control techniques for above and below base speeds for DC shunt motor
5. Determine the constant & variable losses in DC motor by performing appropriate test.

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Control Systems Lab

Course Objectives:

1. To familiarize with modeling of dynamical systems and the characteristics of control components like AC servo motor, Synchros and magnetic amplifier.
2. To study the effect of P, PI & PID controllers on second order system.
3. To provide the basic knowledge state space model for a given classical transfer function.
4. To learn the basics of Programmable Logic Control.
5. To simulate and analyze the stability and design the compensator.

List of Experiments:

Part - A

1. Time response of Second Order System
2. Effect of P, PI, PID controller on a Second Order System
3. Characteristics of Synchros
4. Lead and Lag Compensation –Magnitude and phase plot
5. Characteristics of AC Servomotor
6. Effect of feedback on DC Servomotor
7. Transfer function of a DC motor

Part – B

8. Simulation of OP-AMP based Integrator and Differentiator
9. Root Locus Plot, Bode Plot, Nyquist Plot and Polar Plot of Transfer Function
10. State space model for a given classical transfer function
11. Programmable Logic Controller
12. Temperature control using PID controller
13. Magnetic amplifier

Note:-All experiments from part A and Three experiments from part B to be conducted

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Analyze the physical systems represented in given transfer function.
2. Apply the knowledge of various control systems components for different applications like AC servo motor, Synchros.
3. Analyze the effect of P.PI & PID controllers on second order systems
4. Design a Lag and Lead compensator using magnitude and phase plot
5. Analyze and simulate design of various control system problems using software.

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Environmental Studies
(Mandatory Course)

Course Objectives:

1. To introduce the knowledge about Environment.
2. To introduce the concepts of pollution, Biodiversity
3. To develop awareness on global Environmental problems.
4. To learn to protect environment and to get awareness on legal issues
5. To learn about importance of sustainable development and role of IT in environment.

Unit – I: Multidisciplinary nature of Environmental Studies:

Definition, Scope and Importance–Need for Public Awareness.

Ecosystems: Concept of an ecosystem–Classification, structure and function of differentecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids.

Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystemdiversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit – II: Natural Resources:

Renewable and non-renewable–Natural resources and associated problems: Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest and tribal people: Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources: Equitable use of resources for sustainable lifestyles.

Unit – III: Environmental Pollution

Definition, Cause, effects and control measures of different kindsof pollution (Air, Water, Soil, Marine, Noise, Thermal, Nuclear, e –Waste)

Carbon Capture & Sequestration – different storage sources, major disadvantages,environmental effect**s**

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

Unit – IV: Waste management technology

Solid waste Management: Causes, effects and controlmeasures of urban and industrial wastes. - Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

Waste water and sewage treatment technology: primary, secondary and tertiary treatments.

Bioremediation, Phyto-remediation, ZLD (zero liquid discharge), membrane technology. Application of GIS and GPS system in environmental science.

Environmental policy, Rules and regulations.EIA (Environmental Impact Assessment) &EMP (ENVIRONMENTAL Management Plan) – Environment Protection Act. - Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act - Wildlife Protection Act –Forest Conservation Act.-Public awareness. Global environmental problems and global efforts.

Unit – V: Towards sustainable future

Concept of sustainable development, threats of sustainability,population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources.Urban sprawl, sustainable cities and sustainable communities, human health. Role of IT in environment, environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

Text Books:

1. ErachBharucha, Textbook of Environmental Studies for Undergraduate Courses- University Press Private Limited, Reprinted in 2005.
2. R.Rajagopalan, Environmental Studies: From Crisis to Cure- Oxford University Press, 2nd Edition, 2005

References Books:

1. by Richard T.Wright. Environmental Science: Towards a Sustainable Future- PHL Learning Private Ltd .New Delhi, 2008
2. Gilbert M.Masters and Wendell P.Ela. Environmental Engineering and science- PHI Learning Pvt. Ltd. 4th edition, 2008

Course Outcomes:

At the end of this course, students will have knowledge and ability to

1. Understand fundamental physical and biological principles that govern natural processes.
2. Understand fundamental concepts from the social sciences and humanities underlying environmental thought and governance
3. Integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
4. Communicate integrated perspectives on complex environmental problems in the form of written and oral argument to both professional and lay audiences.
5. Design and conduct independent research that contributes to environmental thought and/or problem solving.

M. TECH (Electrical Power Systems)

COURSE STRUCTURE & SYLLABUS

M. Tech EPS I Year I Semester

6T+1L+1 Seminar

Category	Course Title	L	T	P	C
PC-I	Advanced Power System Analysis	3	0	0	3
PC-II	Modern Control Theory	3	0	0	3
PE-I	• EHVAC Transmission • Electrical and Hybrid Vehicles • Smart Grid Technologies	3	0	0	3
PE-II	• Reactive Power Compensation and Management • Reliability Engineering • Voltage Stability	3	0	0	3
PE-III	• Power System Operation and Deregulation • Distributed Energy Sources and Grid Integration • Neural Networks & Fuzzy Logic	3	0	0	3
Course Work	Research Methodology	2	0	0	2
Laboratory-I	Power Systems Simulation Lab - I	0	0	4	2
Seminar I	Seminar –I	0	0	4	2
Total		**17**	**0**	**8**	**21**

M. Tech EPS I Year II Semester **5T+1 L+1 Seminar+1 Audit Course**

Category	Course Title	L	T	P	C
PC-III	Advanced Power System Protection	4	0	0	4
PC-IV	Power System Dynamics & Control	4	0	0	4
PE-IV	• Energy Storage Systems • Industrial Load Modeling & Control • Energy Auditing And Management	3	0	0	3
PE-V	• Renewable Energy Technologies • Power Quality Analysis and Mitigation Techniques • Protocols for Smart Grids	3	0	0	3
Audit Course	English for Research Paper Writing	2	0	0	0
Open Elective	• Energy from Waste • Composite Materials • Industrial Safety	3	0	0	3
Laboratory-II	Power Systems & Simulation Lab - II	0	0	4	2
Seminar II	Seminar –II	0	0	4	2
Total		**19**	**0**	**8**	**21**

M. Tech EPS III Semester

Course	Course Title	L	T	P	C
	Project Review -I	0	0	24	12
Total		**0**	**0**	**24**	**12**

M. Tech EPS IV Semester

Course	Course Title	L	T	P	C
	Project Review-II	0	0	28	14
Total		**0**	**0**	**28**	**14**

M. TECH (EPS)– I YEAR – I SEM.
ADVANCED POWER SYSTEM ANALYSIS
(Professional Core - I)

Prerequisite: Computer Methods in Power Systems
Course Objectives:

- To analyze a Power System Network using graph theory.
- To interpret the formation of Network matrices.
- To construct the necessity of load flow studies and various methods of Analysis.
- To examine short circuit analysis using Z_{Bus}.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Remember proper mathematical models for analysis.
- Conclude methodologies of load flow studies for the power network.
- Apply contingency Analysis.
- Analyze power system studies.

UNIT-I:

Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in YBUS , An Equivalent Admittance Network, Modification of YBUS , Network Incidence Matrix and YBUS , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

UNIT-II:

Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and ZBUS ,Algorithms for building ZBUS Modification of existing ZBUS, Calculation of ZBUS elements from YBUS, Power Invariant Transformations, Mutually Coupled Branches in ZBUS.

UNIT-III:

Gauss Seidel method, N-R Method, Decoupled method, fast decoupled method, comparison between power flow solutions. DC load flow.

UNIT-IV:

ZBUS Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

UNIT-V:

Fault Analysis: Symmetrical faults-Fault calculations using ZBUS- Fault calculations using ZBUS equivalent circuits –Selection of circuit breakers- Unsymmetrical faults- Problems on various types of faults.

TEXT BOOKS:

1. John J. Grainger and W. D. Stevenson, "Power System Analysis"- T.M.H.Edition.
2. Modern Power System Analysis– by I. J. Nagrath& D. P. Kothari TataMcGraw – Hill Publishing Company Ltd, 2nd edition.

REFERENCE BOOKS:

1. Power System Analysis and Design by J. Duncan Glover and M.S.Sarma., Cengage 3rd Edition.
2. Olle. L.Elgard, "Electrical Energy Systems Theory"-T.M.H.Edition.
3. Power systems stability and control, Prabha Kundur, The McGraw – Hillcompanies**.**
4. Power System Operation and Control, Dr. K. Uma Rao, Wiley India Pvt.Ltd.
5. Operation and Control in Power Systems, PSR Murthy, BsPublications.
6. Power System Operation, Robert H. Miller, Jamesh H. Malinowski,The McGraw – Hill companies**.**
7. Power Systems Analysis, operation and control by Abhijit Chakrabarti,Sunitha Halder, PHI 3/e ,2010

M. TECH (EPS)– I YEAR – I SEM.
MODERN CONTROL THEORY
(Professional Core - II)

Prerequisite: Control Systems
Course Objectives

- To explain the concepts of basic and modern control system for the real time analysis and design of control systems.
- To Explain and apply concepts of state variables analysis. To study and analyze non linear systems.
- To analyze the concept of stability of nonlinear systems and categorization.
- To apply the comprehensive knowledge of optimal theory for Control Systems.

Course Outcomes: Upon completion of this course, students should be able to:

- Apply the knowledge of basic and modern control system for the realtime analysis and design of control systems.
- Understand the concepts of state variables analysis.
- Analyze the concept of stability of nonlinear systems and optimal control.

UNIT–I:

Mathematical Preliminaries: Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen- values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-II:

State Variable Analysis: Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III:

Non Linear Systems: Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-IV:

Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V:

Optimal Control: Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional
– fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

TEXTBOOKS:

1. Modern Control System Theory by M. Gopal – new age international-1984
2. Control System Engineering, Nagrath and Gopal - New Age International – Fourth Edition

REFERENCES BOOKS:

1. Optimal control by Kirck , DoverPublications
2. Advanced Control Theory A. NagoorKani, RBA Publications,1999
3. Modern Control Engineering by Ogata.K – Prentice Hall -1997

M. TECH (EPS)– I YEAR – I SEM.

EHVAC TRANSMISSION

(Professional Elective - I)

Prerequisite: Power Systems -II
Course objectives:

- To identify the different aspects of Extra High Voltage A.C and D.C Transmission design and Analysis
- To understand the importance of modern developments of E.H.V and U.H.V transmission systems.
- To demonstrate EHV ac transmission system components, protection and insulation level for over voltages.

Course Outcomes: Upon the completion of the subject, the student will be able to

- List the necessity of EHV AC transmission, choice of voltage for transmission, line losses and power handling capability.
- Estimate the Statistical procedures for line designs, scientific and engineering principles in power systems.
- Construct commercial transmission system.

UNIT- I:

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems- Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT- II:

Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines

– effect of high electrostatic field on biological organisms and human beings - surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT- III:

Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – un energized lines.

Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

UNIT - IV:

Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits.

Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT- V:

Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

TEXT BOOKS:

1. R. D. Begamudre, “EHVAC Transmission Engineering”, New Age International (p) Ltd. 3rd Edition.
2. K. R. Padiyar, “HVDC Power Transmission Systems” New Age International(p) Ltd. 2nd revised Edition,2012.

REFERENCES BOOKS:

1. S. Rao “EHVAC and HVDC Transmission Engg. Practice” Khannapublishers.
2. Arrillaga. J“High Voltage Direct Current Transmission” 2nd Edition (London) peter Peregrines, IEE,1998.
3. Padiyar. K.R, “FACTS Controllers in Power Transmission and Distribution” New Age Int. Publishers,2007.
4. Hingorani H G and Gyugyi. L “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems” New York, IEEE Press, 2000.

M. Tech (EPS)– I Year – I Sem.

Electrical and Hybrid Vehicles

(Professional Elective – I)

Course Objectives:

- To study the concepts and drive train configurations of electric drive vehicles To provide different electric propulsion systems and energy storage devices
- To explain the technology, design methodologies and control strategy of hybrid electric vehicles
- To emphasize battery charger topologies for plug in hybrid electric vehicles

- **Course Outcomes:**
  - Upon the completion of this course, the student will be able to
  - Understand the concepts and drive train configurations of electric drive vehicles Interpret different electric propulsion systems and energy storage devices
  - Appreciate the technology, design methodologies and control strategy of hybrid electric vehicles
  - Realize battery charger topologies for plug in hybrid electric vehicles

UNIT - I

Introduction to Electric Vehicles: Sustainable Transportation - EV System - EV Advantages - Vehicle Mechanics - Performance of EVs - Electric Vehicle drivetrain - EV Transmission Configurations and components-Tractive Effort in Normal Driving - Energy Consumption - EV Market - Types of Electric Vehicle in Use Today - Electric Vehicles for the Future.

UNIT - II

Electric Vehicle Modelling - Consideration of Rolling Resistance - Transmission Efficiency - Consideration of Vehicle Mass - Tractive Effort - Modelling Vehicle Acceleration - Modelling Electric Vehicle Range - Aerodynamic Considerations - Ideal Gearbox Steady State Model - EV Motor Sizing - General Issues in Design.

UNIT - III

Introduction to electric vehicle batteries - electric vehicle battery efficiency - electric vehicle battery capacity - electric vehicle battery charging - electric vehicle battery fast charging - electric vehicle battery discharging - electric vehicle battery performance – testing.

UNIT - IV

Hybrid Electric Vehicles - HEV Fundamentals -Architectures of HEVs- Interdisciplinary Nature of HEVs - State of the Art of HEVs - Advantages and Disadvantages - Challenges and Key Technology of HEVs - Concept of Hybridization of the Automobile-Plug-in Hybrid Electric Vehicles - Design and Control Principles of Plug-In Hybrid Electric Vehicles - Fuel Cell Hybrid Electric Drive Train Design - HEV Applications for Military Vehicles.

UNIT - V

Advanced topics - Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks – Sizing Ultra capacitors for Hybrid Electric Vehicles.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles – Fundamentals, Theory andDesign
2. Mehrdad Ehsani, Uimin Gao and Ali Emadi - Second Edition - CRC Press,2010.
3. Electric Vehicle Technology Explained - James Larminie, John Lowry - John Wiley & Sons Ltd, -2003.
4. Electric Vehicle Battery Systems – Sandeep Dhameja – Newnes- New Delhi – 2002.
5. Hybrid electric Vehicles Principles and applications With practical perspectives -Chris Mi, Dearborn - M. Abul Masrur, David Wenzhong Gao - A John Wiley &Sons, Ltd., -2011.
6. Electric & Hybrid Vehicles – Design Fundamentals - Iqbal Hussain, Second Edition, CRC Press,2011.

Research Papers:

1. The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks: a Review and Outlook - Robert C. Green II, Lingfeng Wang and Mansoor Alam - 2010IEEE.
2. Sizing Ultracapacitors for Hybrid Electric Vehicles - H. Douglas P Pillay - 2005IEEE.
3. Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - Murat Yilmaz, and Philip T. Krein, - IEEE transactions on power electronics, vol. 28, no. 5, May2013.

M. Tech (EPS)– I Year – I Sem.

SMART GRID TECHNOLOGIES

(Professional Elective – I)

Prerequisites: Electrical Distribution Systems, Power Systems

Course Objectives**:**

- To understand various aspects of smart grid
- To study various smart transmission and distribution technologies To appreciate distribution generation and smart consumption
- To know the regulations and market models for smart grid

Course Outcomes**:**

- Upon the completion of the subject, the student will be able to
- Understand technologies for smart grid
- Appreciate the smart transmission as well distribution systems Realize the distribution generation and smart consumption
- Know the regulations and market models for smart grid

UNIT - I:

Introduction to Smart Grids: Definition, justification for smart grids, smart grid conceptual model, smart grid architectures, Interoperability, communication technologies, role of smart grids standards, intelligrid initiative, national smart grid mission (NSGM) by Govt. of India

UNIT - II:

Smart Transmission Technologies: Substation automation, Supervisory control and data acquisition (SCADA), energy management system (EMS), phasor measurement units (PMU), Wide area measurement systems (WAMS)

UNIT - III:

Smart Distribution Technologies: Distribution automation, outage management systems, automated meter reading (AMR), automated metering infrastructure (AMI), fault location isolation and service restoration (FLISR), Outage Management Systems (OMS), Energy Storage, Renewable Integration

UNIT - IV:

Distributed Generation and Smart Consumption: Distributed energy resources (DERs), smart appliances, low voltage DC (LVDC) distribution in homes / buildings, home energy management system (HEMS), Net Metering, Building to Grid B2G, Vehicle to Grid V2G, Solar to Grid, Microgrid

UNIT - V:

Regulations and Market Models for Smart Grid: Demand Response, Tariff Design, Time of the day pricing (TOD), Time of use pricing (TOU), Consumer privacy and data protection, consumer engagement etc

Cost benefit analysis of smart grid projects

TEXT BOOKS:

1 Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
2 Jean Claude Sabonnadière, Nouredine Hadjsaïd, "Smart Grids", Wiley-ISTE, IEEE Press, May 2012

REFERENCES BOOKS:

1 Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley,2012.
2 James Momoh, "Smart Grid: Fundamentals of Design and Analysis" - Wiley, IEEE Press,2012.
3 India Smart Grid KnowledgePortal

M. TECH (EPS)– I YEAR – I SEM.
REACTIVE POWER COMPENSATION AND MANAGEMENT
(Professional Elective – II)

Prerequisite: Power Systems - II

Course Objectives:

- To identify the necessity of reactive power compensation
- To describe load compensation
- To select various types of reactive power compensation in transmission systems
- To contrast reactive power coordination system
- To characterize distribution side and utility side reactive power management.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
- Observe various compensation methods in transmission lines Construct model for reactive power coordination
- Distinguish demand side reactive power management & user side reactive power management

UNIT - I:

Load Compensation: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

UNIT - II:

Steady – State Reactive Power Compensation in Transmission System: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation –examples **Transient state reactive power compensation in transmission systems:** Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers –examples

UNIT - III:

Reactive Power Coordination: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences

UNIT - IV:

Demand Side Management: Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels

Distribution side Reactive power Management:: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

UNIT - V:

User Side Reactive Power Management: KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors

– types of available capacitor, characteristics and Limitations

Reactive power management in electric traction systems and are furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures – power factor of an arc furnace

TEXT BOOKS:

1. Reactive power control in Electric power systems by T. J. E. Miller, JohnWiley and sons,1982.
2. Reactive power Management by D. M. Tagare, Tata McGraw Hill,2004.

REFERENCES BOOKS:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just “Reactive Power Compensation: A Practical Guide, April, 2012, Wiely publication.

M. TECH (EPS) – I YEAR – I SEM
RELIABILITY ENGINEERING
(Professional Elective – II)

Prerequisite: Reliability Engineering

Course Objectives:

- To identify the generation system model and recursive relation for capacitive model building
- To calculate the equivalent transitional rates, cumulative probability and cumulative frequency
- To classify the risk, system and load point reliability indices
- To evaluate the basic reliability indices

Course Outcomes: Upon the completion of the subject, the student will be able to

- Find loss of load and energy indices for generation systems model
- Describe merging generation and load models
- Apply various indices for distribution systems

UNIT - I:

Generating System Reliability Analysis – I: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples.

UNIT - II:

Generating System Reliability Analysis – II: Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2- level daily load representation - merging generation and load models –Examples.

UNIT - III:

Operating Reserve Evaluation: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.
Bulk Power System Reliability Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

UNIT - IV:

Inter Connected System Reliability Analysis: Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency.

Distribution System Reliability Analysis – I (Radial configuration): Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy oriented indices – Examples.

UNIT - V:

Distribution System Reliability Analysis - II (Parallel Configuration): Basic techniques – inclusion of bus bar failures, scheduled maintenance – temporary and transient failures – weather effects – common mode failures –Evaluation of various indices – Examples **Substations and Switching Stations:** Effects of short-circuits - breaker operation – Open and Short-circuit failures – Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times.

TEXT BOOKS:

1. ReliabilityEvaluationofPowersystemsbyR.Billinton,R.N.Allan,BSPublications, 2007.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley andSons, 1978

REFERENCES BOOKS:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by E. Balaguruswamy, TMH Publications.
4. Reliability Engineering by ElsayedA. Elsayed, Prentice Hall Publications.

M. TECH (EPS)– I YEAR – I SEM
VOLTAGE STABILITY
(Professional Elective – II)

Prerequisite: Computers Methods in Power Systems

Course Objectives:

- To choose SEC Planning and Operational Standards of Security
- To estimate Reactive Power Control in Generation/Transmission Interconnected Networks
- To apply stability/Instability in Generation/Transmission Interconnected Networks
- To analyze design and Operational Solutions
- To characterize voltage Control in Distribution Networks

Course Outcomes: Upon the completion of the subject, the student will be able to

- Understand issues related to power system stability and control.
- Demonstrate various load models in voltage stability analysis.
- Detect reactive power compensation techniques & their practical importance

UNIT– I:

Introduction to Voltage Stability

Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Physical relation indicating dependency of voltage on reactive power flow; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

UNIT– II:

Graphical Analysis of Voltage Stability

Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

UNIT– III:

Analysis of Voltage Stability

Analysis of voltage stability on SMLB system: Analytical treatment and analysis.

Voltage Stability Indices:

Voltage collapse proximity indicator; Determinant of Jacobin as proximity indicators; Voltage stability margin.

UNIT– IV:

Power System Loads

Loads that influences voltage stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.

Reactive Power Compensation:

Generation and Absorption of reactive power; Series and Shunt compensation; Synchronous condensers, SVC s; OLTC s; Booster Transformers.

UNIT–V:

Voltage Stability Margin

Stability Margin: Compensated and un-compensated systems.

Voltage Security

Definition; Voltage security; Methods to improve voltage stability and its practical aspects.

TEXT BOOKS:

1. "Performance, operation and control of EHV power transmission system"-A. CHAKRABARTHY, D.P. KOTARI and A.K. MUKOPADYAY, A.H. Wheeler Publishing, I Edition, 1995.
2. "Power System Dynamics: Stability and Control" – K.R. PADIYAR, II Edition, B.S.Publications.

REFERENCES BOOKS:

1. "Power System Voltage Stability"- C.W. TAYLOR, McGraw Hill, 1994.

M. TECH (EPS)– I YEAR – I SEM.
POWER SYSTEM OPERATION AND DEREGULATION
(Professional Eore -III)

Prerequisite: Power System Operation and Control
Course objectives:

- To find OPF with security constraints.
- To generalize modeling of load frequency control of a power system
- To compute reactive power control of a power system.
- To apply the concept of deregulation and ATC.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Know the optimal scheduling of power plants
- Outline the modeling of turbine and generator
- Compute the steady state behavior of the power system for voltage and frequency fluctuations.
- Analyze ATC and the cost of transmission

UNIT- I:

Optimal Power Flow: Introduction- Solution to the optimal power flow-gradient method-Newton's method-Linear sensitivity analysis- Linear programming methods- Security constrained OPF-Interior point algorithm-Bus incremental costs

UNIT- II:

Power System Security: Introduction –Factors affecting power system security- Contingency analysis-Detection of network problems-Linear sensitivity analysis-AC power flow methods-contingency selection-concentric relaxation-Bounding area method

UNIT- III:

State Estimation in Power Systems: Introduction- Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network-State estimation by orthogonal decomposition- detection and identification of Bad measurements-

Estimation of quantities not being measured- Network observability and pseudo measurements

UNIT- IV:

Power System Deregulation: Introduction- motivation for restructuring of power systems- Electricity market entities model-benefits of deregulation-terminology- deregulation in Indian power sector-Operations in power markets-power pools- transmission networks and electricity markets.

UNIT-V:

Available Transfer Capability: Introduction methods: of determination of ATC - ATC calculation considering the effect of contingency analysis-Transmission open access and pricing-cost components of transmission system- transmission pricing methods-Incremental cost based transmission pricing.

TEXT BOOKS:

1. J. Wood & B.F. Woollenberg- John Wiley Power Generation, "Operationand Control"-2nd edition.
2. P. Venkatesh. B. V. Manikandan, S. Charles Raja- A. Srinivasan, "Electrical power systems: Analysis, security, Deregulation"– PHI2012

REFERENCES BOOKS:

1. Bhattacharya, Kankar, Bollen, Math, Daalder, Jaap E. "Operation ofRestructured Power System", 2001,Springer.
2. Venkatesh P. , Manikandan B. V., Raja S. Charles , Srinivasan A. Electrical Power Systems: Analysis, Security And Deregulation, Phi Learning PvtLtd

M. TECH (EPS)– I YEAR – I SEM.
DISTRIBUTED ENERGY SOURCES AND GRID INTEGRATION
(Professional Eore -III)

UNITI INTRODUCTION

Conventional power generation: advantages and disadvantages, Energy crises, Non - conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidalsources.

UNITII DISTRIBUTED GENERATIONS (DG)

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNITIII IMPACT OFGRID INTEGRATION

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNITIV BASICS OFA MICROGRID

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids,

UNITV CONTROL AND OPERATION OFMICROGRID

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids

M. Tech (EPS) – I Year – I Sem.

Neural Networks and Fuzzy Logic

(Program Elective – III)

Course Objectives:

- To locate soft commanding methodologies, such as artificial neural networks, Fuzzy logic and GeneticAlgorithms.
- To observe the concepts of feed forward neural networks and about feedback neuralnetworks.
- Topracticetheconceptoffuzzinessinvolvedinvarioussystemsandcomprehensiveknowledgeof fuzzy logic control and to design the fuzzycontrol
- To analyze genetic algorithm, genetic operations and geneticmutations.

Course Outcomes:

- Understand feed forward neural networks, feedback neural networks and learningtechniques.
- Analyze fuzziness involved in various systems and fuzzy settheory.
- Develop fuzzy logic control for applications in electricalengineering
- Develop genetic algorithm for applications in electricalengineering.

UNIT – I:

Artificial Neural Networks: Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks – Learning process – Error correction learning

– Hebbian learning – Competitive learning – Boltzman learning – Supervised learning – Unsupervised learning – Reinforcement learning - learning tasks.

UNIT- II:

ANN Paradigms : Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network – Functional link, network – Hopfield Network.

UNIT – III:

Fuzzy Logic: Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets – Fuzzy cartesian Product – Operations on

Fuzzy relations – Fuzzy logic – Fuzzy Quantifiers - Fuzzy Inference - Fuzzy Rule based system - Defuzzification methods.

UNIT – IV:

Genetic Algorithms: Introduction-Encoding – Fitness Function-Reproduction operators - Genetic Modeling – Genetic operators - Crossover - Single–site crossover – Two-point crossover – Multi point crossover-Uniform crossover – Matrix crossover - Crossover Rate - Inversion & Deletion – Mutation operator –Mutation – Mutation Rate-Bit-wise operators - Generational cycle-convergence of Genetic Algorithm.

UNIT–V:

Applications of AI Techniques: Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability) Reactive power control – speed control of DC and AC Motors.

TEXT BOOK:

1. S. Rajasekaran and G. A. V. Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi,2003.

REFERENCES BOOKS:

1 P. D. Wasserman, Van Nostrand Reinhold, "Neural Computing Theory & Practice" - New York, 1989.
2 Bart Kosko,"Neural Network & Fuzzy System" Prentice Hall, 1992.
3 G. J. Klirand T. A. Folger, "Fuzzy sets, Uncertainty and Information"-PHI,Pvt.Ltd, 1994.
4 D. E. Goldberg," Genetic Algorithms"- Addison Wesley1999

M. TECH (EPS)– I YEAR – I SEM.
POWER SYSTEMS SIMULATION LAB - I

Prerequisites: Power System Analysis, Power System Reliability, Voltage Stability

Course Objectives:

- Develop Programs for Power System Analysis.
- Design models for Power Systems and Power Electronics.
- Develop Programs of Power System Reliability and Power Electronics.

Course outcomes:

Upon the completion of the lab, the student will be able to Understand / Simulate / Analyze

- Power System Analysis using Software.
- Models of Power Systems and Power Electronics.
- Programs of Power System Reliability and Power Electronics

List of Experiments:

1. Simulation program for YBUS formation.
2. Simulation program for G-S Load Flow Analysis.
3. Simulation program for N-R Load Flow Analysis.
4. Simulation program for FDLF Load Flow Analysis.
5. Simulation program for Short Circuit Analysis.
6. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
7. Simulation Program for Generation System Reliability Analysis.
8. Simulation Program for Distribution System Reliability Analysis.
9. Simulink model for a single area load frequency problem and simulate the same.
10. Simulink model for a two area load frequency problem and simulate the same.

NOTE: - All the Experiment Have To Be Conducted

M. TECH (EPS)– I YEAR – II SEM.
ADVANCED POWER SYSTEM PROTECTION
(Professional Core - III)

Prerequisite: Switch Gear and Protection

Course Objectives:

- To distinguish all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
- To generalize neutral grounding for overall protection.
- To illustrate the phenomenon of Over Voltages and its classification.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Understand the basic function of a circuit breaker, all kinds of circuit breaker sand differentiate fuse and circuit breakers under fault condition.
- Describe the necessity for the protection of alternators, transformers and feeder bus bars from over voltages and other hazards
- Illustrate neutral grounding, and how over voltages can be generated and how system can be protected against lightning and switching transient over voltages with various protective means
- Identify operation and control of microprocessor based relays.

UNIT-I:

Static Relays: Advantages of static relays-Basic construction of static relays-Level detectors-Replica impedance –Mixing circuits-General equation for two input phase and amplitude comparators-Duality between amplitude and phase comparators.
Amplitude Comparators: Circulating current type and opposed voltage type- rectifier bridge comparators, Direct and Instantaneous comparators.

UNIT-II:

Phase Comparators: Coincidence circuit type- block spike phase comparator, techniques to measure the period of coincidence-Integrating type-Rectifier and Vector product type- Phase comparators.
Static Over Current Relays: Instantaneous over-current relay-Time over-current relays- basic principles –definite time and Inverse definite time over-current relays.

UNIT-III:

Static Differential Relays: Analysis of Static Differential Relays –Static Relay schemes – Duo bias transformer differential protection –Harmonic restraint relay.
Static Distance Relays: Static impedance-reactance–MHO and angle impedance relay- sampling comparator –realization of reactance and MHO relay using sampling comparator.

UNIT-IV:

Multi-Input Comparators: Conic section characteristics-Three input amplitude comparator –

Hybrid
comparator-switched distance schemes –Poly phase distance schemes- phase fault scheme –three phase scheme – combined and ground fault scheme.
Power Swings: Effect of power swings on the performance of distance relays –Power swing analysis-Principle of out of step tripping and blocking relays-effect of line and length and source impedance on distance relays.

UNIT-V:

Microprocessor based Protective Relays: (Block diagram and flowchart approach only)- Over current relays–impedance relays-directional relay-reactance relay .Generalized mathematical expressions for distance relays-measurement of resistance and reactance – MHO and offset MHO relays-Realization of MHO characteristics-Realization of offset MHO characteristics -Basic principle of Digital computer relaying, Introduction to wide area control(qualitative).

TEXT BOOKS:

1. Badri Ram and D.N. Vishwakarma, “Power system protection and Switch gear“, TMH publication New Delhi1995.
2. T.S. Madhava Rao , “Static relays”, TMH publication, second edition 1989.

REFERENCE BOOKS:

1. Protection and Switchgear, Bhavesh Bhalja, R. P. Mahesheari, NileshG. Chothani, Oxford University Press.
2. Electrical Power System Protection, C. Christopoulos and A. Wright, Springer International.

M. TECH (EPS)– I YEAR – II SEM.
POWER SYSTEM DYNAMICS AND CONTROL
(Professional Core - IV)

Prerequisite: Computer Methods in Power Systems

Course objectives:

- To remember the dynamic characteristics of power system equipment,
- To recognize dynamic performance of power systems
- To illustrate the system stability and controls.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Choose the fundamental dynamic behavior and controls of power systems to perform basic stability analysis.
- Comprehend concepts in modeling and simulating the dynamic phenomena of power systems Interpret results of system stability studies
- Analyze theory and practice of modeling main power system components, such as synchronous machines, excitation systems and governors

UNIT- I:

Basic Concepts: Power system stability states of operation and system security - system dynamics - problems system model analysis of steady State stability and transient stability - simplified representation of Excitation control.

UNIT- II:

Modeling of Synchronous Machine: Synchronous machine - park's Transformation-analysis of steady state performance per - unit quantities-Equivalent circuits of synchronous machine-determination of parameters of equivalent circuits.

UNIT- III:

Excitation System: Excitation system modeling-excitation systems block Diagram

- system representation by state equations- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

UNIT- IV:

Analysis of Single Machine System: Small signal analysis with block diagram - Representation Characteristic equation and application of Routh Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

UNIT - V:

Application of Power System Stabilizers: Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

TEXT BOOKS:

1. K. R. PADIYAR," Power system dynamics "- B.S.Publications.
2. P.M. Anderson and A. A. Fouad, "Power system control and stability", IEEE Press

REFERENCE BOOK:

1. R. Ramanujam, "Power Systems Dynamics"- PHI Publications

M. Tech (EPS)– I Year – II Sem.

ENERGY STORAGE SYSTEMS

(Professional Elective – IV)

Course objectives:

- To understand the different storage techniques
- To know the basic energy storage devices such as batteries, thermoelectric converters, fuel cells, super capacitors.
- To design energy storage for different applications.
- To analyze and design different fuel cells.

Course Outcomes:

Upon the completion of this subject, the student will be able

- To understand different energy storage techniques
- To compare different battery technologies and its characters.
- To analyze and design modern day battery technologies.
- To analyze different fields of application of ESS.

Unit-I:

Introduction: Mechanical, electrical and chemical energy storage systems and its

applications - Available and unavailable energy - Energy Analysis - Second law efficiency - Helmholtz & Gibb's function - Energy Analysis - Recent trends in Energy storage systems.

Unit-II:

Classical & Modern Batteries: Basic Concepts - Battery performance - charging and discharging - storage density - energy density and safety issues - Lead Acid- Nickel-Cadmium - Zinc Manganese dioxide.

Zinc-Air - Nickel Hydride - Lithium Battery - State Of Charge - Technology Challenges.

Unit-III:

Super Capacitors & Fuel Cells: Super capacitors - types of electrodes and some electrolytes- Electrode materials – high surface area activated carbons- metal oxide- and conducting polymers- Electrolyte - aqueous or organic- disadvantages and advantages of super capacitors - Applications of Super capacitors.

Fuel cells - direct energy conversion - maximum intrinsic efficiency of an electrochemical converter- physical interpretation - Carnot efficiency factor in electrochemical energy convertors - types of fuel cells - hydrogen oxygen cells - hydrogen air cell - alkaline fuel cell- and phosphoric fuel cell.

Unit-IV:

Mobile Applications and Micro-Power Sources: The diverse energy needs of mobile applications -Characteristics due to the miniaturized scale - Capacitative storage-electrochemical storage - Hydrocarbon storage- Pyro-electricity - Radioactive source - Recovering ambient energy.

Unit-V:

Energy Storage in Photovoltaic Systems:

Standalone photovoltaic systems - Grid connected systems- Energy Storage in PV systems using lead acid battery technology- Flywheels - Compressed Air Energy Storage - Thermal energy storage - capturing heat and cold to create energy on demand - Pumped Hydro power.

Text Books:

1. Yves Brunet, “Energy Storage", Wiley-ISTE, 1st Edition, 2010.
2. Robert A.Huggins, “Energy Storage”, Springer, 2nd Edition, 2015.

Reference Books:

1. Andrei G. Ter-Gazarian, "Energy storage systems for Power systems", 2nd edition, IET 2011.
2. R M. Dell, D.A.J. Rand, "Understanding Batteries" RSC Publications, 1st edition, 2012.

M. Tech (EPS) – I Year – II Sem.

INDUSTRIAL LOAD MODELLING & CONTROL

(Professional Elective – IV)

Prerequisite: Power Systems

Course Objectives: to prepare the students to

- understand the energy demand scenario
- model the industrial loads and study load demand
- Study reactive power management in Industries

Course Outcomes: Students will be able to

- Gain knowledge about load control techniques in industries and its application.
- Understand different types of industrial processes and optimize the process
- Apply load management to reduce demand of electricity during peak time
- Apply different energy saving opportunities in industries.

UNIT-I: INTRODUCTION TO INDUSTRIAL LOAD MODELING

Electric Energy Scenario-DemandSideManagement-IndustrialLoadManagement.LoadCurves-Load Shaping Objectives-Methodologies. Barriers; Classification of Industrial Loads- Continuous and Batch processes –Load Modeling.

UNIT-II: LOAD CONTROL METHODS

Direct load control- Interruptible load control. Bottom up approach- scheduling- Formulation of load models-Optimizationandcontrolalgorithms-Casestudies.Reactivepowermanagementinindustries- controls-power quality impacts, application of filters, Energy saving in industries.

UNIT-III: COOLING AND HEATING

Load profiling- Modeling. Cool storage-Types- Control strategies. Optimal operation Problem formulation- Case studies.

UNIT-IV: CAPTIVE POWER MANAGEMENT

Captive power units- Operating and control strategies- Power Pooling- Operation models. Energy banking-Industrial Cogeneration

UNIT-V: OPTIMAL OPERATING STRATEGIES

Selection of Schemes Optimal Operating Strategies. Peak load saving-Constraints-Problem formulation Case study. Integrated Load management for Industries

TEXT BOOKS:

1. C.O. Bjork “Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands,1989.
2. C.W.Gellings and S.N.Talukdar, “Load management concepts, ”IEEE Press, NewYork,1986, pp.3-28.

REFERENCES BOOKS:

1. Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April1981.
2. H. G. Stoll, "Least cost Electricity Utility Planning”, Wiley Inter science Publication, USA,1989.
3. I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi, 1995.
4. IEEE Bronze Book- “Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities”, IEEE Inc,USA.

M. Tech (EPS) – I Year – II Sem.

ENERGY AUDITING AND MANAGEMENT

(Professional Elective – IV)

Course Objectives:

- To know the necessity of conservation ofenergy
- To generalize the methods of energymanagement
- To illustrate the factors to increase the efficiency of electricalequipment
- To detect the benefits of carrying out energyaudits.

Course Outcomes: Upon the completion of this course, the student will be able to

- Tell energy audit ofindustries
- Predict management of energysystems
- Sequence the methods of improving efficiency of electricmotor
- Analyze the power factor and to design a good illuminationsystem
- Determine pay back periods for energy savingequipment

UNIT- I:

Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT- II:

Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

UNIT- III:

Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT- IV:

Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, pf with non linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application ofPLC's.

UNIT- V:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return , present worth method , replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment .

TEXT BOOKS:

1. Energy management by W.R. Murphy AND G. Mckay Butter worth,Heinemann publications.

2. Energy management by Paul o’ Callaghan, Mc-graw Hill Book company- 1stedition, 1998

REFERENCES:

1. Energy efficient electric motors by John .C. Andreas, Marcel Dekker IncLtd-2nd edition,1995-
2. Energy management hand book by W.C.Turner, John wiley andsons
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

M. Tech (EPS) – I Year – II Sem.

RENEWABLE ENERGY TECHNOLOGIES

(Professional Elective - V)

Course Objectives:

- To learn about photovoltaic energy conversion & its basics.
- To understand solar panels such as flat plate collectors, dish collectors and converter systems.
- To learn Renewable energy sources, like Wind Energy & Bio-Mass.
- To understand about geothermal, ocean, tidal and wave energy & concepts of DEC.
- To learn about various converter topologies for Wind Power Generation.

Course Outcomes:

At the end of this course, students will have knowledge and ability to

- Describe Renewable energy sources, generating systems, its performance characteristics and potential in India
- Explain about solar photovoltaic energy conversion systems.
- Analyze the Non conventional energy sources like Wind Energy & Bio Mass.
- Illustrate the types of energy generating systems, construction, principle, operation and applications.
- Demonstrate the different topologies of wind energy conversion system

Unit – I: Solar Radiation and Solar Energy Collection

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, photovoltaic energy conversion, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Unit – II: Solar photovoltaic

Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating

collectors, orientation and thermal analysis, advanced collectors.

Unit-III: Wind Energy and Bio-Mass

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, tip speed ratio stall & Pitch Control performance characteristics, Betz criteria.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Unit-IV: Geothermal, Ocean, Tidal and Wave Energy

Geothermal Energy: Methods of harnessing the energy.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants.

Tidal and Wave energy: Potential and conversion techniques.

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, and principles of DEC.

See beck effect, MHD generators (Ideal and Practical).

Unit-V: Wind Generator Topologies

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Text Books:

1. Non-Conventional Energy Sources - G.D. Rai, Khanna Publishing House, 2011.

2. Renewable Energy Technologies - Ramesh &Kumar ,NarosaPublishing House.

Reference Books:

1. Non-Conventional Energy Systems - K Mittal, Wheeler Publishing Co.
2. Renewable energy resources- Tiwari and Ghosal, Narosa Publishing House, 2007.
3. Non-Conventional Energy - Ashok V Desai,Wiley Eastern Ltd, New Delhi, 2003.

M. Tech (EPS)– I Year – II Sem.

POWER QUALITY & MITIGATION TECHNIQUES

(Professional Elective - V)

Prerequisite: Digital Signal Processing

Course Objectives:

- To describe various power quality issues in power system
- To analyze the power quality issues using appropriate techniques
- To give an insight to various measurement techniques and conduct power quality analysis.
- To evaluate and implement various mitigation techniques for power quality improvement.

Course Outcomes:

Upon the completion of the course the student will be able to

- Simulate and Analyze voltage sag, swell and interruption and Describe methods to reduce sag and swell
- Analyze single and three phase loads for improving power factor, harmonics and unbalanced loads
- Design of filters and compensators for harmonic reduction, load balancing and power factor improvement
- Evaluate power quality at an Industry/Data centre/Hospital and Develop solution and design a component or a product applying all the relevant standards with realistic constraints

UNIT–I:

INTRODUCTION TO POWER QUALITY: Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. Power Acceptability curves – Power Quality Standards, limits and regulations.

UNIT–II:

VOLTAGE SAGS AND SWELLS: Sources of sags and interruptions - Estimating Voltage Sag Performance -Fundamental Principles of Protection -Solutions at the End-User Level-Evaluating the Economics of Different Ride-Through Alternatives -Motor-Starting Sags - Utility System Fault-Clearing Issues, Sources of over voltages - Capacitor switching – Ferro resonance. Mitigation of voltage swells - surge arresters.

UNIT-III:

ANALYSIS OF SINGLE PHASE AND THREE PHASE LOADS: Power in single phase systems: Sinusoidal voltage, non-sinusoidal voltage – Power in three phase systems: Balanced & unbalanced loads – phasor analysis – three phase unbalanced and distorted source supplying nonlinear loads – concept of power factor under non-sinusoidal voltages and/or currents.

UNIT-IV:

CONVENTIONAL LOAD COMPENSATION TECHNIQUES & HARMONIC ANALYSIS: Analysis of unbalance – symmetrical components, instantaneous real and reactive powers - Principle of load compensation and voltage regulation – classical load balancing problem: open loop balancing closed loop balancing, current balancing.

Principles for Controlling Harmonics - Harmonic analysis using mathematical tools – Computation of THD, TDD, DIN – Extraction of fundamental sequence component from measured samples.

UNIT-V:

FILTER DESIGN & POWER QUALITY MONITORING AND SURVEY:

Harmonic Reduction: Design of passive filter – performance evaluation and rating of filters - Instantaneous real and reactive power theory - shunt active filter - series active filter - reference current generations - Instantaneous symmetrical component theory - realization of DSTATCOM,UPQC energy.

Monitoring Considerations - Power Quality Measurement Equipment-Assessment of Power Quality Measurement Data-Application of Intelligent Systems-Power Quality Monitoring Standards.

Text Books

1. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, Tata Mcgraw-hill, Newdelhi, 2012

2. Mohammad A.SMasoum, Ewald F.Fuchs, “Power Quality in Power Systems and Electrical Machines”, Academic Press, Elsevier, 2015.

Reference Books

1. Ghosh and G. Ledwich, “Power Quality Enhancement Using Custom Power Devices”, Springer Verlag, 2012.

2.Surajit Chattopadhyay, Madhuchhanda Mitra, SamarjitSengupta,“Electric Power Quality”, Springer Publications, 2011

3.Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, “Power Quality: Problems and Mitigation Techniques”, John Wiley & sons Ltd, 2015.

M. Tech (EPS)– I Year – II Sem.

PROTOCOLS FOR SMART GRID

(Professional Elective - V)

Course Objectives:

- To familiarize with the working and features of smart grid
- To understand the various communication technologies for Smart grid
- To understand the standards and protocols for smart grid

Course Outcomes:

At the end of this course, students will have knowledge and ability to

- Identify the importance of smart grid as compared to a conventional AC grid.
- Illustrate the importance and application of Phasor measuring unit
- Recognize the importance of management of power demand in grid
- Describe the various security issues related to smart grid
- Apply the various control aspects to smart grid

Unit – I: Measurement Technology:

Introduction: Electric grid-Grid Topologies- Microgrid concept- Justifications for smart grids-Differences between the conventional grid and smart grid-Working definition of smart grid based on performance measures-Functions of smart grid components-Monitoring and Control Technology component- Intelligent Grid Distribution component-Demand Side Management.

Measurement Technology: Monitoring, Phasor Measurement Units(PMU) Working and applications-Optimal placement of PMU-Fault Detection and Self healing-smart meters-an overview of the hardware used-Demand Side Integration-smart appliances-Advanced Metering Infrastructure-Multi agent Systems for smart grid implementation

Unit – II: Information and Communications Technology:

Data Communication-dedicated and shared communication channels-GSM,GPRS,3G-WiMax,Zigbee Coordination between cloud computing and smart power grids-Development of power system models and control and communication Software.

Unit-III: Interoperability, Standards and Cyber Security:

State of the art interoperability-Benefits and challenges of interoperability-Smart grid network interoperability-Cyber Security concerns associated with AMI.

Unit-IV: Standards for Smart Grid Operations & Communication Protocols:

IEC standards for substation automation-IEC 61850-IEC standard for energy management systems- IEC 61970-ANSI C12.22 for Smart metering.

Providing Common information model- IEC 60870-IEC 62351-High Speed Power Line

communication-IEEE P1901**.**

Unit-V: Smart Grid Operations:

SCADA (supervisory control and data acquisition) Functions and function architecture - Configuration Management- Fault Management -Accounting Management Security Management Data and data architecture-Common Information Model (CIM) Process architecture.

Text Books:

1. James A.Momoh, "Smart grid: Fundamentals of Design and Analysis", IEEE press and Wiley publications, 2012.
2. Janaka Ekanayake, KithsiriLiyanage,JianzhongWu,AkihikoYokoyama,Nick Jenkins, "Smart Grid Technology and Applications", Wiley 2011.

Reference Books:

1. Hassan Farhangi, "The path of the smart grid", IEEE power and Energy Magazine, Vol.8, No.1, Jan 2010.

M. Tech (EPS) – I Year – II Sem.

English for Research Paper Writing

(Audit Course)

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first- time submission

Syllabus

UNIT-I

Planning and Preparation, Word Order, Breaking up long sentences,Structuring Paragraphs and Sentences, Being Conciseand Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT-II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper,Abstracts, Introduction.

UNIT-III

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT-IV

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing anIntroduction, skills needed when writing a Review of the Literature.

UNIT-V

Skills are needed when writing the Methods, skills needed when writing the Results; skills are needed when writing the Discussion,Skills are needed when writing the Conclusions.

UNIT-VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

TEXT BOOKS/ REFERENCE BOOKS:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998),Handbook of Writing for the MathematicalSciences,SIAM. Highman'sbook.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London,2011

M. Tech (EPS)– I Year – II Sem.
ENERGY FROM WASTE
(Open Elective)

Prerequisite: None

UNIT- I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT- II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT- III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT- IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT- V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion Types of biogas Plants–Applications-Alcoholproductionfrombiomass-Biodieselproduction-Urbanwastetoenergy conversion - Biomass energy programme in India.

TEXT BOOKS/ REFERENCE BOOKS:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996.

M. Tech (EPS)– I Year – II Sem.

COMPOSITE MATERIALS
(Open Elective)

Prerequisite: None

UNIT– I

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT– IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS/ REFERENCE BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.

3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K. K.Chawla.
5. Composite Materials Science and Applications – Deborah D. L.Chung.
6. Composite Materials Design and Applications–Danial Gay, SuongV. Hoa ,and Stephen W.Tasi.

M. Tech (EPS)– I Year – II Sem.
INDUSTRIAL SAFETY
(Open Elective)

Course Objectives:

- To provide information regarding different elements of industrial water pollution and Methods of treatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

Course Outcomes: At the end of the course, student will be able to:

- Know how to take safety measures in executing works
- Identify the need for maintenance (or) replacement of equipment
- Understand the need for periodic and preventive maintenance

UNIT- I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT- II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT- III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,

i. Screw down grease cup,
ii. Pressure grease gun,
iii. Splash lubrication,
iv. Gravity lubrication,
v. Wick feed lubrication
vi. Side feed lubrication,
vii. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT- IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,

I. Any one machine tool,
II. Pump
III. Air compressor

IV. Internal combustion engine,
V. Boiler,
VI. Electrical motors, Types of faults in machine tools and their general causes.

UNIT- V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

I. Machine tools,
II. Pumps,
III. Air compressors,
IV. Diesel generating (DG)sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins &Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman &Hall London.

M. TECH (EPS)– I YEAR – II SEM.
POWER SYSTEMS & SIMULATION LAB -II

Prerequisites: Power System Analysis, Power System Protection

Course Objectives:

- To understand the Performance of Transformers and Synchronous Machines
- To select the Transmission Lines, UG Cables, CTs and PTs.
- To analyze the characteristics of different types of relays.

Course Outcomes: Upon the completion of the lab, the student will be able to

- Test and evaluate the performance of Transformers and Synchronous Machines.
- Test and evaluate the performance of Transmission lines, UG Cables, Insulators and other Auxiliary Power Systems Equipment
- Test, Evaluate/Choose the various types of Relays

List of Experiments:

Part A:

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Fault Analysis (single line to line fault).
3. Determination of Sub-transient reactance's of a Salient Pole Synchronous Machine.
4. Characteristics of Over Current Relay.
5. Performance and Testing of Generator Protection System.
6. Performance and Testing of Transformer Protection System.
7. Performance and Testing of Transmission Line Model.
8. Determination of Transmission Line Parameters.
9. Determination of Earth resistance under various conditions.

Part B:

1. Load Flow Analysis Using ETAP.
2. Short Circuit Analysis Using ETAP.
3. Transient Stability Analysis Using ETAP.

NOTE: - From the Above 10 Experiments Have To Be Conducted

Electrical & Electronics Engineering

B-Tech Honors on "Electric Vehicles"

S.No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Introduction to Hybrid& Electric Vehicles	3	0	0	3
2		Control of Electric Vehicles	3	0	0	3
3		E-Mobility and Charging Infrastructure(Online Course)	3	0	0	3
4		Electric Vehicles and Smart Grids(Online)	3	0	0	3
5		Project on Electric Vehicles	0	0	06	6
TOTAL			**12**	**0**	**06**	**18**

****Not only above said courses any other courses recommended by internal BoS members will be considered**

Electrical & Electronics Engineering

B-Tech Honors in "Smart Grids"

S.No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Introduction to Smart Grids(Online)	3	0	0	3
2		Smart Grids Planning and Operation	3	0	0	3
3		Cyber Security of Smart Grids(Online)	3	0	0	3
4		Smart Grid Protection	3	0	0	3
5		Project on Smart Grids	0	0	06	6
TOTAL			**12**	**0**	**06**	**18**

****Not only above said courses any other courses recommended by internal BoS members will be considered**

B-Tech Minor in "Electric Vehicles"

S.No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Fundamentals of Hybrid& Electric Vehicles	4	0	0	4
2		Control Aspects of Electric Vehicles	4	0	0	4
3		E-Mobility and Charging Infrastructure	4	0	0	4
4		Energy Storage Systems	3	0	0	3
5		Battery Management System(BMS) for Electric Vehicles	3	0	0	3
TOTAL			**18**	**0**	**0**	**18**

****Not only above said courses any other courses recommended by internal BoS members will be considered**

g) <u>Minutes of the BoS in Information Technology</u>

Minutes of the Meeting of Board of Studies

The Second Board of Studies (BoS) meeting of the Department of Information Technology, Anurag University was held on Saturday 27th March 2021 at 2.00 PM. Due to the ongoing pandemic of Covid-19, the meeting was conducted online.

The meeting was convened to discuss and finalize the Anurag University - R20 regulations (AU-R20):

- Course structure and syllabus of B. Tech II, III and IV Year
- Pre-Ph. D course structure and syllabus
- Introduction of B. Tech Honors and Minors and their course structure and syllabi

The chairman has welcomed the members and conducted the proceedings. The following resolutions were made in the meeting.

Item	Description	Resolution
Item No. 1:	Course Structure of II, III & IV Years of B. Tech in Information Technology of AU-R20	The BoS members had a glance of the approved (as on 4th July 2020) course structure of II, III & IV Years of B. Tech in Information Technology. All the members appreciated the course structure.
Item No. 2:	Distribution of the credits	The board has approved the credit distribution to Humanities & Sciences, Basic Sciences, Engineering Sciences, Program Core, Program Electives, Open Electives, and Project Work.
Item No. 3:	Course Objectives and Course Outcomes	The members suggested modifications to the course objectives and outcomes of few courses in line with Bloom's taxonomy verbs. The suggestions are incorporated.
Item No. 4:	Course syllabi of II, III & IV Years of B. Tech in Information Technology of AU-R20	After an elaborate discussion, the BoS has approved the syllabi of II, III & IV Years of B. Tech in Information Technology.
Item No. 5:	B. Tech Honors in Cyber Security	The Board has appreciated the proposal to offer B. Tech honors in Cyber Security. The proposed course structure and syllabi has been approved.
Item No. 6:	B. Tech Minors in Information Technology	The proposed course structure and syllabi of Minors has been approved by the board.

Item No. 7:	Course Structure and Syllabus of Pre-Ph.D in Information Technology of AU-R20	The course structure and syllabus of Pre Ph.D has been approved.
Item No. 8:	In case of amendments / changes in the course structure or syllabi, the Board has suggested the Chairman:	a. In any case, if there are major changes/amendments either in course structure or syllabus, the BoS meeting shall be called for its approval b. If there are any minor changes in course structure or syllabus, it will be communicated to all BoS members through email for e-approval.
Item No. 9:	The Board has empowered the chairman, to:	a. Incorporate new elective courses (Professional and Open Electives) as per the need b. Modify / change the syllabus as per Item 8 c. Finalize the list of examiners for the external examination.

The meeting was concluded with a vote of thanks.

The following members have attended the meeting:

S.No	Name	Designation in BOS
1	Dr. Atulnegi, Professor, University of Hyderabad	External Member
2	Mr. Neeraj Kapre, Asst. Manager, Campus Hiring , CapGemini, Mumbai	External Member
3	Ms. T. Niveditha, (Alumnus), Associate Consultant, Amazon India, Hyderabad	External Member
4	Dr. Prasantha Rao, Professor, Dept. of Information Technology	Internal Member
5	Mrs. Niteesha Sharma, Asst. Professor, Dept. of Information Technology	Internal Member
6	Dr. K. S. Reddy, Professor and Head, Dept. of Information Technology	Chairman
7	Other senior faculty members and doctorates were also attended	

Department of Information Technology
Four Year Course Structure
R20 Regulations

B.TECH (IT) I YEAR I SEMESTER **[4 T + 5 P]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–I	3	1	0	4.0
2	BSC	Physics	3	1	0	4.0
3	BSC	Physics Lab	0	0	3	1.5
4	ESC	Basic Electrical Engineering	3	0	0	3.0
5	ESC	Basic Electrical Engineering Lab	0	0	2	1.0
6	ESC	Engineering Workshop	0	0	3	1.5
7	HSS&MC	English Language Skills Lab	0	0	2	1.0
8	ESC	Programming and Problem Solving- I	2	0	0	2.0
9	ESC	Programming and Problem Solving-I Lab	0	0	3	1.5
		TOTAL	11	02	13	19.5

B.TECH (IT) I YEAR II SEMESTER **[4 T + 4 P]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	BSC	Mathematics–II	3	1	0	4.0
2	BSC	Chemistry	3	1	0	4.0
3	BSC	Chemistry Lab	0	0	3	1.5
4	HSS&MC	English	2	0	0	2.0
5	HSS&MC	English Communication Skills Lab	0	0	2	1.0
6	ESC	Programming and Problem Solving-II	2	0	0	2.0
7	ESC	Programming and Problem Solving – II Lab	0	0	3	1.5
8	ESC	Engineering Graphics	1	0	3	2.5
		TOTAL	11	2	11	18.5

B.TECH (IT) II YEAR I SEMESTER **[5 T + 3 P + 1 M]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	PCC	Data Structures	3	0	0	3.0
2	ESC	Digital Logic Design	3	0	0	3.0
3	ESC	Discrete Mathematics	3	0	0	3.0
4	BSC	Probability and Statistics	3	0	0	3.0
5	PCC	Introduction to Python Programming	2	0	0	2.0
6	PCC LAB	Python Programming Lab	0	0	4	2.0
7	PCC LAB	Data Structures Lab	0	0	4	2.0
8	PCC LAB	Linux Programming Lab	0	0	4	2.0
9	MC	Environmental Studies	2	0	0	0
		TOTAL	16	0	12	20

B.TECH (IT) II YEAR II SEMESTER **[5 T + 3 P + 1 M]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	PCC	Computer Organization	3	0	0	3.0
2	PCC	Formal Languages and Automata Theory	3	0	0	3.0
3	PCC	Software Engineering	3	0	0	3.0
4	PCC	Database Management Systems	3	0	0	3.0
5	PCC	Object Oriented Programming	3	0	0	3.0
6	PCC LAB	Database Management Systems Lab	0	0	4	2.0
7	PCC LAB	Java Programming Lab	0	0	4	2.0
8	HSS&MC LAB	Soft Skills for Success Lab	0	0	2	1.0
9	MC	Gender Sensitization	2	0	0	0
		TOTAL	17	0	10	20

B.TECH (IT) III YEAR I SEMESTER **[4 T + 4 P + 1 M]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	PCC	Artificial Intelligence	3	0	0	3.0
2	PCC	Operating Systems	3	0	0	3.0
3	PEC-I	1. Mobile Application Development 2. Object Oriented Analysis and Design 3. Software Testing	3	1	0	4.0
4	PCC	Design and Analysis of Algorithms	3	1	0	4.0
5	HSS&MC	Design Thinking	0	0	3	1.5
6	PCC LAB	Web Technologies Lab	0	0	3	1.5
7	PEC-I LAB	1. Mobile Application Development 2. Object Oriented Analysis and Design 3. Software Testing	0	0	3	1.5
8	BSC LAB	Quantitative Aptitude and Reasoning	0	0	3	1.5
9	MC	NSS / NSO	2	0	0	0
		TOTAL	14	2	12	20

B.TECH (IT) III YEAR II SEMESTER **[4 T + 4 P]**

S. No	Category	Course	Hours per week			Credits
			L	T	P	
1	PCC	Computer Networks	3	0	0	3.0
2	HSS&MC	Entrepreneurship Development	3	0	0	3.0
3	PEC –II	1. Machine Learning 2. Cloud Computing 3. Data Warehousing and Data Mining	3	1	0	4.0
4	PEC – III	1. Compiler Design 2. Software Project Management 3. Data Science	3	1	0	4.0
5	PCC LAB	Computer Networks Lab	0	0	3	1.5
6	PEC –II LAB	1. Machine Learning Lab 2. Cloud Computing Lab 3. Data Warehousing and Data Mining Lab	0	0	3	1.5
7	BSC LAB	Verbal Ability and Critical Reasoning	0	0	3	1.5
8	HSS&MC LAB	Professional Skills Lab	0	0	3	1.5
		TOTAL	12	2	12	20

B.TECH (IT) IV YEAR I SEMESTER **[4 T + 4 P]**

S. No	Category	Course	Hours per week L	T	P	Credits
1	HSS&MC	Managerial Economics and Financial Analysis	3	0	0	3.0
2	PCC	Information Security	3	1	0	4.0
3	PEC-IV	1. Block chain Technology 2. Big Data Analytics 3. User Experience Design	3	1	0	4.0
4	OEC - I	1. Essential English & Employability Skills 2. Technical and Business Communication Skills 3. English for Professionals	3	0	0	3.0
5	OEC – I LAB	1. Essential English & Employability Skills 2. Technical and Business Communication Skills 3. English for Professionals	0	0	4	2.0
6	PCC LAB	Internet of Things Lab	0	0	4	2.0
7	PEC-IV LAB	1. Block chain Technology Lab 2. Big Data Analytics Lab 3. User Experience Design Lab	0	0	4	2.0
8	PROJ	Mini Project / Summer Internship	0	0	4	2.0
		TOTAL	12	2	16	22

B.TECH (IT) IV YEAR II SEMESTER **[2 T + 3 P]**

S. No	Category	Course	Hours per week L	T	P	Credits
1	OEC-II	1. Management Science 2. Operations Research 3. Intellectual Property Rights	3	0	0	3.0
2	OEC-III	1. Negotiation Skills 2. Project Management 3. Value Engineering	3	0	0	3.0
3	PROJ	Seminar	0	0	4	2.0
4	PROJ	Comprehensive Viva-Voce	0	0	0	2.0
5	PROJ	Project	0	0	20	10
		TOTAL	6	0	24	20

Weightages of Category of Courses:

S. No	Category	AICTE Suggested Credits	Credits
1	Humanities and Social Sciences including Management Courses	12	4+8.5=14
2	Basic Science Courses	24	19+6=25
3	Engineering Science courses including Workshop, Drawing, Basics of Electrical / Computer/Mechanical etc.	29	15+6=21
4	Professional Core Courses	49	52
5	Professional Elective Courses relevant to chosen specialization / branch	18	21
6	Open Elective courses	12	11
7	Project work, Seminar and internship in Industry or elsewhere	15	16
8	Mandatory Courses MC [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	0	0
Total Credits		159	160

Syllabus of 2nd Year B. Tech IT

ANURAG UNIVERSITY

B.Tech. IT – II Year I Sem.

L	T / P / D	C
3	0	3

DATA STRUCTURES

Course Objectives:

Course Objectives of Data Structures are to:

1. Appraise the fundamental concepts of data structures and their representations.
2. Describe the applications of non-linear data structures.
3. Summarize the concepts of Advanced Trees.
4. Discuss the implementation of various Graph representations and traversals.
5. Outline the basic concepts of Hashing and Collision resolution Techniques.

Course Outcomes:

At the end of this Data Structures course, students will be able to:

1. Summarize Static and Dynamic data structures in implementing Stack applications
2. Implement Tree traversal algorithms in solving real time applications
3. Analyze the concepts of Advanced Trees to generate search efficiently
4. Interpret the importance of Graphs in solving real time applications
5. Apply the concepts of hashing.

UNIT I:

Introduction: What is data structure, Types of data structures, Static and Dynamic representation of data structure and comparison. Stacks- definition, operations,Applications ofstacks – Representation and evaluation of expressions using Infix, Prefix and Postfix, Algorithms for conversions and evaluations of expressions from infix to prefix and postfix using stack, Towers of Hanoi, Parenthesis checker.

UNIT II:

Trees: Basic terminology, Types of trees: Binary Tree: terminology, Complete and Full Binary Tree, Extended Binary Trees, Threaded Binary Trees-Inorder Threading. Representation of Trees using Arrays and Linked lists (advantages and disadvantages). Tree Traversal and Representation of Algebraic expressions; Algorithms for Tree Traversals,

Heaps: Introduction, types of Heaps – Min binary heap, Max binary heap.

UNIT III:

Advanced concepts on trees: Representation and Creation of Binary Search Trees (BST), Algorithm for Inserting, deleting and searching in BST. Representation and advantages of AVL Trees, algorithms on AVL Trees-Insertion, Rotation and Deletion. Definition and advantages of B-trees, B Tree of Order M, operations- Insertion and Searching, Introduction to Red-Black Trees and Splay Trees.

UNIT IV:

Graphs: Basic terminology, Representation of graphs: sequential representation (Adjacency, Path Matrix) Linked representation.

Graph Traversals-Breadth First Search, Depth First Search with algorithms. Definition and properties of Spanning Tree, Minimum Spanning Tree, Minimum Spanning Tree Algorithms, Dijkstra Algorithms.

UNIT V:

Hashing: General Idea, Hash Functions, Collision Resolution- Separate Chaining, Open Addressing-Linear probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Implementation of Dictionaries

Text Book:

1. Seymour Lipschutz, Schaum’s Outlines, Data Structures, Special Second Edition, Tata McGraw-Hill,2014.

Reference Books:

1. Richard F.Gillberg & Behrouz A. Forouzan, Data Structures, A Pseudo code Approach with C, Second Edition, Cengage Learning, India Edition, 2005.
2. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, Data Structures Using C and C++, PHI Learning Private Limited, Delhi India,2001.
3. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publications Pvt Ltd Delhi India,2015.
4. A.K. Sharma, Data Structure Using C, Pearson Education India,2011

ANURAG UNIVERSITY

B.Tech. IT – II Year I Sem.

DIGITAL LOGIC DESIGN

L	T / P / D	C
3	0	3

Course Objectives:

Course Objectives of Digital Logic Design are to:

1. Describe Number system, conversions on other codes and their significance.
2. Evaluate the minimization of logic gates using Boolean algebraic principles and k-maps.
3. Analyze logic processes and design logical operations using combinational logic circuits.
4. Analyze different flip-flops using sequential circuit concepts.
5. Develop Register and Counters applications using sequential Circuits.

Course Outcomes:

At the end of this Digital Logic Design course, students will be able to:

1. Demonstrate different type of codes and number system conversion.
2. Apply Boolean algebra techniques to minimize logic gates in digital circuits.
3. Design various simple and complex combinational circuits with real time applications.
4. Analyze the basic principles behind flip flops and the design of sequential circuits.
5. Construct various types of counters and registers.

UNIT I:

Number Systems: Binary, Octal, Hex Decimal, and Conversions, range; Binary additions and subtractions (using 1c, and 2c), concept of overflow; representations of negative numbers using 1’s and 2’s complement and range; BCD numbers: Representation of 8421, 2421, Ex-3, Gray and self-complementary codes; additions and subtractions on 8421 codes; Error detecting codes: even, odd parity, hamming codes; Error correcting codes: hamming codes, block parity codes; Floating point representation.

UNIT II:

Boolean Algebra and Digital Logic GATES, Basic Boolean laws and properties; Boolean functions; canonical and standard forms (SOP, POS); Gate minimization using three and four variable K-Map’s with and without don’t cares. Logic Circuit Design BCD code converters using K-map.

UNIT III:

Introduction to combinational circuits and applications,Design Procedure, Combinational circuit for Half Adder, Full Adder and other problems, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers.

UNIT IV:

Introduction to Sequential Circuits and its applications, Lathes, Flip flops, Storage Elements, Flip-flops, S-R Flip-flop, D Flip Flop, J-K Flip Flop, T Flip-flop. Analysis of Clocked Sequential Circuits, Simple Problems. Flip Flop Conversions

UNIT V:

Registers and Counters: Introduction**,** Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter, Ripple Counter

Text Book:

1. M. Morris Mano, Digital Design, Third Edition, Pearson Education/PHI, 2001.

Reference Books:

1. John F. Wakerly, Digital Design, Principles and Practices, 4th Edition, Pearson / Prentice Hall, 2005.
2. Malvino & Leach, Digital Principles and Applications, Seventh Edition, Tata McGraw-Hill Education, 2010.
3. A.K. Maini, Digital Electronics, Principles and Integrated Circuits, 1st Edition, Wiley India Publications, 2007.
4. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2012.
5. Roth, Fundamentals of Logic Design, Fifth Edition, Thomson, 2004.

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B.Tech. IT – II Year I Sem.

DISCRETE MATHEMATICS

L	T / P / D	C
3	0	3

Course Objectives:

Course Objectives of Discrete Mathematics are to:

1.Interpret the Sets, syntax and semantics of propositional and predicate logic.

2. Solve applications involving Permutations and Combinations.

3. Formulate Recurrence relations to solve problems involving an unknown sequence.

4. Explain the concepts of Relations and Graphs.

5. Illustrate the Algebraic Structures.

Course Outcomes:

At the end of this Discrete Mathematics course, students will be able to:

1. Distinguish between Statement Logic and Predicate Logic.
2. Apply the principles of Permutations and Combinations with repetition & without repetitions.
3. Solve Recurrence Relations by using generating functions.
4. Demonstrate the use of Relations and Graph Theory.
5. Analyze the Algebraic Structures with their properties.

UNIT I:

Foundations: Basics, Sets and Operations of Sets, Fundamentals of Logic, Logical Inferences, First order logic and other methods of Proof, Rules of Inference for Quantified Propositions. **(Problems Only and Theorems without Proofs)** [TB:1, CH:1]

UNIT II:

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumerating Combinations and Permutations with & without repetitions, constrained repetitions, and Principle of Inclusion and Exclusion. **(Problems Only and Theorems without Proofs)**

[TB:1, CH:2]

UNIT III:

Recurrence Relations: Generating Functions, calculating coefficient of Generating Function, Solving Recurrence relations by substitution method and Generating Functions, The Method of Characteristic Roots, Solutions to inhomogeneous recurrence relations. **(Problems Only and Theorems without Proofs)** [TB:1, CH:3]

UNIT IV:

Relations and Digraphs: Relations and Directed Graphs, Special Properties of Binary Relations, Equivalence Relations, Ordering Relations, Lattices, Operations on Relations, Paths and Closures, Directed Graphs and adjacency matrices. **(Problems Only and Theorems without Proofs)**

Graphs: Basic Concepts, Isomorphism's and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs. **(Problems Only and Theorems without Proofs)** [TB:1, CH:4&5]

UNIT V:

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. **(Problems Only and Theorems without Proofs)** [TB:2, CH:3]

Text Books:

1. Joe L. Mott, Abraham Kandel, Theodare P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition, PHI, 2019.

2. J. P.Tremblay and P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2007

Reference Books:

1. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7th Edition, Tata McGraw Hill,2012.

2. S. K. Chakraborthy and B.K. Sarkar," Discrete Mathematics ", Oxford, 2011.

3. C. L. Liu and D. P. Mohapatra,"Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill,2008.

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B.Tech. IT – II Year I Sem.	L	T / P / D	C
INTRODUCTION TO PYTHON PROGRAMMING	2	0	2

Prerequisites: Any Programming language concepts

Course Objectives:

Course Objectives of Introduction to Python Programming are to:

1. Appraise the classes and objects and its usage.
2. Discuss the functions and string operations.
3. Describe the built-in functions and Inheritance concepts.
4. Compare the Overloading and Overriding concepts.
5. Develop the programs on various packages.

Course Outcomes:
At the end of this Introduction to Python Programming course, students will be able to:
1. Apply different control structures and object-oriented concepts to develop programs.
2. Illustrate various String handling functions and Regular Expressions.
3. Solve the problems by using Inheritance and Abstract classes
4. Build programs on Operator overloading, Overriding and Exception Handling
5. Implement programs on various packages.

UNIT I:

Basic concepts of Object-Oriented Programming (OOP): Introduction to OOP, Procedural vs Object Oriented Programming, Concept pf class, object, Abstraction, Encapsulation, Inheritance and Polymorphism, benefits and applications of OOP

Introduction to Python:

Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations

UNIT II:

Functions and Modules: Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Strings and Regular Expressions: String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.

Sequence: List, Tuples, Dictionaries, Sets.

UNIT III:

Implementation of classes and objects in Python: Classes and Objects, Class Method and Self Argument. The **__init__**Method, Class Variables and Object Variables, The **__del__**

Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Implementation of Inheritance in Python: Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class.

UNIT IV:

Implementation of Operator Overloading in Python: Introduction, Implementing Operator Overloading, Overriding Methods

Exception Handling in Python: Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

UNIT V:

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib: Plot, Scatterplot, Introduction to Tkinter, Date and Time Packages.

Text Book:

1. Reema Thareja, Python Programming using Problem Solving Approach, First Edition, Oxford Higher Education,2017.

Reference Books:

1.Kenneth A. Lambert, Fundamentals of Python, Cengage Learning, Second Edition,2019.

2.CharlesDierach, Introduction to Computer Science using Python, Wiley Indian Edition,2013.

3.James Payne, Beginning Python using Python 2.6 and Python 3,Wrox , First Edition,2010.

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B.Tech. IT – II Year I Sem.	L T / P / D C
PYTHON PROGRAMMING LAB	0 4 2

Course Outcomes:
At the end of this Python Programming Lab course, students will be able to:

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write programs on strings and functions
4. Implement programs on class and related concepts.
5. Solve various exception handling programs and implement the packages.

Week 1:

Installation and Environment set up of Python & Programs on Data types

Week 2:

Programs on Standard I/O, Operators and Expressions

Week 3:

Programs on Functions

Week 4:

Programs on lists and Tuples

Week 5:

Programs on Dictionaries

Week 6:

Programs on Strings and string operations

Week 7:

Programs on Regular Expressions.

Week 8:

Programs on class & object, static and instance method implementation

Week 9:

Programs on Inheritance and Polymorphism

Week 10:

Programs on Stacks and Queues

Week 11:

Programs on Exception Handling, Database Connectivity, Executing queries

Week 12:

Demonstration of Numpy Package

Week 13:

Demonstration of Pandas Package

Week 14:

Demonstration of Matplotlib Package and Tkinter Package

Week 15:

Demonstration of Date and Time Packages

ANURAG UNIVERSITY

B.Tech. IT – II Year I Sem.

L	T / P / D	C
0	4	2

DATA STRUCTURES LAB

Course Outcomes:

At the end of this Data Structures Lab course, students will be able to:

1. Develop the programs on stacks and its applications.
2. Demonstrate the operations on Trees.
3. Code the implementation of various advanced trees.
4. Design and implementation of programs on BST and Graph Traversals.
5. Develop the programs on Hashing and Dictionaries

List of Experiments:

Week 1:

1. Review of Stack and Queue Operations using arrays and Linked Lists

Week 2:

2. Program to convert infix to postfix notation

3. Program to evaluate postfix notations

Week 3:

4.Program to implement towers of Hanoi

5.Program to implement parenthesis checker

Week 4:

6.Program to illustrate tree traversals
   a) In order b) Preorder c) Post order

Week 5:

7.Program to illustrate insertion, deletion and searching in Binary Search Tree.

Week 6:

8.Program to implement Heaps
   a) Min Heap b) Max Heap

Week 7:

9.Program to illustrate Insertion on AVL Trees.

10.Program to illustrate deletion and Rotation on AVL Trees.

Week 8:

11.Program to implement B-Trees

a) Insertion b) Search c) Display

Week 9:

12.Program to illustrate Graph traversals

a. Breadth First Search
b. Depth First Search

Week 10:

13.Program to implement

a) Prim's algorithm b) Kruskal's algorithm

Week 11:

14.Program to Implement Dijkstra algorithm.

Week 12 & 13:

15.Program to implement Hashing and collision resolution techniques

Week 14:

16.Program to implement Dictionaries.

Week 15:

Review

ANURAG UNIVERSITY

B.Tech. IT – II Year I Sem.

LINUX PROGRAMMING LAB

L	T / P / D	C
0	4	2

Course Outcomes:
At the end of this course, Students will be able to:
1. Practice the basic commands in Linux Operating System.
2. Create directories and Shell Script programs.
3. Analyze a given problem and apply requisite facets of Shell programming.
4. Apply system calls to file handling mechanisms.
5. Develop a C Program for Unix Commands.

Over View Session-1
Linux Operating System

List of Experiments:
Week-1:
Practice Vi Commands
Week-2:
a) Open the file created in session 1
b) Add some text
c) Change some text
d) Delete some text
e) Save the Changes
Week-3:
a) Create mytable (name of the table) using cat command for the following data.use tab to separate fields.

1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86

b) Use the cat command to display the file, mytable.
c) Use the vi command to correct any errors in the file, mytable.

Week-4:
a)Use the sort command to sort the file mytable according to the first field. Call the sorted file mytable (same name)
b) Print the file mytable
c) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)
d) Print the new file, mytable
e) Logout of the system.

Week-5:

a) Use the appropriate command to determine your login shell

b) Use the /etc/passwd file to verify the result of "step a".

c) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.

d) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

Week-6:

a) Write a sed command that deletes the first character in each line in a file.

b) Write a sed command that deletes the character before the last character in each line in a file.

c) Write a sed command that swaps the first and second words in each line in a file.

Week-7:

a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.

b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.

Week-8:

a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.

b) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.

c) Write a shell script that determines the period for which a specified user is working on the System.

Week-9:

a) Write a shell script to perform the following string operations:

i) To extract a sub-string from a given string.

ii) To find the length of a given string.

b)Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.

c) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

Week-10:

a) Write a shell script that computes the gross salary of a employee according to the following rules:

i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.

ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic

The basic salary is entered interactively through the key board.

b) Write a shell script that accepts two integers as its arguments and compute the value of first number raised to the power of the second number.

Week-11:

a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, then program ask the user for the necessary information, such as the file name, new name and so on.

Week-12:

a) Write shell script that takes a login name as command – line argument and reports when that person logs in

b) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

Week-13:

a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.

b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

Week-14:

Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:

i) File type

ii) Number of links

iii) Read, write and execute permissions

iv) Time of last access

(Note: Use stat/fstat system calls)

Over View Session-2

Importance of shell Script

Text Books:

1. Unix concepts and applications, Fourth Edition, Sumitabha Das, TMH,2008

2. Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education, 2007.

B.Tech Honors Degree in Cyber Security

S. No	Course Code	Course	Hours per week			Credits
			L	T	P	
1	PCC	Information Theory for Cyber Security	3	0	0	3.0
2	PCC	Fundamentals of Cyber Security	3	0	0	3.0
3	PCC	Steganography and Digital Watermarking	3	0	0	3,0
4	PEC-I	1. Cyber Law and Security Policy 2. Security Assessment and Risk Analysis 3. Data Encryption and Compression 4. Database Security 5. Web Security 6. Cloud Security	3	0	0	3.0
	…	OR Any other MOOCS course as suggested and approved by the BoS				
6	PROJ	Project Work	0	0	12	6
		TOTAL	12	0	6	18

B.TECH Minor Degree in Information Technology

S. No	Course Code	Course	Hours per week			Credits
			L	T	P	
1	PCC	Design of Algorithms	3	0	3	4.5
2	PCC	Object Oriented Programming	3	0	3	4.5
3	PCC	Database Management Systems	3	0	3	4.5
4	PCC	Operating Systems	3	0	3	4.5
5	PCC	Python Programming	3	0	3	4.5
6	PCC	Web Technologies	3	0	3	4.5
7	PCC	Cloud Computing	3	0	3	4.5
8	PCC	Mobile Application Development	3	0	3	4.5
		TOTAL	12	0	12	18

Student has to register for any of the four courses from the list.

h)<u>Minutes of the BoS in Mechanical Engineering</u>

Minutes of BoS Meeting of Mechanical Engineering (UG&PG)

held on 1st and 3rd April, .2021

The meeting of all the members of Board of Studies - **Mechanical Engineering,** Anurag University, was held on 01.04.2021 at 11:00 A.M. and on 03.04.2021 at 2:00 pm in virtual mode on Google Meet.

The following members were Present/Absent for the meeting:

S. No.	Name & Details of Members	Designation	Present/ Absent
1	Dr. A.V. Sita Rama Raju Professor, Dept. of Mechanical Engineering, A.U.	Chairman	Present
2	Dr.S.Madhu Professor & Head, Dept. of Mechanical Engineering, A.U.	Head of Mech. Engg. & Member	Present
3	Dr Venkatesham B Associate Professor Dept. of Mechanical & Aerospace Engineering, Indian Institute of Technology Hyderabad.	Member - Outside Subject Expert	Present
4	Dr. Srinivasa Prakash Regalla Dean (Institute-wide), Practice School Division Professor, Department of Mechanical Engineering, BITS, Hyderabad Campus	Member - Outside Subject Expert	Present
5	Mr Krishna Prasad B S Delivery Head, Automotive OEMs Tech Mahindra, Hyderabad	Member – Industry Expert	Present on 03.04.2021
6	Mr.B.Venkatram Reddy, Senior Manager, CYIENT, Hyderabad	Member – Industry Expert	Absent
7	Dr. R. Venkat Reddy Professor, Dept. of Mechanical Engineering, A.U.	Member	Present
8	Dr Ravikanth Raju Associate Professor, Dept. of Mechanical Engineering, A.U.	Member	Present

9	Dr. Sikindar Baba Associate Professor, Dept. of Mechanical Engineering, A.U.	Member	Present
10	Mr. K. Srinivasa Chalapathi Associate Professor, Dept. of Mechanical Engineering, A.U.	Member	Present
11	Mr. Manish Kumar Madal Partner Pipe Supports Company	Member – Alumni	Absent

At the start of the meeting, Chairman welcomed Hon'ble members of the Board of Studies.

With the permission of the chairman, the proceedings of BoS started.

<u>Item No: 1</u>

To discuss and approve syllabi of II, III & IV year of B.Tech. as per R20 regulations:

1.1 Members have discussed the syllabi of II, III & IV year of B.Tech. as per R20 regulations, proposed by the Department and **approved** with the following suggestions:

(i) Suggested that in courses like **Kinematics of Machines** and **Dynamics of Machines**, the assessment of internal marks should include making of working models as a part of assignment, which helps in understanding of course in depth

(ii) In **Kinematics of Machines** course, the name of the **Unit - IV "Higher Pairs"** is to be changed as **"Gears"**

(iii) Advised to introduce text book on **"Theory Mechanisms and Machines"** by **Amitabh Ghosh** keeping in view the GATE syllabus

(iv) In laboratory courses, objectives must be based on the actual equipment

(v) Advised to introduce uploading of 2 to 3 minutes of video on their understanding about the experiment done by each student

(vi) In the syllabus of **"Manufacturing Processes"**, in **Unit - IV**, heading is to be changed as **"Metal forming"** only instead of **"Metal forming and working"**. Also advised to introduce some unconventional machining processes, as everyone may not opt for the "Unconventional Machining Processes" course which is an elective

(vii) Advised to introduce modelling software in addition to drafting package **AUTOCAD**. Also suggested to introduce one programming course like **MATLAB, PYTHON etc.** so that student can write his own program

(viii) Suggested to have an exclusive robotic lab., where in actual construction of robots can be practiced

(ix) The syllabus for the course **"Mechanical Vibrations"** is to be elaborated

The modified syllabi as per the above suggestions is enclosed in the consolidated file in word format.

1.2 Internal members of BoS is authorized to make necessary minor changes as per the guidelines of Academic Council.

Item No: 2

- ***(a) To discuss and approve open elective courses to be offered for the Department by other Departments as per R20 regulations.***
- ***(b) To discuss and approve the syllabi of the open elective courses to be offered by the Department to other Departments.***

2.1 Members have discussed the draft copy of structure and syllabi of open electives to be offered at B.Tech. level as per R20 regulations and **approved** with the following suggestions:

(i) In **Open Elective - I**, **"Logical Reasoning and Quantitative Ability (LRQA)"** may be renamed as **"Arithmetic Methodology"**. **"Technical Business Communication"** may be renamed as **"Technical and Business Communication"**. In **Open Elective - II**, the title **"Entrepreneurship Development"** is to be changed to **"Introduction to Entrepreneurship"**

(ii) The members felt that guest lectures can also be arranged by industry experts for open elective courses to make the courses more interesting

(iii) The members opined that open elective courses should reflect the latest advancements in the respective branch of engineering and should be generic in nature and the title of the course also should be attractive

(iv) The open elective course viz. **"Basics of Mechanisms"** can be renamed as **"Introduction to Machines and Mechanisms"**. In third unit, the title **"Straight line motion mechanisms"** can be renamed as **"Motion mechanisms"**. The unit V is to be changed entirely with **"Robotic mechanisms"**

(v) The title of the open elective course viz. **"Green Engineering Systems"** can be renamed as **"Green technologies"** and unit V can be renamed as **"Sustainable materials for buildings"**

(vi) In the open elective course viz. **"Smart materials"**, it is better to add laboratory component

The modified syllabi as per the above suggestions is enclosed in the consolidated file in word format.

2.2 Internal members of BoS is authorized to make necessary minor changes as per the guidelines of Academic Council.

<u>Item No: 3</u>

To discuss and approve the minor & honors course structure and syllabi as per R20 Regulations:

3.1 Members have discussed the draft copy of structure and syllabi of minor and honors degrees to be offered at B.Tech. level as per R20 regulations and **approved** with the following suggestions:

(i) The title of Honors course is to be changed from **"3D-Printing"** to **"Additive Manufacturing"**. All the courses in Minor and Honors must be given only 3 credits and the project can be given 6 credits. If the student is not interested to carry out the project, he/she has to take two more courses each of 3 credits in an online mode. Laboratory component is to be introduced in **"Fundamentals of CAD"** course of B. Tech Minor and **"Materials and Applications of 3D printing"** course of B. Tech Honors

The modified syllabi as per the above suggestions is enclosed in the consolidated file in word format.

3.2 Internal members of BoS is authorized to make necessary minor changes as per the guidelines of Academic Council.

<u>Item No: 4</u>

To discuss and approve M.Tech. (Machine Design) course structure and syllabi as per R21 Regulations:

4.1 Members have discussed the draft copy of structure & syllabi of M.Tech. (Machine Design) for R21 regulations based on AICTE model curriculum and **approved** with the following suggestions:

(i) For the course "Engineering Noise Control", the title of unit IV is to be changed as "Noise Control Strategies". The text book "Noise and Vibration Control "by Manohar Lal Munjal is to be included

(ii) For the course "Advanced mechanics of solids", a text book by L.S. Srinath is to be included

(iii) For the course, "Vibration analysis of Mechanical systems", unit IV can be renamed as "Experimental modal analysis". The text book "Mechanical vibrations" by W.T.Thomson is to be included

(iv) For the course "Tribology in Design", a text book "Engineering Tribology" by A. W Batchelor and G. W. Stachowiak is to be included

(v) For the course "Advanced Mechanics of Composite Materials" include "Principles of Composite Material Mechanics" by Ronald F.

Gibson as text book

(vi) In the First year II Sem the professional core course, “Analysis and Synthesis of mechanisms” is to be swapped with professional elective course, “Vehicle Dynamics” and also rename the title as Multibody dynamics. Also include the topic of “Tyre Dynamics”

(vii) It is suggested to change the title of unit V in Advanced Finite Element Analysis course as 3D and Non-linear problems

(viii) For the course “Product Design and Development”, in unit V, replace “Design for manufacturing” topic with “Ergonomics”

(ix) For the course “Design and Analysis of Experiments”, in Unit I, include “Error analysis” and in Unit 4, replace the word “regression” as “linear regression”

(x) For the course, “Signal Analysis and Condition Monitoring” the title is to be changed as “Condition Monitoring of Mechanical Systems”. The word “practical” in II, III and IV units is to be removed.

The modified syllabi as per the above suggestions is enclosed in the consolidated file in word format.

4.2 Internal members of BoS is authorized to make necessary minor changes as per the guidelines of Academic Council.

<u>Item No: 5</u>

To discuss about adopting GATE syllabus for Ph.D admission test from time to time and approve:

Approved with a suggestion that, as the GATE syllabus is based on UG program, interview should be based on PG standard with due weightage.

Department of Mechanical Engineering
FOUR YEARS COURSE STRUCTURE
R20 REGULATIONS

B. Tech. (Mech) I Year 1st Sem. **5 T + 3 L**

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	A51001	Mathematics–I	3	1	-	4.0
2	HSMC	A51002	English	2	-	-	2.0
3	BSC	A51003	Engineering Chemistry	3	1	-	4.0
4	ESC	A51004	Programming for Problem Solving - I	2	-	-	2.0
5	ESC	A51005	Engineering Graphics	1	-	3	2.5
6	BSC	A51207	Engineering Chemistry Lab	-	-	3	1.5
7	HSMC	A51208	English Language Skills Lab	-	-	2	1.0
8	ESC	A51209	Programming for Problem Solving Lab-I	-	-	3	1.5
Total							**18.5**

B.Tech. I Year 2nd Sem. **4 T + 4 L**

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	A52001	Mathematics–II	3	1	-	4.0
2	BSC	A52002	Engineering Physics	3	1	-	4.0
3	ESC	A52003	Programming for Problem Solving –II	2	-	-	2.0
4	ESC	A52004	EngineeringMechanics	3	1	-	4.0
5	BSC	A52210	Engineering Physics Lab	-	-	3	1.5
6	ESC	A52211	Engineering Workshop	-	-	3	1.5
7	HSMC	A52212	English Communication skills Lab	-	-	2	1.0
8	ESC	A52213	Programming for Problem Solving Lab-II	-	-	3	1.5
Total							**19.5**

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) II Year I Sem. (3rd Semester) **6 T + 2 L + 1 MC**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC		Kinematics of Machines	2	1	-	3
2	PCC		Strength of Materials	2	1	-	3
3	PCC		Materials Engineering	3	-	-	3
4	PCC		Thermodynamics	2	1	-	3
5	ESC		Basic Electrical and Electronics Engineering	2	1	-	3
6	HSMC		Managerial Economics and Financial Analysis	2	1	-	3
7	MC		Gender Sensitization	2	-	-	-
8	PCC Lab		Strength of Materials Lab.	-	-	2	1
9	PCC Lab		Materials Engineering Lab.	-	-	2	1
Total							**20**

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) II Year II Sem. (4^{th} Semester) 5 T + 3 L + 1 MC

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC		Dynamics of Machines	2	1	-	3
2	PCC		Manufacturing Processes	3	-	-	3
3	PCC		Applied Thermodynamics-I	2	1	-	3
4	PCC		Fluid Mechanics & Hydraulic Machines	2	1	-	3
5	BSC		Mathematics III (Numerical Methods & Partial Differential Equations)	2	1	-	3
6	MC		Environmental Studies	2	-	-	-
7	PCC		Machine Drawing & Drafting Lab.	-	1	4	3
8	PCC		Manufacturing Processes Lab.	-	-	2	1
9	PCC		Fluid Mechanics & Hydraulic Machines Lab.	-	-	2	1
Total							**20**

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) III Year I Sem. (5th Semester) **5 T + 4 L**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC		Design of Machine Elements-I	2	1	-	3
2	PCC		Manufacturing Technologies	3	-	-	3
3	PCC		Engineering Metrology & Surface Engineering	3	-	-	3
4	PCC		Applied Thermodynamics-II	2	1	-	3
5	PEC - I		1. Automation in Manufacturing 2. Industrial Engineering and Product Life Cycle Management 3. Renewable Energy and Waste Heat Recovery Systems	3	-	-	3
6	HSMC		Quantitative Aptitude and Reasoning Lab.	-	-	3	1.5
7	HSMC		Soft Skills for Success Lab.	-	-	3	1.5
8	PCC		Manufacturing Technologies Lab.	-	-	2	1
9	PCC		Applied Thermodynamics Lab.	-	-	2	1
Total							**20**

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) III Year II Sem. (6th Semester) **6 T + 2 L + 1 MC**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC		Design of Machine Elements-II	2	1	-	3
2	PCC		Finite Element Method	2	1	-	3
3	PCC		AI for Mechanical Engineering	3	-	-	3
4	PCC		Heat Transfer	2	1	-	3
5	OEC - I		1. Entrepreneurship Development 2. Technical and Business Communication 3. Industrial Relations and Employment Laws	3	-	-	3
6	PEC - II		1. Automotive Mechanics and Hybrid Vehicles 2. Production Planning and Control 3. Refrigeration and Air Conditioning	3	-	-	3
7	MC		NSS/NSO	-	-	2	-
8	PCC		Heat Transfer Lab.	-	-	2	1
9	HSMC		Skill Integrated Language Lab.	-	-	2	1
Total							**20**

NOTE: Students are required to do Mini Project/ Summer Internship at the end of this semester and its evaluation will be done in IV Year I Sem. (7th Semester)

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) IV Year I Sem. (7th Semester) 6 T + 2 L + 1 PROJ

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	PCC		Computer Aided Design & Manufacturing	3	-	-	3
2	PCC		Robotics	3	-	-	3
3	PCC		Mechanical Measurements	3	-	-	3
4	PEC - III		1. Composite Materials 2. Micro Electro Mechanical Systems (MEMS) 3. Fuel Cells and Hydrogen Storage	3	-	-	3
5	PEC - IV		1. Mechanical Vibrations 2. Precision Engineering 3. Power Plant Engineering	3	-	-	3
6	PEC - V		1. CNC Technology and Programming 2. Operations Research 3. Computational Fluid Dynamics	3	-	-	3
7	PCC		Computer Aided Design & Manufacturing Lab.	-	-	2	1
8	PCC		Mechanical Measurements & Robotics Lab.	-	-	2	1
9	PROJ		Mini Project / Summer Internship	-	-	4	2
Total							**22**

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech. (Mech) IV Year II Sem. (8th Semester) 2T + 1 PROJ

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	OEC - II		1. Fundamentals of Budget 2. Project Management 3. Language for life Skills	3	-	-	3
2	OEC - III		1. Intellectual Property Rights 2. Disaster Management 3. Digital marketing	3	-	-	3
3	PROJ		Project Work	-	-	20	10
4			Technical Seminar	-	-	4	2
5			Comprehensive Viva-voice	-	-	-	2
Total							**20**

ANURAG UNIVERSITY
SCHOOL OF ENGINEERING
DEPT. OF MECHANICAL ENGINEERING

<table>
<tr><td>B.Tech. Mech.
II Year I Sem.</td><td colspan="5">Course Title</td><td colspan="2"></td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">KINEMATICS OF MACHINES</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Mechanics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>2</td><td>1</td><td>-</td><td>-</td><td>3</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. gain knowledge on various types of mechanisms and machines
2. impart skills to analyze the displacement, velocity and acceleration in mechanisms
3. a. draw the cam profile for various motions of the followers
   b. state the steering gear mechanism
4. estimate the various kinematic parameters associated with gear
5. calculate the transmission of power by gear train

Course Outcomes:After completion of this course, the students will be able to:

1. apply the knowledge of machines, mechanisms in real time applications
2. a. analyze the planar mechanism for displacement, velocity and acceleration graphically
   b. understand the correct steering condition in steering gear mechanisms
3. a. design Cam profile for follower executing different types of motions, various configurations of followers
   b. differentiate various steering gear mechanisms
4. analyze the various motion transmission parameters associated with Gears
5. select the appropriate gear trains with respect to different applications

UNIT I:

Mechanisms: Elements of links – Classification: Rigid Link, flexible and fluid link – Types of kinematic pairs: sliding, turning, rolling, screw and spherical pairs – Lower and higher pairs – Closed and open pairs – Constrained motion: Completely, partially or successfully constrained and incompletely constrained

Machines: Mechanism and machines – Classification of machines – Kinematic chain – Inversion of mechanism: inversions of quadric cycle chain, single and double slider crank chains

Straight line motion mechanisms: Exact and approximate copiers and generated types: Peaucellier, Hart, Scott russul , Grasshopper, Watt, Tchebicheff and Robert mechanisms - Pantograph

UNIT II:

Kinematics: Velocity and acceleration – Motion of link on machine – Determination of velocity and acceleration through vector diagrams – Graphical method – Application of relative velocity method for four bar chain

Analysis of mechanisms: Analysis of slider crank chain for displacement, Velocity and acceleration of slider – Acceleration diagram for a given mechanism – Coriolis acceleration – Determination of Coriolis component of acceleration

Plane motion of body: Instantaneous center of motion – Centroids and axodes – Relative motion between two bodies – Three centers in line theorem – Graphical determination of angular velocity of points and links

UNIT III:

Cams : Definition of cam and followers – their uses – Types of followers and cams – Terminology- Types of follower motion: Uniform velocity, simple harmonic motion and uniform acceleration – Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases

Steering mechanisms: Conditions for correct steering – Davis steering gear – Ackerman's steering gear – velocity ratio

UNIT IV:

Gears – types – law of gearing – Condition for constant velocity ratio for transmission of motion – Form of teeth: Cycloidal and involute profiles – Velocity of sliding – Phenomena of interferences – Methods of interference – Condition for minimum number of teeth to avoid interference – Expressions for arc of contact and path of contact – Introduction of Helical, Bevel and worm gearing

UNIT V:

Gear Trains: Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear train– Methods of finding train value or velocity ratio – Types of Epicyclic gear trains – Selection of gear box – Differential gear for an automobile

TEXT BOOKS:

1. Theory of Machines / Rattan .S.S. / TMH
2. Theory Mechanisms and Machines/Amitabh Ghosh/ Affiliated East-West Press
3. Theory of Machines / Thomas Bevan / CBS

REFERENCES:

1. Theory of Machines / R.S Khurmi & J.K Gupta / S Chand
2. Theory of Machines / R.K Bansal / Laxmi Publications
3. Theory of Machines / P.L. Ballaney / kharina publishers,
4. Theory of Machines / Sadhu Singh / Pearsons Edn.
5. Mechanism and Machine Theory / J.S. Rao and R.V. Dukkipati / NewAge
6. Theory of Machines / Shigley / Oxford.

ANURAG UNIVERSITY
SCHOOL OF ENGINEERING
DEPT. OF MECHANICAL ENGINEERING

<table>
<tr><td>B.Tech. Mech.
II Year I Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">STRENGTH OF MATERIALS</td><td rowspan="2">PCC</td></tr>
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<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Mechanics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>2</td><td>1</td><td>-</td><td>-</td><td>3</td></tr>
</table>

Course Objectives: The objectives of this course are to:
1. gain knowledge of different types of stresses and strains
2. attain the shear force and bending moment of various beams with various loads
3. obtain the shear stress and bending stress for various cross sections of beams
4. know the deflection calculation of various types of beams using various methods
5. impart the knowledge of columns, struts & geometric elongations of thin and thick cylinders

Course Outcomes: At the end of this course, students will be able to:
1. distinguish the types of stresses, strains and relationship among elastic constants
2. construct the shear force and bending moment diagrams of the beams subjected to various loads
3. estimate the bending and shear stresses induced for various cross sections of the beams
4. determine the deflection of beams by various methods
5. evaluate the stresses of columns, struts & geometric elongations of thin and thick cylinders

UNIT I:

Simple stresses and strains: Elasticity and plasticity – Types of stresses and strains – Hooke’s law – Stress – strain diagram for mild steel – Working stress – Factory of safety – Lateral strain – Poisson’s ratio and volumetric strain – Elastic moduli and the relationship between them – Principal stresses and principal planes – Mohr’s Circle

UNIT II:

Shear force and bending moment: Definition of beam – Types of beams – Concept of shear force (S.F.) and bending moment (B.M.) – S.F and B.M diagrams for Cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads (UDL), uniformly varying loads (UVL) and combination of these loads – Point of contra flexure – Relation between S.F, B.M and rate of loading at a section of a beam

UNIT III:

Flexural stresses: Theory of simple bending – Assumptions – Derivation of bending equation – Neutral axis – Determination of bending stresses and section modulus of Rectangular and circular sections (solid and hollow) - I, T and angle sections – Design of simple beam sections

Shear Stresses: Derivation – Shear stress distribution across various beam sections of rectangular, circular, triangular, I, T and angle sections

UNIT IV:

Deflection of beams: Bending into a circular arc, slope, deflection and radius of curvature – Differential equations for the elastic line of a beam – Determination of slope and deflection for Cantilever and simply supported beams subjected to point loads, UDL and UVL by Macaulay's method, double integration method and moment area method – Application to simple cases including overhanging beams

UNIT V:

Introduction to columns & struts: Introduction – Failure of Column and strut –Types of columns – Euler's formula for the columns – Equivalent length – Simple problems on Euler's formula & equivalent length

Thin cylinders – Introduction – Failure of thin cylinders – Stresses in thin cylinders – Formula for change in dimensions and change in volume, simple problems

Thick Cylinders - Lame's equation – Cylinders subjected to inside and outside pressures – Compound cylinders

TEXT BOOKS:

1. Strength of materials / Dr. R. K. Bansal / Laxmi Publications.
2. Strength of materials / W. A. Nash / Tata McGraw-Hill Education.
3. Strength of Materials / S. S. Rattan / Tata McGraw-Hill Higher Education.

REFERENCE BOOKS:

1. Basics of Strength of Materials / Stephen P. Timoshenko / Dover Publications, INC, New York.
2. Analysis of Structures / V.N.Vazirani and M.M.Ratwani / Khanna Publications.
3. Strength of Materials / Sadhu Singh/ Khanna Publications.
4. Mechanics of Structures Vol-III / S.B. Junnarkar / Charotar Publishing House Pvt. Ltd.
5. Strength of materials / Ryder, G.H / Macmillan Education.

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DEPT. OF MECHANICAL ENGINEERING

B.Tech. Mech. II Year I Sem.	Course Title							PCC/PEC/OEC/MC
Course Code	**MATERIALS ENGINEERING**							PCC
Prerequisite	Contact Hours Per Week					CIE	SEE	Credits
Engineering Physics	L	T	D	P	Total Hours	40	60	3
	3	-	-	-	3			

Course Objectives: The objectives of this course are to:

1. Identify the relation between processing, structure and physical properties
2. Study the phase diagrams of binary systems
3. Study the heat treatment principles
4. Classify the different types of ferrous and non-ferrous metals
5. Learn the recent developments in material science and engineering

Course Outcomes: At the end of this course, students will be able to:

1. Discuss the crystal structure and defects
2. Assess mechanical properties of metals and alloys by conducting various tests
3. Construct the equilibrium diagrams of different alloys
4. Select suitable heat treatment processes to achieve desired properties of materials
5. Classify metals, non- metals and study their applications

UNIT-I:

Crystal Structure: Unit cells – Basis and crystal lattice – Metallic crystal structures– Imperfections in solids: point, line, surface and volume defects – Dislocation strengthening mechanisms and slip systems – Critically resolved shear stress – Effect of grain size on the properties of metals and alloys

UNIT-II:

Mechanical properties measurement: Tensile, compression and torsion tests – Young's modulus – Relation between true and engineering stress – strain – Generalized Hooke's law – Yielding and yield strength – Ductility – Resilience – Toughness and elastic recovery – Fatigue – Creep – Hardness: Rockwell, Brinell and Vickers – Introduction to Non-Destructive Testing (NDT)

UNIT-III:

Alloys and Phase diagrams: Necessity of alloying – Effect of various alloying elements – Substitutional and interstitial solid solutions – Hume Rothary's rules for solid solution – Phase rule – Lever rule

Phase diagrams: Interpretation of binary phase diagrams and microstructure development – Isomorphous, eutectic, peritectic diagrams – Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite

UNIT-IV:

Heat Treatment of steels: Annealing – Normalizing – Hardening – Tempering – Austempering – Martempering – Isothermal transformation curves – Diagrams for Fe-C alloys and microstructure development – Continuous cooling curves and interpretation of final microstructures and properties – Surface hardening methods: case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, age hardening

UNIT-V:

Cast irons and Steels: Classification – Properties and applications of cast irons – Grey, white, malleable and spheroidal cast irons – Classification – Properties and applications of plain carbon steels – Alloy steels: stainless steel, tool steels, maraging steels, Hadfield Manganese steels, High speed steels
Non-ferrous metals and alloys: Properties and applications of copper and copper alloys – Brass – Bronze and cupro-nickel – Aluminum and Al-Cu-Mg alloys – Nickel based superalloys and titanium alloys
Non-metals: Classification – Properties and applications of Polymers – Ceramics – Composites and Nano Materials

TEXT BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener / Tata Mc-Graw Hill Publications
2. Essential of Materials for Science and Engineering / Donald R. Askeland / CL Engineering Publications
3. Material Science and Metallurgy / Kodgire / Everest Publishing Home

REFERENCE BOOKS:

1. Science of Engineering Materials / Agarwal / McGraw Hill Education
2. Materials Science and Engineering / William and collister / John Wiley and Sons
3. Elements of Material Science / V. Raghavan / Prentice Hall India Learning Pvt Ltd
4. An Introduction to Material Science / W.G. Vinas& HL Mancini / Princeton University Press
5. Engineering Materials and their applications / R.A Flinn and P.K Trojan / Jaico books

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DEPT. OF MECHANICAL ENGINEERING

B.Tech. Mech. II Year I Sem.	Course Title							PCC/PEC/OEC/MC
Course Code	**THERMODYNAMICS**							PCC
Prerequisite	**Contact Hours Per Week**					**CIE**	**SEE**	**Credits**
Engineering Chemistry & Physics	L	T	D	P	Total Hours	40	60	3
	2	1	-	-	3			

Course Objectives: The objectives of this course are to:

1. discuss the basic concepts of thermodynamics for finding work interactions in various thermodynamic processes and various laws of perfect gases
2. determine the various properties of mixtures of perfect gases and applications of law of partial pressures, additive volumes; application of zeroth law of thermodynamics and introduce the concept of internal energy and enthalpy
3. introduce the concept of entropy, apply various laws, concepts and principles of thermodynamics to analyze the performance of work consuming and work producing devices
4. estimate the properties of pure substances by using property tables and charts and discuss various properties of air vapor mixtures
5. analyze air standard power cycles and refrigeration cycles

Course Outcomes: At the end of this course, students will be able to:

1. understand the basic concepts of thermodynamics to analyze work interactions in various thermodynamic processes and study various laws of perfect gases
2. (a) evaluate properties of perfect gas mixtures and identify the importance of law of partial pressures and additive volumes
   (b) apply zeroth law of thermodynamics in temperature measurements and explain the concept of internal energy and enthalpy
3. (a) apply concepts of internal energy, enthalpy and entropy to non flow and flow systems
   (b) apply the laws of thermodynamics to work producing and work consuming devices and analyze their performance
   (c) Analyze the Carnot cycle and discuss the concepts of availability, irreversibility and thermodynamic potentials
4. evaluate the properties of pure substances using p-v-T surface, h-s and T-s diagrams and discuss various properties of air vapor mixtures
5. evaluate the performance of air standard power cycles and refrigeration cycles

UNIT I:

Introduction to basic concepts: Definition of thermodynamics– Macroscopic and microscopic viewpoints – **S**ystem –Surroundings – Boundaries – Universe – Types of systems – Control volume – Concept of continuum –Thermodynamic equilibrium – Property – State – Process – Cycle – Quasi–static process – Reversible process– Energy in state and transit – Work and heat – Point and path functions – pdv work in various non flow processes including problems on work transfer in various non flow processes – Flow work – Introduction to other forms of work

Perfect gas laws – Equation of state – Specific and universal gas constants – Van der Waals equation of state

UNIT II:

Mixtures of perfect gases – Mole Fraction, Volume fraction and mass fraction – Gravimetric and volumetric analysis – Including problems

Dalton's law of partial pressures – Avogadro's law of additive volumes

Laws of Thermodynamics:

Zeroth law of thermodynamics – Concept of quality of temperature – Principles of thermometry – Reference points – Constant volume gas thermometer – Scales of temperatures – Ideal gas scale **-** including problems on temperature scales

First law of thermodynamics: Joule's experiments– First law of thermodynamics – Corollaries – PMM I – First law applied to a system – Internal energy – Enthalpy – Specific heats – Heat transfer in various non flow processes – Adiabatic process

UNIT III:

First law applied to a flow system – Throttling and free expansion processes – Steady flow energy equation – Work done in a flow process – Limitations of the first law – Including problems

Second law of thermodynamics – Thermal reservoirs – Kelvin-Planck statement – Efficiency of Engine – Clausius statement – COP for refrigerator and heat pump – Equivalence of Kelvin–Planck and Clausius statements – Corollaries – PMM II– Problems on second law of thermodynamics

Carnot's principle – Carnot cycle and its Limitations – Clausius inequality – Entropy – Principle of entropy increase – Change of entropy in various non flow processes – Availability and Irreversibility – Causes for irreversibility – Thermodynamic potentials – Gibbs and Helmholtz functions – Maxwell relations – Elementary treatment of the third law of thermodynamics – Including problems

UNIT IV:

Pure substances: p-v-T surfaces – T-s and h-s diagrams (Mollier charts) – Phase transformations – Triple point – Critical state properties – Dryness fraction – Property tables – Clausius-Clapeyron equation – Various thermodynamic processes and energy transfer – Steam calorimetry – Problems on evaluation of properties of steam

Psychrometry: Saturated air – Dry bulb, Wet bulb and Dew point temperatures – Specific humidity – Relative humidity –Vapor pressure – Degree of saturation – Adiabatic saturation – Carrier's equation – Psychrometric chart.

UNIT V:

Power cycles: Otto, Diesel and Dual combustion cycles – Description and representation on p-v and T-s diagrams – Thermal efficiency – Mean effective pressure on air standard basis– Comparison of cycles – Problems on cycles.

Sterling cycle – Atkinson cycle – Ericsson cycle – Lenoir cycle – Description and representation on p-v and T-s diagrams – Thermal efficiency

Refrigeration Cycles: Description of reversed Brayton cycle (Bell - Coleman cycle) with representation on p-v & T-s diagrams – Vapor compression refrigeration cycle with schematic diagrams and representation on p-h & T-s diagrams

TEXT BOOKS:

1. Engineering Thermodynamics, P K Nag, Tata McGraw-Hill Publishing Company Limited
2. Thermodynamics, An Engineering Approach , Yunus Cengel and Michael A Boles, Tata McGraw-Hill Publications.
3. Engineering Thermodynamics, D S Kumar, S K Kataria & Sons.

REFERENCE BOOKS:

1. Solution Manual to Introduction to Thermodynamics, Y V C Rao, Universities press.
2. Engineering Thermodynamics, J B Jones and R E Dugan, Prentice Hall India Learning Private Limited.
3. Thermodynamics Theory and Applications, Balmer Robert, Jaico Publishing House Mumbai.
4. Engineering Thermodynamics, K Ramakrishna, Anuradha Publishers.
5. Fundamentals of Engineering Thermodynamics, Moran M S and Shapiro H N, John Wiley Sons.

NOTE: Steam and Refrigerants property tables and charts are permitted.

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DEPT. OF MECHANICAL ENGINEERING

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<tr><td>B.Tech. Mech.
II Year I Sem.</td><td colspan="5">Course Title</td><td colspan="2"></td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">STRENGTH OF MATERIALS LAB.</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Mechanics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">1</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td></tr>
</table>

Course Objectives: The objectives of this Lab. are to:

1. know the different strengths of various specimens
2. know the various beams strength by conducting bending test
3. determine hardness of various metal specimens
4. impart knowledge about mechanical behavior of springs under axial load
5. know the energy absorbed by the specimens during failure

Course Outcomes: At the end of this Lab. students will be able to:

1. evaluate the stresses of various specimens at different loads
2. justify the type of beam and cross section used for various applications
3. predict the hardness of various metals by Brinell and Rockwell hardness tester
4. prioritize the use of springs based on stiffness
5. evaluate the impact strength of specimens using test rigs

LIST OF EXPERIMENTS:

1. Tensile test on the given specimen using universal testing machine (UTM)
2. Shear test on the given rod using UTM
3. Compression test on the cement cube using UTM
4. Compression test on the wooden specimen using UTM
5. Bending test on a simply supported beam
6. Bending test on a cantilever beam
7. Torsion test on the given rod

   Determination of:

8. Brinell hardness of the given specimen
9. Rockwell hardness of the given specimen
10. Stiffness of the spring under compressive loads
11. Stiffness of the spring under tensile loads
12. Charpy V-Notch test on the given specimen
13. Izod impact test on the given specimen

REFERENCE BOOKS:

1. Strength of materials / Dr.R.K. Bansal / Laxmi Publications
2. Strength of materials / R.S. Khurmi and N. Khurmi / S.Chand Publications
3. Strength of materials / S.Ramamrutham and R.Narayan / Dhanpat Rai Publications
4. Strength of materials / Er.R.K. Rajput / S. Chand Publications
5. Strength of materials Fundamentals and Applications / T. D. Gunneswara Rao and Mudiby Andal / Cambridge

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SCHOOLOF ENGINEERING

DEPT. OF MECHANICAL ENGINEERING

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<tr><td>Course Code</td><td colspan="7" rowspan="2">MATERIALS ENGINEERING LAB.</td><td rowspan="2">PCC</td></tr>
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<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Physics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">1</td></tr>
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Course Objectives: The objectives of this course are to give hands on experience in operating the various test rigs, acquire the required data and to:

1. gain fundamental knowledge on engineering materials and applications
2. develop the necessary industry-oriented skills
3. prepare metallographic samples
4. assess the significance of microstructure of different materials
5. analyze the microstructure changes after various heat treatment processes

Course Outcomes: At the end of this course, students will be able to demonstrate the hands on experience in conducting various experiments and to:

1. explain the relationship between the properties and microstructures of various ferrous and non-ferrous metals and their alloys
2. analyze the hardness of steels before and after heat treatment
3. compare the microstructure of steels before and after heat treatment
4. study the types of heat treatment processes
5. evaluate the change in hardness based on various cooling methods

LIST OF EXPERIMENTS

Study of the micro structure of:

1. pure iron
2. pure copper
3. pure aluminum
4. mild steel
5. low carbon steel
6. high carbon steel
7. cast iron
8. non-ferrous alloys
9. heat treated steels

Determination of the:

10. hardenability of steels by Jominy End Quench test
11. hardness of heat - treated steel

12. hardness of untreated steels

REFERENCE BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener / Tata Mc-Graw Hill Publications
2. Essential of Materials for Science and Engineering / Donald R. Askeland / CL Engineering Publications

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<table>
<tr><td>B.Tech. Mech. II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">DYNAMICS OF MACHINES</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Mechanics, Kinematics of machines</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. gain the knowledge of gyroscopic forces in moving vehicles
2. impart the knowledge of turning moment diagrams and flywheel
3. understand the working principle of governors
4. understand the knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses
5. impart the knowledge on classification of vibrations and its significance

Course Outcomes: At the end of this course, students will be able to:

1. analyze the effect of gyroscopic forces in moving vehicles
2. examine the turning moment diagrams and design the flywheel
3. study the working of various governors
4. calculate the unbalanced forces in rotary and reciprocating parts of an engine
5. estimate the longitudinal, transverse and torsional vibrations so as to avoid the resonance

UNIT I:

Static and dynamic Force analysis of planar mechanisms: Introduction – Free body diagrams – conditions for equilibrium: Two, three and four force members – Inertia forces and D' Alembert's principle – Planar rotation about a fixed center

Precession: Gyroscopes – Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships

UNIT II:

Turning moment diagram and flywheels: Turning moment – Inertia torque – angular velocity and acceleration of Connecting rod – Crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design

Brakes: Types of brakes: Simple block brake, band block brake, internal expanding shoe brake – Braking effect of a vehicle

Dynamometers: Dynamometers: Absorption and transmission types – General description and methods of operation

UNIT III:

Governors: Watt, porter and proell governors – Spring loaded governors: Hartnell and Hartung with auxiliary springs – Sensitiveness – Isochronisms – Hunting

UNIT IV:

Balancing: Balancing of rotating masses: Single and multiple masses in single and different planes – Balancing of reciprocating masses: Primary and secondary balancing of reciprocating masses – Analytical and graphical methods – Unbalanced forces and couples – Balancing of locomotive – Multi cylinder inline and radial engines - Balancing of "V" Engine

UNIT V:

Vibrations: Free vibration of mass attached to vertical spring – Vibration isolation and transmissibility – Whirling of shafts – Critical speeds – Torsional vibrations of two and three rotor systems

TEXT BOOKS:

1. Theory of Machines / Rattan. S.S. / Tata McGraw-Hill Education
2. Theory of Machines / Thomas Bevan / CBS Publishers
3. Theory of Machines / R.S. Khurmi and J.K Gupta / S Chand and Co Ltd.

REFERENCE BOOKS:

1. Theory of Machines / R.K. Bansal / Laxmi publications Pvt Ltd.
2. Theory of Machines / PL. Ballaney / Kharina Publishers
3. Theory of Machines / Sadhu Singh / Pearson's Education
4. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age International (P) Ltd. Publishers
5. Theory of mechanisms and machines / Jagadish Lal / Metropolitan Book Co Pvt Ltd.

ANURAG UNIVERSITY

SCHOOLOF ENGINEERING

DEPT. OF MECHANICAL ENGINEERING

<table>
<tr><td>B.Tech.
Mech. II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">MANUFACTURING PROCESSES</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Workshop</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td><td>3</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. know the fundamentals of sand casting and metal casting processes
2. discuss the advanced casting techniques
3. explain the techniques of various welding processes
4. understand rolling, forging and sheet metal operations and their applications
5. describe the extrusion, forging and processing of plastics

Course Outcomes: At the end of this course, students will be able to:

1. identify the suitable gating and riser system in casting process
2. apply the different special casting processes for real time applications
3. identify the suitability of welding processes for joining the metal parts to fabricate the end product
4. explain the different metal forming processes and their applications
5. differentiate the extrusion and forging processes and understand the different processing techniques of plastics

UNIT I:

Casting: Steps involved in making a casting – Advantage of casting and its applications – Patterns and pattern making – Types of patterns – Materials used for patterns – Pattern allowances and their construction – Principles of gating – Gating ratio and design of gating systems

UNIT II:

Advanced Casting Processes: Solidification of casting – Concept – Solidification of pure metal and alloys – Short and long freezing range alloys – Risers – Types – Function and design – Casting design considerations – Special casting processes – Centrifugal, die, investment – Methods of Melting – Crucible melting, cupola operation-steel making processes

UNIT III:

Metal Joining Processes:

A) Welding – Classification of welding process – types of welds – welded joints: their characteristics – design of welded joints – gas welding, arc welding, forge welding, resistance welding, thermit welding, plasma welding
B) Cutting of Metals – Oxy acetylene gas cutting, Water plasma, Cutting of ferrous metals
C) Inert Gas Welding – TIG and MIG welding, friction welding, induction welding, explosive welding, laser welding, soldering and brazing – Heat Affected Zones in welding – welding defects – causes, remedies – Destructive, non-destructive testing of welds

UNIT IV:

Metal Forming: Hot working – Cold working – Strain hardening – Recovery –Recrystallization and grain growth – Comparison of properties of cold and hot worked parts – Rolling fundamentals – Theory of rolling – Types of rolling mills and product forces in rolling and power requirements

Stamping – Forming and other cold working processes – Blanking and piercing – Bending and forming – Drawing and its types – Deep drawing – Wire drawing and tube drawing – Coining – Hot and cold spinning – Types of presses and press tools – Forces and power requirement in the above operations

UNIT V:

Extrusion Of Metals: Basic extrusion process and its characteristics – Hot extrusion and cold extrusion – Forward extrusion and backward extrusion – Impact extrusion – Hydrostatic extrusion

Forging Processes: Principles of forging – Tools and dies – Types of forging – Smith forging – Drop forging – Roll forging – Forging hammers – Rotary forging and forging defects

Processing Of Plastics: Types of plastics – Properties – Applications and their processing methods and equipment (blow and injection molding)

Introduction to Unconventional Machining Processes: Need for non-traditional machining processes – Classification based on energy, mechanism, source of energy, transfer media and process, comparative study of different processes

TEXT BOOKS:

1. Manufacturing Technology / P.N Rao / Tata McGraw,Hill Education
2. Production Technology / Sarma P.C / S.Chand publication
3. Production Technology / R.K Jain / Khanna Publishers

REFERENCES BOOKS:

1. Process and Material of Manufacture / Lindberg / Pearson Education India
2. Principles of Metal Castings / Richard Heine, CarlLoper, Philip Rosenthal / Tata McGraw-Hill Education
3. Welding Processes and Technology / R.S.Paramar / Khanna Publishers
4. Production Engineering / Suresh Dalela and Ravi Shanker / Galgotia Publications Pvt. Ltd
5. Manufacturing Engineering and Technology / Kalpakjin.S / Pearson Publication

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SCHOOL OF ENGINEERING
DEPT. OF MECHANICAL ENGINEERING

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<tr><td>B.Tech. Mech. II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">APPLIED THERMODYNAMICS-I</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Thermodynamics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>2</td><td>1</td><td>-</td><td>-</td><td>3</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. know the basic working principles of IC engines
2. understand the combustion phenomena in SI and CI engines
3. determine the performance parameters and draw heat balance sheet of IC engines
4. understand the working principle of compressors and evaluate the performance of reciprocating and centrifugal air compressors
5. understand the working principle of air, vapor compression and absorption refrigeration systems and evaluate the performance of air and vapor compression refrigeration systems

Course Outcomes: At the end of this course, students will be able to:

1. know the various internal combustion engine components, understand their working principle and various losses occurring in the IC engines
2. analyze various stages of combustion in SI and CI engines and variables affecting the combustion process
3. evaluate the performance of internal combustion engines by estimating various parameters of single and multi-cylinder engines
4. analyze the performance of reciprocating and centrifugal air compressors and introduce axial flow compressors
5. determine the performance of air refrigeration and vapor compression refrigeration systems and introduce vapor absorption refrigeration system

UNIT I:

Internal Combustion (IC) Engines: Definition of heat engines and classification – IC engines and their classification – Parts of IC engines – Nomenclature – Working principle of IC engines – Two stroke and four stroke engines – Spark ignition (SI) and compression ignition (CI) engines – Valve and port timing diagrams – Comparison of air standard and actual cycles – Time loss factor – Heat loss factor – Exhaust blow down – Fuel supply systems – Principle and working of simple carburetor – Fuel injection systems for both SI and CI engines

UNIT II:

Combustion in SI engines: Normal combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of abnormal combustion – Pre-ignition – Knock – Knock limited parameters – Effect of engine variables on knock – Combustion chamber requirements and types of combustion chambers

Combustion in CI engines: Stages of combustion – Delay period and its importance – Effect of engine variables on delay period – Diesel knock –Turbulence: suction, compression and combustion induced turbulence – Direct and indirect injection combustion chambers

Fuel requirements – Fuel rating and anti-knock additives for SI and CI engines

UNIT III:

Testing and performance of IC engines: Parameters of performance – Measurement of cylinder pressure – Fuel consumption – Air intake – Performance test: determination of indicated power, brake power and frictional losses – Performance curves – Heat balance sheet and chart – Exhaust gas composition – Numerical problems

UNIT IV:

Compressors: Classification

Reciprocating compressors: Principle of operation – Work required – Isothermal efficiency – Volumetric efficiency and effect of clearance – Multi-stage compression – Inter cooling – Minimum work condition for multi-stage compression – Numerical problems

Centrifugal compressors: Mechanical details and principle of operation – Energy transfer – Impeller blade shape – Losses – Slip factor – Power input factor – Pressure coefficient and adiabatic coefficient –Velocity diagrams – Numerical problems

Axial flow compressors: Mechanical details and principle of operation

UNIT V:

Refrigeration: Units of refrigeration – Introduction to air refrigeration system – Vapor compression refrigeration system – Calculation of COP – Use of p-h charts for calculations – Effect of superheating and sub-cooling – Desired properties of refrigerants – Vapor absorption refrigeration system: mechanical details and working principle

TEXT BOOKS:

1. Internal Combustion Engines / V Ganesan / Tata McGraw-Hill Education.

2. Thermal Engineering / R.K Rajput / Lakshmi Publications
3. Thermal Engineering / Mahesh M Rathore / Tata McGraw-Hill Education

REFERENCE BOOKS:

1. Internal Combustion Engine Fundamentals / John B Heywood / Tata McGraw-Hill Education
2. Internal Combustion Engines / M L Mathur and R P Sharma / Dhanpat Rai Publications
3. Engineering Fundamentals of Internal Combustion Engines / Willard W Pulkrabek / Pearson Publications
4. Thermal Engineering / R Rudramoorthy / Tata McGraw-Hill Education
5. Thermodynamics and Heat Engines / B Yadav / Central Publishing House, Allahabad

ANURAG UNIVERSITY
SCHOOL OF ENGINEERING
DEPT. OF MECHANICAL ENGINEERING

B.Tech. Mech. II Year II Sem.	Course Title							PCC/PEC/OEC/MC
Course Code	**FLUID MECHANICS & HYDRAULIC MACHINES**							PCC
Prerequisite	Contact Hours Per Week					CIE	SEE	Credits
Engineering Mechanics	L	T	D	P	Total Hours	40	60	3
	2	1	-	-	3			

Course Objectives: The objectives of this course are to:

6. know the concepts of fluid properties and measurements
7. study the fluid flow patterns and derive Bernoulli's & Momentum equations
8. identify the losses in pipes and introduce boundary layer concepts
9. understand the hydrodynamic forces acting on vanes and working principles of various hydraulic turbines
10. assess the performance of different hydraulic turbines and pumps

Course Outcomes: At the end of this course, students will be able to:

6. explain the concepts of fluid properties and their measurements
7. classify fluid flows, apply Bernoulli's & Momentum equations for various flow configurations
8. derive the expressions for losses and understand the boundary layer concepts
9. calculate the force of jets on different geometries of vanes and evaluate the performance of various hydraulic turbines
10. compare the performance of different hydraulic turbines and evaluate the performance of centrifugal and reciprocating pumps

UNIT I:

Fluid Statics: Definition of fluid – Physical properties of fluids – Viscosity – Surface tension – Capillarity – Vapor pressure – Atmospheric pressure, gauge and vacuum pressures – Measurement of pressure – Piezometer, U-tube Manometer, differential and inverted manometers

UNIT II:

Fluid Kinematics: Classification of flows – Steady and unsteady – Uniform and non-uniform – laminar and turbulent – Rotational and irrotational flows – Stream line – Streak line – Path line – Continuity equation for one dimensional and three dimensional flows

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for fluid flow along a stream line and it's applications – Venturi meter, Orifice meter & Pitot tube – Momentum equation and it's application of force on pipe bend

UNIT III:

Closed Conduit Flow: Reynold's experiment – Darcy Weisbach equation – Chezy's formula – Major & Minor losses in pipes – Pipes in series and pipes in parallel – Equivalent pipes

Boundary Layer Concepts: Definition – Thicknesses – Characteristics along the thin plate – laminar and turbulent boundary layers (No derivation) – Boundary layer in transition – separation of boundary layer – Submerged objects – Drag and lift forces

UNIT IV:

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes – Jet striking centrally and at tip – Velocity diagrams – Work done and efficiency – Flow over radial vanes

Hydraulic Turbines: Classification of turbines – Heads and efficiencies – Impulse and reaction turbines – Pelton wheel – Francis turbine – Kaplan turbine – Working proportions – Work done – Efficiencies – Hydraulic design – Draft tube theory – Functions and efficiency

UNIT V:

Performance of Hydraulic Turbines: Geometric similarity – Unit and specific quantities – characteristic curves – Governing of turbines – Selection of turbine – Cavitation – Surge tank – water hammer

Centrifugal Pumps: Classification – Working – Priming – Work done – Barometric head – Losses and efficiencies – Specific speed – Performance characteristic curves – NPSH

Reciprocating Pumps: Discharge – Priming – Work done – Power – Slip – Indicator diagrams

TEXT BOOKS:

1. Fluid Mechanics and Fluid Power Engineering / D S Kumar / S K Kataria and Sons
2. Fluid Mechanics and Hydraulic Machines / R K Bansal / Laxmi Publications
3. Hydraulics & Fluid Mechanics Including Hydraulics Machines / P N Modi and S M Seth / Rajsons Publications

REFERENCE BOOKS:

1. Fluid Mechanics and Machinery / D. Rama Durgaiah / New Age International Publishers
2. Engineering Fluid Mechanics / K L Kumar / S Chand Publications
3. Fluid Mechanics and Hydraulic Machines / R.S.Khurmi /S Chand Publications
4. Fluid Mechanics and Fluid Machines / S K Som & Gautam Biswas / McGraw Hill Education
5. Fluid Mechanics / Frank M White / McGraw Hill Education

ANURAG UNIVERSITY
SCHOOLOF ENGINEERING
DEPT. OF MECHANICAL ENGINEERING

<table>
<tr><td>B.Tech. Mech.
II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">MACHINE DRAWING & DRAFTING LAB.</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Engineering Graphics</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">2</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>4</td><td>4</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. practice conventional representation for materials and standard machine elements
2. represent fastening arrangements such as screws, nuts, bolts, keyed joints, riveted joints and pin joints
3. draw different types of saft couplings
4. indicate different bearings
5. give hands on experience in the preparation of part and assembly drawings of various machine components

Course Outcomes: At the end of this course, students will be able to:

1. apply conventional representation of materials for common machine elements
2. classify and draw different types of Keys, Cotters and Pin Joints
3. prepare drawings of different types of shaft couplings
4. illustrate different types of bearings
5. develop assembled views for the part drawings

Selection of views of individual machine components must be in such a way that the assembled view of the machine can be drawn by using 2D CAD software.

LIST OF EXPERIMENTS

PART-A: DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS:

1. Conventional representation of materials and popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Rivetted joints for plates.
4. Shaft couplings, socket and spigot joint.
5. Journal and foot step bearings.

PART-B: ASSEMBLY DRAWINGS:
Drawings of assembled views for the part drawings of the following using conventions and simple drawing proportions

STEAM ENGINE PARTS:

1. Stuffing box
2. Cross head

3. Eccentric

MACHINE TOOL PARTS:

4. Tail stock
5. Tool Post
6. Machine Vice

OTHER MACHINE PARTS:

7. Screws jack
8. Connecting rod for an I.C. engine
9. Plummer block

PART-C: GEOMETRIC DIMENSIONING AND TOLERENCES:

1. Principles and Methods of Geometric Dimensioning
2. Form and Positional Tolerances: Indication of the tolerances of form and position on drawings, deformation of runout and total runout and their indication

PART-D: Introduction to MATLAB

NOTE: Total 12 drawings need to be drawn by taking minimum 5 each from Part A and Part B with Part C being mandatory

TEXT BOOKS:

1. Machine Drawing / K.L Narayana, P.Kannaiah and K.Venkata Reddy / New Age Publishers
2. Machine Drawing / N.D Bhatt / Charotar Publications
3. Machine Drawing with AutoCAD / Pohit and Ghosh / PE

REFERENCE BOOKS:

1. Machine Drawing / P.S. Gill / Katson Books Pvt.Ltd
2. Machine Drawing / R.S.Kurmi and J.K.Gupta / S.Chand Publications
3. Machine Drawing / Rajput / Laxmi Publications
4. Fundamentals of Machine Drawing / Sadhu Singh, P.L.Sah / PHI Publications
5. Machine Drawing / Dr.R.K.Dhavan / S.Chand Publications

ANURAG UNIVERSITY
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<table>
<tr><td>B.Tech. Mech.
II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">MANUFACTURING PROCESSES LAB.</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Manufacturing Processes</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">1</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. impart hands-on practical exposure on manufacturing processes and equipment
2. know the design and manufacture of simple patterns
3. get acquainted with sand testing, arc welding, gas welding and resistance welding equipment
4. operate pipe bending and injection molding equipment
5. gain knowledge in various manufacturing methods and their use

Course Outcomes: At the end of this course, students will be able to:

1. prepare patterns, sand moldings and melting & pouring of molten metals to obtain quality castings
2. do various types of metal joints
3. work on sheet metal operations
4. operate blow and injection moulding equipment and produce plastic components
5. acquire necessary skills to use modern engg. tools for various manufacturing processes

LIST OF EXPERIMENTS

I. Metal Casting Lab

1. Pattern design and making – for one casting drawing – 1 Exercise
2. Sand properties testing – strengths and permeability – 1Exercise
3. Sand moisture testing –1 Exercise
4. Moulding Melting and Casting – 1 Exercise

II. Welding Lab

1. ARC Welding Butt Joint – 1 Exercise
2. Spot Welding – 1 Exercise
3. TIG Welding – 1 Exercise
4. Gas Welding – 1. Exercise
5. Brazing – 1 Exercise

III. Mechanical Press Working

1. Blanking and piercing operation and study of simple, compound and progressive press tool – 1 Exercise
2. Hydraulic Press: Deep drawing and extrusion operation – 1 Exercise
3. Bending operations – 1 Exercise

IV. Processing Of Plastics

1. Injection Moulding – 1 Exercise
2. Blow Moulding – 1 Exercise

REFERENCE BOOKS:

1. Manufacturing Engineering and Technology / Kalpakjin. S / Pearson Publication
2. Manufacturing Technology / P.N Rao / Tata McGraw-Hill Education
3. Production Technology / R. K. Jain / Khanna Publishers
4. Principles of Metal Castings / Philips Rosenthal / TMH
5. A Course in Workshop Technology / B. S.Raghuwamshi / Dhanpat Rai & Sons

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<table>
<tr><td>B.Tech. Mech.
II Year II Sem.</td><td colspan="7">Course Title</td><td>PCC/PEC/OEC/MC</td></tr>
<tr><td>Course Code</td><td colspan="7" rowspan="2">FLUID MECHANICS AND HYDRAULIC MACHINES LAB.</td><td rowspan="2">PCC</td></tr>
<tr><td></td></tr>
<tr><td>Prerequisite</td><td colspan="5">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Fluid Mechanics and Hydraulic Machines</td><td>L</td><td>T</td><td>D</td><td>P</td><td>Total Hours</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">1</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td></tr>
</table>

Course Objectives: The objectives of this course are to give hands on experience in operating various experimental setups, acquire the required data and to

1. validate the general governing equations for various fluid flows
2. operate flow measuring devices
3. illustrate the losses in pipes
4. estimate the performance of hydraulic turbines
5. estimate the performance of pumps

Course Outcomes: At the end of this course, students will be able to demonstrate hands on experience in operating various experimental setups, acquire the required data and to

1. apply general governing equations for various fluid flows
2. calibrate flow measuring devices
3. analyze various losses in pipes
4. evaluate the performance characteristics of hydraulic turbines
5. evaluate the performance characteristics of pumps

LIST OF EXPERIMENTS

1. Verification of Bernoulli's theorem at different flow rates
2. Calibration of Venturi meter
3. Calibration of Orifice meter
4. Determination of Frictional losses of flow through pipes (major losses)
5. Determination of losses of flow through pipes due to pipe fittings and bends (minor losses)
6. Evaluation of Impact of jet on vane

Determination of performance characteristics of

7. Pelton wheel
8. Francis turbine at constant speed
9. Kaplan turbine at constant speed
10. Single stage Centrifugal pump at various speeds
11. Two stage Centrifugal pump at various heads and discharges
12. Reciprocating Pump at various speeds

REFERENCE BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic machinery / MODI and SETH.

2. Fluid Mechanics and Hydraulic Machines / Rajput.

3. Fluid Mechanics and Hydraulic Machines / RK Bansal / Laxmi Publications (P) Ltd.

4. Fluid Mechanics and Fluid Power Engineering / D S Kumar / Kotaria& Sons.

5. Fluid Mechanics and Machinery / D Rama Durgaiah / New Age International.

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) R21

I YEAR I SEMESTER

Category	Course Title	L	T	P	C
PCC-I	Engineering Noise Control	3	-	-	3
PCC-II	Multibody Dynamics	3	-	-	3
PEC-I	1. Design Optimization 2. Vibration Analysis of Mechanical Systems 3. Tribology in Design	3	-	-	3
PEC-II	1. Advanced Mechanics of Composite Materials 2. Design for Manufacturing & Assembly 3. Design of Pressure Vessels and Piping	3	-	-	3
PEC- III	1. Mechanical Behavior of Engineering Materials 2. Theory of Elasticity and Plasticity 3. Condition Monitoring of Mechanical Systems	-	-	-	3
-	Research Methodology	2	-	-	2
Laboratory I	Kinematics & Dynamics Lab.	-	-	3	2
Seminar I	Seminar-I	-	-	3	2
Total		**21**	**0**	**6**	**21**

I YEAR II SEMESTER

Category	Course Title	L	T	P	C
PCC-III	Advanced Finite Element Analysis	3	1	-	4
PCC-IV	Advanced Mechanics of Solids	3	1	-	4
PEC-IV	1. Industrial Robotics 2. Product Design & Development 3. Experimental Stress Analysis	3	-	-	3
PEC-V	1. Design and Analysis of Experiments 2. Advanced Optimization Techniques and Applications 3. Analysis & Synthesis of Mechanisms	3	-	-	3
OEC-I	1. Computational Methods in engineering 2. Database Management System	3	-	-	3
AUDIT COURSE	Pedagogy Studies	-	-	-	-
Laboratory II	Computer Aided Testing, Analysis & Modeling Lab.	-	-	3	2
Seminar II	Seminar-II	-	-	3	2
Total		**21**	**0**	**6**	**21**

II YEAR I SEMESTER

Category	Course Title	L	T	P	C
PROJ	Project work Review I	-	-	24	12

II YEAR II SEMESTER

Category	Course Title	L	T	P	C
PROJ	Project work Review II	-	-	28	14

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DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. I Year I Semester (Machine Design)

Course Code	Course Title						PCC/PEC/OEC
	ENGINEERING NOISE CONTROL						PCC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Basics of vibration and acoustics, physics and mathematics.	L	T	D	P	40	60	3
	3	-	-	-			

Course Objectives: The objectives of this course are to:

1. identify the effects of noise and the approach to its control
2. study the sound propagation outdoors and indoors
3. identify the sound radiation from vibrating structures and evaluations
4. solve the measurement techniques for absorption
5. study the design of different devices

Course Outcomes: At the end of this course, students will be able to:

1. draw plotting in octave and understanding the background mathematics
2. understand the frequency and noise of different sound propagation systems
3. understand the radiation from the vibrating bodies under different conditions
4. apply various techniques for absorption and radiation concept
5. design different devices and understanding to control noise from devices

UNIT-I:

Units of Noise Measurement: Overview of decibels for sound pressure, intensity and power levels; combining sound pressures (incoherent and coherent); basic frequency analysis including one-third octave bands; A-weighting and other measures of sound

Characterization of Noise Sources: Physical nature of noise sources, idealizations; acoustical efficiency; frequency spectrum; parametric dependencies including operational speed; directivity; estimation of source sound power (including engines, fans etc). Summary of sound power measurement methods (ISO 3745, ISO 3744, ISO 3741, ISO 9614)

UNIT-II:

Sound Propagation outdoors and Indoors: Point source and line source; geometric spreading; ground effects; meteorological effects; noise barriers; sound in rooms, reverberant field. Principles of passive noise control: Effect of multiple sources and multiple paths; noise path models; control at source; airborne transmission; structure-borne transmission

UNIT-III:

Sound radiation from vibrating structures (engineering approach) Definition of radiation ratio; radiation from monopole and dipole sources; radiation from bending waves in plates; corner modes, edge modes, coincidence; means of reducing radiation ratio. Transmission of airborne sound through partitions Transmission loss of a single partition, mathematical derivation for normal incidence; coincidence and the transmission loss for particular angles of incidence and for a diffuse field (qualitative); double partitions (qualitative); measurement methods for sound reduction index; machinery enclosures using Sabine formula

UNIT-IV:

Noise Control Strategies: Surface impedance and its relation to absorption coefficient; qualitative treatment of dissipation mechanisms; practical forms of sound absorber; measurement techniques for absorption (ISO10534, ISO354)

Vibration Control: Force and velocity excitation, blocked force and free velocity; vibration isolation - low and high frequency models; damping treatments; effects of damping; structural modification; vibration absorbers and neutralisers

UNIT-V:

Silencer Design: Acoustic impedance; insertion loss; reactive silencers: side branches, expansion chambers; flow-generated noise; lined ducts, splitter attenuators; pressure drop; break-out noise

Text Books:

1. F.J. Fahy (2001), Foundations of Engineering Acoustics
2. D. A. Bies and C.H. Hansen (1996), Engineering Noise Control
3. Manohar Lal Munjal, Noise and Vibration Control

Reference Books:

1. Key Texts available in Hartley and EJ Richards Libraries
2. F.J.Fahy and D.J. Thompson (2015). Fundamentals of Sound and Vibration

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DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. I Year II Semester (Machine Design)

<table>
<tr><td>Course Code</td><td colspan="4">Course Title</td><td></td><td></td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">MULTIBODY DYNAMICS</td><td>PCC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Theory of Machines, Automobile Engineering</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. understand the fundamental principles of vehicle dynamics
2. learn 3D mechanisms and 3D vehicle design
3. gain knowledge of bond graph technology
4. know about steering mechanisms and dynamics of vehicle rollovers
5. identify various functions involved in wheeled vehicle handling

Course Outcomes: At the end of this course, students will be able to:

1. explain the fundamental principles of vehicle dynamics
2. compare and contrast various 3D mechanisms
3. use the computer models in suspension designs
4. analyze steering mechanisms, forces and moments involved
5. estimate the torque and speeds required to avoid skidding

UNIT - I: Introduction- Fundamental Principles, Vehicle tires performance, cornering characteristics, Mechanics of Vehicle Terrain interaction. Vehicle Kinematics, Fundamental principles of velocity, acceleration. Two dimensional mechanisms, Forward Vehicle Dynamics

UNIT - II: Three dimensional Mechanisms - Multi-Body Systems Design, Introduction to 3D vehicle design

UNIT- III: Suspension Design: Computer models using Bond Graph Technology, Drive train dynamics, Tyre dynamics, vehicle performance

UNIT– IV: Steering Mechanisms: Two- and three-dimensional analysis, Mechanics of Vehicle Terrain interaction. Vehicle Collations, Fundamental laws of motion, energy and momentum, Forces and Moments 2D and 3D. The Dynamics of vehicle rollovers

UNIT- V: Wheeled Vehicle Handling – Handling control loop, vehicle transfer function, Kinematic behavior of vehicles with rigid wheels and with compliant tyres: Neutral steer point, static margin, over and under-steer. Solution with two degree of freedom in the steady state: Stability factor, characteristic and critical speeds. Tracked Vehicle Handling – Analysis of sprocket torques and speeds, required to skid steer a tracked vehicle. Extension of theory to include three degrees of freedom

Text Books:

1. Vehicle Dynamics: Theory and Application/Reza Jazar/Springer 2008
2. Theory of Ground Vehicles/ J. Y. Wong/ John Wiley

Reference Books:

1. Vehicle stability/ Dean Karnopp/ Dekker Mechanical Engineering
2. Modeling& Simulation of Mechatronics Systems/ Karnoop Margolis, Rosenberg,/Wiley/2007
3. Suspension and Tyres / Giles J.G. Steering/ Illiffe Books Ltd., London
4. Fundamental of Vehicle Dynamics/ Gillespie/ T.D, SAE USA

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. I Year I Semester (Machine Design)

Course Code	Course Title						PCC/PEC/OEC
	DESIGN OPTIMIZATION						PEC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Introductory courses in mathematics, mechanics, solid mechanics and mechanical engineering design.	3	-	-	-	40	60	3

Course Objectives: The objectives of this course are to:

1. introduce the concept of design optimization and classify optimization problems
2. familiarize the techniques of unconstrained minimization
3. elaborate on the direct and indirect methods using various mathematical functions and algorithms
4. give exposure to optimization techniques with respect to various engineering problems
5. extend the knowledge of optimization techniques to degrees of freedom systems

Course Outcomes: At the end of this course, students will be able to

1. understand the concept of design optimization and classify optimization problems
2. explain the technique of unconstrained minimization
3. analyze the direct and indirect methods using various mathematical functions and algorithms
4. apply optimization techniques to various engineering problems
5. relate optimization techniques to two degrees of freedom systems

UNIT-I:

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints, classification of optimization problems. Single and multivariable optimization techniques

UNIT-II:

Technique of unconstrained minimization. Golden section, Random, Pattern and Gradient search methods, interpolation methods, equality and inequality constraints

UNIT-III:

Direct methods and indirect methods using penalty function, Lagrange multipliers, Geometric programming, stochastic programming, Genetic algorithms

UNIT-IV:

Engineering applications, structural-design application axial and transverse loaded members for minimum cost, maximum weight. Design of shafts and torsion members, design optimization of springs

UNIT-V:

Dynamics applications for two-degree freedom system. Vibration absorbers. Application in mechanisms

Text Books:

1. Engineering Optimization -Theory and Practice/ Singiresu S. Rao/ New Age
2. Introduction to Optimum Design/Jasbir S. Arora/ Academic Press/ Everest/ 3rd Edition

Reference Books:

1. Optimum Design of Mechanical elements/ Johnson Ray C/ Wiley, John & Sons
2. Genetic Algorithms in search, Optimization and Machine/ Goldberg D. E. Addison/Wesley / New York
3. Optimization for Engineering Design Algorithms and Examples/ Kalyanamoy Deb/Prentice Flail of India

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. I Year I Semester (Machine Design)

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">VIBRATION ANALYSIS OF MECHANICAL SYSTEMS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Strength of Materials, Machine Design</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
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Course Objectives: The objectives of this course are to:

1. study the behavior of single and two-degree freedom systems and principal modes of undamped and damped free and forced vibrations
2. learn the solving solutions of multi-degree freedom through different types of methods
3. study the equations of natural frequency for different beams
4. learn the frequency domain vibration analysis
5. study the vibration control in structures of actuators for active control, semi active control of automotive suspension systems

Course Outcomes: At the end of this course, students will be able to

1. understand the causes of vibration and types of vibration
2. determine the behavior of two degrees freedom systems
3. analyze the multi degree freedom systems
4. determine the methods that can be utilize for condition monitoring of various systems
5. understand the various special vibration measuring techniques

UNIT-I: Single- and Two-Degree Freedom Systems: Response to Non Periodic Excitations: unitimpulse, unit step and unit Ramp functions; response to arbitrary excitations, Principal modes-undamped and damped free and forced vibrations; undamped vibration absorbers

UNIT-II: Multi-Degree of Freedom Systems: Introduction Modeling of Continuous systems as Multi-degree of Freedom systems, Using Newton's second law to derive equations of motion, Influence Coefficients. Potential and kinetic energy expressions in matrix form, Generalized coordinates and generalized forces, Using Lagrange's equations to derive equations of motion, Equations of motion of undamped systems in matrix form, Eigen value problem, solution of the Eigen value problems – solution of the characteristic equation, orthogonality of normal modes, repeated Eigen values

UNIT- III: Determination of Natural Frequencies and Mode Shapes: Introduction, Dunkerley'sformula, Rayleigh's Method- Properties of Rayleigh's Quotient, Computation of the Fundamental Natural Frequency, Fundamental Frequency of Beams and Shafts. Holzer's Method-Torsional, Spring Mass Systems, Jacobi's method, Standard Eigen value Problems

UNIT-IV: Experimental modal analysis: Over view, machine-train monitoring parameters-Database development-vibration data acquisition-trending analysis-failure- node analysis-signature analysis-root cause analysis

UNIT-V: Vibration Control in Structures: Introduction, State space representation of equations of motion,Passive control, Active control and semi active control, Free layer and constrained damping layers, piezo electric sensors and actuators for active control, semi active control of automotive suspension systems

Text Books:

1. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4
2. Mechanical Vibrations/Groover/Nem Chand and Bros
3. Mechanical vibrations/W.T.Thomson/ Prentice Hall Press

Reference Books:

1. Elements of Vibration Analysis by Meirovitch, TMH, 2001
2. Mechanical Vibrations/Schaum Series/ McGraw Hill
3. Mechanical Vibrations/Debabrata Nag/Wiley
4. Vibration problems in Engineering / S.P. Timoshenko
5. Mechanical Vibrations and sound engineering/ A. G. Ambekar/ PHI
6. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/New Age Intl. Publishers/Revised 2nd Edition

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. I Year I Semester (Machine Design)

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">TRIBOLOGY IN DESIGN</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Fluid Mechanics, Machine Design</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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</table>

Course Objectives: The objectives of this course are to:

1. provide the knowledge and importance of Tribology in Design, friction, wear and lubrication aspects of machine components
2. introduce the concept of surface engineering and its importance in tribology
3. understand the principles for selecting compatible materials for minimizing friction and wear in machinery
4. acquire and apply fundamental principles of hydrostatic lubrication
5. understand the fundamental principles of high contact stresses (Hertz stresses) and Elasto hydrodynamic (EHD) lubrication in rolling bearings and gears

Course Outcomes: At the end of this course, students will be able to

1. understand the different types of lubrications and relevant theories used in supporting elements
2. interpret and understand various lubricants and its properties
3. understand and apply principles of mechanism of wear, sources of friction and lubrication systems
4. understand, apply and analyze the hydrostatic lubrication
5. apply the principles of lubrication, lubrication regimes, and theories of hydrodynamic, elasto-hydrodynamic and mixed / boundary lubrication

UNIT-I: Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion

UNIT-II: Wear, types of wear, theories of wear, wear prevention. Tribological properties of bearing materials and lubricants

UNIT-III: Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings

UNIT-IV: Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings

UNIT-V: Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings

Text Books:

1. Fundamentals of Fluid Film Lubrication – B. J. Hamrock, McGraw Hill International, 1994
2. Introduction to Tribology of Bearings –B. C. Majumdar, A. H. Wheeler &co. pvt. Ltd.
3. Engineering Tribology/A. W Batchelor and G. W. Stachowiak/ Butterworth-Heinemann

Reference Books:

1. Cameron, "Basic Lubrication Theory", Ellis Horwood Ltd, 1981
2. Principles in Tribology, Edited by J. Halling, 1975
3. D.D. Fuller, "Theory and Practice of Lubrication for Engineers", John Wiley and Sons, 1984
4. "Fundamentals of Friction and wear of Materials" American Society of Metals

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DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">ADVANCED MECHANICS OF COMPOSITE MATERIALS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Structure and properties of composite materials and design procedures for composite structures.</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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</table>

Course Objectives: The objectives of this course are to:

1. identify the properties of fiber and matrix materials used in commercial composites as well as some common manufacturing techniques
2. determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus
3. study the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness
4. solve the classical laminated plate theory to determine extensional, coupling, and bending stiffnesses of a composite laminate. Also be able to perform this calculation using MATLAB for a composite laminate with many layers
5. identify the fabricate composite laminates and built-up composite structures such as I-beams, box beams, or model-scale aircraft wings using a composite manufacturing procedure

Course Outcomes: At the end of this course, students will be able to

1. understanding of types, manufacturing processes, and applications of compositematerials and basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic materialbehavior
2. analyze problems on macro and micro mechanical behavior oflamina
3. analyze problems on macro mechanical behavior oflaminate
4. predict the loads and moments that cause an individual composite layer and a composite laminate to fail and to compute hygro-thermal loads incomposites
5. compute the properties of a composite laminate with any stackingsequence

UNIT–I: Basic Concepts and Characteristics: Geometric and Physical definitions, natural andman-made composites, Aerospace and structural applications, types and classification of composites. **Reinforcements:** Fibres – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbidefibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT–II: Micromechanics: Unidirectional composites, constituent materials and properties, elasticproperties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, manlayup, pultrusion, RTM.

UNIT–III: Coordinate Transformation: Hooke's law for different types of materials, Hooke's law fortwo dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off – axis, stiffness modulus, off – axis compliance.

Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship betweenengineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

UNIT–IV: Strength of Unidirectional Lamina: Micro mechanics of failure, Failure mechanisms,strength of an orthotropic lamina, strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micros mechanical predictions of elastic constants.

UNIT–V: Analysis of Laminated Composite Plates: Introduction thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

Text Books:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975
2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994
3. Principles of Composite Material Mechanics/ Ronald F. Gibson/CRC Press

Reference Books:

1. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley-Interscience, New York, 1980
2. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw ,Publisher: CRC
3. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, New York, 1969
4. Advanced Mechanics of Composite Materials/ Vasiliev & Morozov /Elsevier/Second Edition

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DEPARTMENT OF MECHANICAL ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="5">DESIGN FOR MANUFACTURING AND ASSEMBLY</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">DMM-I, DMM-II, Manufacturing Technology and Engineering Metrology</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. learn various steps in the product development process and significance of early phases of design for economical production
2. know the fundamental principles of design for economical production and application of these properties in practical design problems
3. understand the interactions among part geometry tolerances, materials and manufacturing processes
4. design the products for ease of assembly and manufacture
5. identify the principles of robust design procedures and how to set values for various design variables

Course Outcomes: At the end of this course, students will be able to

1. design and develop the product economically
2. implement the general design rules for machining and casting processes
3. approve the various metal joining metal joining processes as per standards
4. assemble the parts in order to obtain the final product
5. implement the general design guide lines in manual assembly process

I M. Tech. I Semester (Machine Design)

UNIT-I: Introduction: Design Philosophy, steps in design process, General design rules for manufacturability- basic principles of designing for economical problem- creativity in design materials- selection of materials for design developments in material technology- criteria for material selection-material selection interrelationship which process selection, process selection charts.

UNIT-II: Machining Process: Overview of various manufacturing process-general design rules for machining- Dimensional tolerance and surface roughness- Design for machining ease- Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts.

Metal Casting: Approval of various casting processes, selection of casting process- general design consideration for casting- casting tolerance- use of solidification simulation in casting design-product design rules for sand casting.

UNIT-III: Metal Joining: Approval of various welding processes, Factors on design of weldments- general design guidelines pre and post treatment of welds- effects of thermal stresses in weld joints- design of brazed joints- Forging –design factor for forging- closed die forging design- general design recommendations extrusion& sheet metal work- design guide lines for extruded sections- design principles for punching, blanking, bending, deep drawing, Keeler goodman forming line diagram component design for blanking.

UNIT-IV: Assemble Advantages: Developments of the assemble process, choice of assemble method, assemble advantages, social effects of automation.

Automatic Assembly Transfer Systems: Common transfer, intermittent transfer, indexing mechanisms and operator paced free- transfer machine.

UNIT-V: Design of Manual Assembly: Design for Assembly fits in the design process, general design guide lines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part geometry on handling, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of chamfer design on insertion operations, estimation of insertion time.

Text Books:

1. Assembly Automation and product design GeofferyBoothroyd:Marcel Dekker Inc (NY,1992)
2. Engineering design : Material & Processing Approach George E.Dieter: McGraw Hill Ind 2nd Ed.2000

Reference Books:

1. Hand book of Product design Geoffery Boothroyd and Dekken,NY.1990
2. Computer Aided Assembly London/A. Delbrainbre
3. Product design for manufacturing and Assembly Geoffery Boothroyd
4. Design and Manufacturing/ Surender Kumar & Goutham Sutradar /Oxford & IBH publishing Co. Pvt. Ltd. New Delhi, 1998
5. ASM Hand book.Vol.20

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">DESIGN OF PRESSURE VESSELS AND PIPING</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">DMM-I, DMM-II, Fluid Mechanics</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. know about the need and significance of pressure vessels
2. understand the different components of piping systems
3. identify the various steps in the design of the piping system
4. explain the fundamental principles of design to improve the piping layout
5. design pressure vessels

Course Outcomes: At the end of this course, students will be able to:

1. determine stresses in pressure vessels
2. design pressure vessels using codes
3. design support members of pressure vessels
4. apply various design considerations for pressure vessels
5. design the pressurized fluid piping

UNIT–I: Introduction, Materials- shapes of Vessels – stresses in cylindrical spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load bending and torque-isolation of pressure vessels – conical and tetrahedral vessels. Theory of thick cylinders; Shrink fit stresses in built up cylinders – auto freltage of thick cylinders Thermal stresses in Pressure Vessels.

UNIT–II: Theory of Rectangular Plates: Pure bending – different edge conditions. Theory circular plates: Simple support and clamped ends subjected to concentrated anduniformly distributed loads-stresses from local loads. Design of dome bends, shellconnections, flat heads and cone openings

UNIT–III: Discontinuity Stresses In Pressure Vessels: Introduction beam on an elastic foundation, infinitely long beam semi- infinite beam, cylindrical vessel under axially symmetrical loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses in a bimetallic joints, deformation and stresses in flanges. Pressure vessel materials and their environment : Introduction ductile material tensiletests, structure and strength of steel Leuder's lines determination of stress patterns fromplastic flow observations, behavior of steel beyond the yield point, effect of cold work orstrain hardening on the physical properties of pressure vessel steels fracture types in tension.

Toughness of materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crackgrowth fatigue life prediction cumulative fatigue damage stress theory of failure of vesselssubject to steady state and fatigue conditions.

UNIT–IV: Introduction to Piping Design: Effects of operating conditions, including flow rate design pressure and temperature on piping design, Impact of internal and external forces on the design, piping layout, an overview of the general support classifications.

UNIT-V: Preliminary Piping Design: Concepts and developing an initial piping layout, Design principles Including fluid properties, flow rate and physical laws which influence the complete piping system layout, understand the effect of different piping system components such as tanks, vessels and pumps on the overall system.

Text Books:

1. Theory and design of modern Pressure Vessels / John F. Harvey ‗Van/ Nostrand Reihold

   Company / New York
2. Pressure Vessel Design and Analysis / Bickell M. B. Ruizes / Macmillan Publishers

Reference Books:

1. Process Equipment design / Brownell & Young
2. Indian standard code for unfired Pressure vessels IS 2825
3. Pressure Vessels Design Hand Book Henry H. Bednar PE / CB S Publishers / New Delhi
4. Theory of plates and shells / Timoshenko & Noinosky / Dover Publications
5. Stress in Beams, Plates and Shells / Ansel C. Ugural / CRC Press / 3rd Edition

NURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

Course Code	Course Title						PCC/PEC/OEC
	MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS						PEC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Metallurgy and Material Science	L	T	D	P	40	60	3
	3	-	-	-			

Course Objectives: The objectives of this course are to:

1. impart the knowledge of various fractures and failures in a component subjected to tensile loads
2. know the various loading modes and stress concentration regions
3. know the crack opening displacements for various modes of cracks
4. get the knowledge of various empirical laws and mean stress correction factors
5. impart the knowledge of creep rate

Course Outcomes: At the end of this course, students will be able to

1. understand the energy release rates in crack propagation direction and solution for crack tip stresses
2. analyze the stresses in various crack propagation and factors influencing the crack propagation
3. determine the strain release rate in a material and can able to find out resistance to fracture against crack extension
4. analyze the factors influencing the fatigue life of components and different methods of counting the cycles
5. understand various factors influencing fatigue lives of welded joints

UNIT-I:

Introduction: Fracture behavior of metals and alloys. The ductile/brittle transition temperatures for notched and un-notched components, Ductile rupture as a failure mechanism Fracture at elevated temperature

Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, Equivalence of energy approach and stress intensity approach

Stress Intensity Factor and its use in Fracture Mechanics: Early concepts of stress concentrators and flaws, Ingles solution to stress round an elliptical hole-implications of results. Stress intensity factor for a crack. Westergaard‟s solution for crack tip stresses. Stresses and displacement in Cartesian and polar coordinates

UNIT-II:

Linear Elastic Fracture Mechanics (LEFM): Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, strain energy release rate, fracture energy, R. Modification for ductile materials, loading conditions. Stress intensity factor and the material parameter, the critical stress intensity factor

UNIT-III:

Elastic/Plastic Fracture Mechanics: The crack opening displacement and J-integral approaches, R-curve analysis Testing procedures, Measurement of these parameters, RAD, Fail sage and safe life design approaches, Practical applications. Advanced topics in EOFM

UNIT-IV:

Analysis of Fatigue: The empirical laws of fatigue failure. High cycle-low strain fatigue. Basquin‘s law. Goodman, Soderberg and Gerber mean stress corrections. Miner‘s law of damage summation. Low cycle fatigue, Crack growth and application of fracture mechanics to fatigue. Paris-Ergodan law. Threshold stress intensity range. Crack closure and its theories. Cycle counting methods. Development in using rain flow counting methods to recreate fatigue standard spectra. Standard spectra suitable for different applications

UNIT-V:

Fatigue of Welded Structures: Factors affecting the fatigue lives of welded joints. The codes and standards available to the designer. The use of fracture mechanics to supplement design rules. Practical examples. Introduction to creep phenomena

Text Books:

1. Fracture Mechanics: Fundamental and Applications /Anderson T.L & Boca Raton/ CRC Press, Florida, 1998
2. Deformation and Fracture mechanics of Engineering Materials / Richard W Hertz /Wiley

Reference Books:

1. Plasticity for structural Engineers / W.F. Chen and D.J,. Ha

2. Engineering Fracture Mechanics/ D.R.J. Owen and A.J. Fawkes /Pincridge press, Swansea, U.K
3. Mechanical Metallurgy / Dieter / McGraw Hill
4. Fracture and fatigue control in structures/ S.T. Rolfe and J.M. Barsom/ Prentice Hall, Eglewood cliffs, N.J
5. Fracture of brittle solids/ B.R. Lawn and T.R. Wilshaw/ Cambridge university press
6. Plastic deformation of Metals/ R.W.K. Honeycombe/ 2nd edition, Edward Arnold
7. Elements of Fracture Mechanics/Prasanth Kumar/TMH
8. F.R.N. Nabarro, H.L. deVilliers, The Physics of Creep, Taylor and Francis, (1995)

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">THEORY OF ELASTICITY AND PLASTICITY</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Strength of Materials</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. impart knowledge on basic concepts of theory of elasticity
2. gain knowledge of stresses and strains in three dimensional bodies
3. know the bending stresses induced in beams
4. understand the yield criteria for ductile materials and the plastic stress-strain relations.
5. explore the various methods of solving practical problems

Course Outcomes: At the end of this course, students will be able to:

1. explain the stress strain relations for different types of elastic bodies
2. estimate the stresses and strains for three dimensional elements
3. solve the problems of different cross-sectional bars subjected to bending
4. analyze the structure of a metal when it is in plastic state
5. implement the characteristic and engineering methods in solving the problems

UNIT I:

Elasticity: Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

Problems In Rectangular Co-ordinates -Solution by polynomials – Saint Venent's principles - Determination of displacement - Simple beam problems.

Problems In Polar Coordinates - General equations in polar coordinates – Stress distribution symmetrical about axis - Strain components in polar coordinates – Simple and symmetric problems.

UNIT II:

Analysis of Stress And Strain In Three Dimensions: Principle stresses - Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

General theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

UNIT III:

Bending of Prismatic Bars: Stress function - Bending of cantilever beam – Beam of rectangular cross-section - Beams of circular cross-section.

UNIT IV:

Plasticity: Plastic deformation of metals - Structure of metals - Deformation – Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

UNIT V:

Methods of Solving Practical Problems: The characteristic method – Engineering method - Compression of metal under press - Theoretical and experimental data drawing.

Text Books:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. An Engineering Theory of Plasticity/E.P. Unksov/Butterworths

Reference Books:

1. Applied Elasticity/W.T. Wang/TMH
2. Theory of Plasticity for Engineers/Hoffman and Sacks/TMH
3. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers
4. Theory of Elasticity and Plasticity/Harold Malcolm Westergaard/Harvard University Press

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) II Semester

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="5">CONDITION MONITORING OF MECHANICAL SYSTEMS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">--</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. understand Fourier analysis, signal analysis, and analyzer types
2. get knowledge of stationary signals and filter analysis
3. learn non stationary signals and window types
4. know about various analysis of bandwidths
5. get acquainted with condition monitoring in real systems

Course Outcomes: At the end of this course, students will be able to:

1. use fourier analysis, bandwidths, detectors and recorders
2. analyze stationary signals using various types
3. correlate stationary signals and scale the results
4. explain the various bandwidths
5. apply condition monitoring for various mechanical systems

UNIT-I:

Introduction, Basic concepts. Fourier analysis. Bandwidth. Signal types. Convolution. Signal analysis: Filter response time. Detectors. Recorders. Analog analyzer types.

UNIT-II:

Analysis of Stationary Signals: Stepped filter analysis. Swept filter analysis. High speed analysis. Real-time analysis.

UNIT-III:

Analysis of Continuous Non-Stationary Signals: Choice of window type, Choice of window length, Choice of incremental step, Practical details, Scaling of the results.

UNIT-IV:

Analysis of Transients: Analysis as a periodic signal. Analysis by repeated playback (constant bandwidth), Analysis by repeated playback (variable bandwidth).

UNIT-V:

Condition Monitoring In Real Systems: Diagnostic tools. Condition monitoring of two stage compressor. Cement mill foundation. I.D. fan. Sugar centrifugal. Cooling tower fan. Air separator. Preheater fan. Field balancing of rotors. ISO standards onvibrations.

Text Books:

1. Condition Monitoring of Mechanical Systems / Kolacat
2. Mechanical Vibrations Practice with Basic Theory / V. Ramamurti/ Narosa Publishing House

Reference Books:

1. Frequency Analysis /R. B. Randall
2. Theory of Machines and Mechanisms/ Amitabh Ghosh & AK Malik/ EWP

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">RESEARCH METHODOLOGY</td><td>-</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">None</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. understand the research problem
2. know the process of literature survey, plagiarism check and ethical means of doing research
3. get the knowledge about technical report writing
4. create the awareness about the intellectual property rights
5. know about the patent procedures

Course Outcomes: At the end of this course, students will be able to**:**

1. formulate the research problem
2. analyze research related information by following research ethics
3. convert a technical paper into a research proposal by incorporating new ideas or concepts
4. develop patent from the obtained research outcome
5. protect the research output for further development in the area chosen though IPR

Unit I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit II: Effective literature studies approaches, analysis Plagiarism, Research ethics

Unit III: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit IV: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

Unit V: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Reference Books:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3. Mayall , "Industrial Design", McGraw Hill, 1992
4. Niebel , "Product Design", McGraw Hill, 1974
5. Asimov, "Introduction to Design", Prentice Hall, 1962
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech (Machine Design) I Year I Semester

(A minimum of 10 experiments is to be conducted)

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">KINEMATICS AND DYNAMICS LAB.</td><td>PCC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2"></td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">2</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td></td><td colspan="7">Course Objectives: The objectives of this Lab. are to:
1. know the effect of different viscous oils in a damped natural frequency system
2. conduct study on forced vibratory system
3. study static and dynamic balancing using steel balls
4. impart knowledge about gyroscopic balancing and FFT analyzer
5. study the kinematics of a robotic arm

Course Outcomes: At the end of this Lab. students will be able to:
1. evaluate the influence of viscosity of oils on the damped natural frequency system
2. analyze the forced vibratory systems
3. balance statically and dynamically using steel balls
4. evaluate gyroscopic effect and natural frequency using FFT
5. analyze the kinematics of robotic arm</td></tr>
</table>

Experiments:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils
2. Determination of steady state amplitude of a forced vibratory system
3. Static balancing using steel balls
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing
5. Field balancing of the thin rotors using vibration pickups
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors
7. Determination of natural frequency of given structure using FFT analyzer

8. Diagnosis of a machine using FFT analyzer
9. Direct Kinematic analysis of a robot
10. Inverse Kinematic analysis of a robot
11. Trajectory planning of a robot in joint space scheme
12. Palletizing operation using Robot programming

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

Course Code	Course Title						PCC/PEC/OEC
	ADVANCED FINITE ELEMENT ANALYSIS						PCC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Engineering Mathematics, Strength of Materials, Heat Transfer and Vibrations.	L	T	D	P	40	60	3
	3	-	-	-			

Course Objectives: The objectives of this course are to:

1. study the basics of finite element method for displacement and stress analysis with the help of various methods
2. undergo the basics of FEM relating stresses, strains in the heat transfer and vibrations concepts
3. bridge between hand calculations based on strength of materials and numerical solutions for more complex geometries with loading conditions
4. study approximate nature of the finite element method and convergence of results are examined
5. have hands on experience with FEM software in designing the stiffness matrix of 1D,2D and 3D and do the stress analysis

Course Outcomes: At the end of this course, students will be able to:

1. determine the approximate solutions for various elements using numerical methods
2. evaluate the displacements, stresses and strains of a bar, Truss element
3. solve the nodal displacements for two-dimensional elements
4. perform the heat transfer and dynamic analysis of bars and beams
5. apply professional-level finite element software to solve nonlinear and linear problems

UNIT - I: Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT - II: Types of 1D elements, Displacement function, Global and local coordinate systems, Properties of stiffness matrix, Boundary conditions elimination method and penalty approach, Symmetric boundary conditions, Stress calculations Quadratic shape functions, and problems.

Analysis of Trusses: Plane Trusses and Space Truss elements and problems

UNIT - III:

Analysis of Beams: Hermite shape functions – stiffness matrix – Load vector – Problems.

2-D Problems: CST, force terms, Stiffness matrix and load vectors, boundary conditions, Problems.

UNIT- IV:

Scalar Field Problems: 1-D Heat conduction-Slabs – fins - problems. Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

UNIT - V:

3D and Non-linear problems: Three dimensional problems in stress analysis. Introduction to non-linear problems, incompressible fluid, Bending of elastic plates, and Finite Element analysis software.

Text Books:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI

Reference Books:

1. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu,
2. Prentice Hall of India, 1997
3. Finite Element Method – Zienkiewicz / McGraw Hill
4. Introduction to Fininte element analysis- S. Md. Jalaludeen, Anuradha Publications, print- 2012
5. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition
6. Segerland. L.J., Applied Finite Element Analysis, Wiley Publication, 1984
7. Reddy J.N., An Introduction to Finite Element Methods, Mc Graw Hill Company, 1984

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

I M. Tech. I Semester (Machine Design)

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="5">ADVANCED MECHANICS OF SOLIDS</td><td>PCC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Applied Mechanics, Mechanics of solids</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. impart concepts of stress and strain analyses in a solid
2. study the methodologies in theory of elasticity at a basic level
3. acquaint with the solution of advanced bending problems
4. get familiar with energy methods for solving structural mechanics problems
5. impart concepts of contact stress and deflection of bodies

Course Outcomes: At the end of this course, students will be able to

1. apply concepts of stress and strain analyses in solids
2. use the procedures in theory of elasticity at a basic level
3. solve general bending problems
4. apply energy methods in structural mechanics problems
5. understanding the analogy models developed for analyzing the non-circular bars subjected to torsion, and also analyzing the stresses developed between rolling bodies and stress in three dimensionalbodies

UNIT–I:

Shear Centre: Bending axis and shear center-shear center for axi-symmetric and unsymmetricalsections.

Unsymmetrical Bending: Bending stresses in Beams subjected to Nonsymmetrical bending;Deflection of straight beams due to nonsymmetrical bending.

UNIT–II:

Curved Beam Theory: Winkler Bach formula for circumferential stress – Limitations – Correctionfactors – Radial stress in curved beams – closed ring subjected to concentrated and uniform lads-stresses in chain links.

UNIT-III:

Torsion: Torsion of a cylindrical bar of Circular cross Section; Saint-Venant's semi-inverse methods;Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section; Hallow thin wall torsion members, Multiply connected Cross section, Thin wall torsion members with restrained ends

Axi-Symmetric Problems: Rotating Discs – Flat discs, Discs of uniform thickness, Discs of UniformStrength, Rotating Cylinders

UNIT-IV:

Theory of Plates: Introduction; Stress resultants in a flat plate; Kinematics: Strain-Displacementrelations for plates; Equilibrium equations for small displacement theory of flat plates; Stress – Strain– Temperature relation for Isotropic plates: Strain energy of a plate; Boundary conditions for plate; Solution of rectangular plate problem; Solution of circular plate problem

Beams on Elastic Foundation: General theory; Infinite Beam subjected to Concentrated load;boundary conditions; Infinite beam subjected to a distributed lad segment; Semi-infinite beam with concentrated load near its end; Short Beams

UNIT-V:

Contact Stresses: Introduction, problem of determining contact stresses; Assumptions on which asolution for contact stresses is based; Expressions for principal stresses; Methods of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area

Text Books:

1. Advanced Mechanics of materials/Seely and Smith/ John Willey
2. Advanced Mechanics of materials / Boresi & Sidebottom/wiely international
3. Advanced mechanics of solids/ L.S. Srinath/ Tata McGraw Hill Education Private Limited

Reference Books:

1. Advanced strength of materials / Den Hortog J.P./Torrent
2. Theory of Plates /Timoshenko
3. Strength of materials / Sadhu singh/ Khanna Publishers
4. Mechanics of Materials / Beer & Jhonson / McGraw Hill
5. Theory of Plates & Shells / Timoshenko/ McGraw Hill/ 2nd Edition

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">ADVANCED MECHANICS OF SOLIDS</td><td>PCC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
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Text Books:

4. Advanced Mechanics of materials/Seely and Smith/ John Willey
5. Advanced Mechanics of materials / Boresi & Sidebottom/wiely international
6. Advanced mechanics of solids/ L.S. Srinath/ Tata McGraw Hill Education Private Limited

Reference Books:

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DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">INDUSTRIAL ROBOTICS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Kinematics of Machinery, Dynamics of Machinery</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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</table>

Course Objectives: The objectives of this course are to:

1. identify different types of robot configurations and their anatomy
2. understand the position and velocity of a robotic arm
3. learn the dynamics of a robotic arm
4. gain knowledge of a robotic system to perform a specified task
5. know the importance of different robotic cells in industries

Course Outcomes: At the end of this course, students will be able to:

1. explain the evolution, classification, structures and drives for robots
2. summarize the kinematic arrangement of robots and its applications in the area of manufacturing sectors
3. solve different dynamics related problems associated with the robots
4. classify different types of programming methods for robots
5. build a robot for any type of application

UNIT-I:

Introduction: Automation and Robotics, Robot anatomy configuration, joint motion and notation, work volume, robot drive system, control system and dynamic performance, precision of movement

Control System and Components: basic concept and modals controllers control system analysis, robot actuators and feedback components (sensors): Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics, Power Transmission Systems

UNIT-II:

Motion Analysis and Control: Manipulator kinematics, position representation Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators, Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending

UNIT-III:

Robot Dynamics: Lagrange – Euler & Newton - Euler formulations, problems on two link planar manipulators, configuration of robot controller

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design

Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application

UNIT-IV:

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations. Robot Languages: Textual robot languages, Generation, Robot language structures, Elements and functions

UNIT-V:

Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection and Work cell **controller. Robot Applications:** Material transfer, Machine loading/unloading Processing operations, Assembly and Inspection, Future Applications

Text Books:

1. Industrial robotics by Mikell P.Groover, McGraw Hill
2. Robotics by K.S.Fu, McGraw Hill

Reference Books:

1. Introduction to Robotics Mechanics & Control by John J.Craig, Pearson
2. Robot Analysis by Lung Wen Tsai, John Wiley & Sons
3. Robot Analysis and Control by Asada H. and J. E. Slotin, Wiley, New York

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DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="4">Course Title</td><td></td><td></td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">PRODUCT DESIGN AND DEVELOPMENT</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Design of Machine Elements.</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>0</td><td>-</td><td>0</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. understand the need of product development, customer needs and product management
2. explore the concept generation and selection, based on customer needs
3. have knowledge on component standardization and integrated design process
4. interpret the quality of industrial design based on customer needs
5. learn evaluation of the manufacturing cost and understand the basics of prototyping

Course Outcomes: At the end of this course, students will be able to:

1. plan the need of industrial product development, customer needs and design aspects of new products
2. involve customer into the development of new products and managing requirements
3. design and develop the product architecture accordingly
4. investigate the customer requirement through various survey methods
5. prototype new products

UNIT – I:

Introduction: Need for PDD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis

Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification

UNIT – II:

Concept generation and concept selection: Activity of concept generation – Structured approaches– Five step Method: clarify – Search-Externally and internally – explore systematically – reflect on the solutions and processes – Concept selection – Integral part of PDD process-methodology – benefits

UNIT – III:

Product architecture: Implications – Product change – variety – component standardization

– Product performance – manufacturability

Industrial design: Assessing the need for industrial design, impact – design process Integrate design process – assessing the quality of industrial design

Robust design - introduction, various steps in robust design

UNIT – IV:

Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design

UNIT – V:

Design for manufacturing: Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs –cost of supporting production. Minimizing System complexity

Prototyping: Prototype basics – Principles of prototyping – planning for prototypes – Economic and Ergonomic analysis Understanding and representing tasks – baseline project planning – accelerating the project execution

Text Books:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger /McGraw Hill International Edns. 1999
2. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4

Reference Books:

1. Concurrent Engg/ integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book
2. Tool Design – Integrated Methods for Successful Product Engineering / Staurt Pugh / Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">EXPERIMENTAL STRESS ANALYSIS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Strength of Materials</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. recognize the various techniques available to measure the stress and strains using different sources.
2. realize the working of recording instruments and data logging methods
3. identify the crack growth by applying brittle coatings.
4. know the principles of photo elasticity in two-dimensional stress analyses
5. acquire the knowledge of birefringent coatings.

Course Outcomes: At the end of this course, students will be able to:

1. implement the overall concepts of stress/strain analysis by experimental means
2. record data through static and dynamic recording instruments
3. analyze the crack propagation in a material and also the displacement fields can be measured by moiré methods.
4. determine the stress distribution in a material when it is subjected to mechanical deformation.
5. apply different techniques to estimate the stresses and strains in 3D models and estimate the effective thickness of coating by birefringent coating

UNIT I:

Introduction**,** Theory of Elasticity, Plane stress and plane strain conditions, compatibility conditions, problem using plane stress and plane strain conditions, three-dimensional stress strain relations.

Strain measurement methods: various types of strain gauges, electrical resistance strain gauges, semiconductor strain gauge circuit

UNIT II:

Recording Instruments: Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT III:

Brittle Coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to moiré-fringe analysis, the displacement field approach to Moire-fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of moiré-fringes, experimental procedure and techniques.

UNIT IV:

Photo Elasticity: Photo elasticity, polariscope, plane and circularly polarized light, bright and dark filed setup, photo elasticity materials, Isochromatic fringes – Isoclinics.

UNIT V:

Three Dimensional Photo Elasticity: Introduction, locking in model deformation, materials for three dimensional photo elasticity, machining cementing and slicing three dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

Birefringent coating: Introduction, coating stress and stains, coating sensitivity, coating materials, application of coatings, effective of coating thickness, fringe-order determinations in coatings, stress separation methods.

Text Books:

1. Theory of elasticity / Timoshenko and Goodier Jr.
2. Experimental Stress analysis/ Dally and Riley, McGraw-Hill

Reference Books:

1. A treatise on Mathematical theory of elasticity / LOVE A.H./ Dover Publications
2. Photo Elasticity / Frocht/ Wiley / 3rdEdition
3. Experimental Stress Analysis / Sadhu Singh / Khanna Publications

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

Course Code	Course Title						PCC/PEC/OEC
	DESIGN AND ANALYSIS OF EXPERIMENTS						PEC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Probability and Statistics	L	T	D	P	40	60	3
	3	-	-	-			

Course Objectives: The objectives of this course are to:

1. study differenttypes of formal experimental designs
2. learn fundamental concepts of probability and statistics
3. know how to design experiments
4. understand the technique of regression analysis
5. know about the optimization techniques

Course Outcomes: At the end of this course, students will be able to:
1. make use of the basics of the design of experiments
2. explain the basic concepts of probability and statistics
3. design the experiment
4. apply the concepts of response surface methodology and regression analysis
5. implement the Taguchi method to identify significant factors that influence the process

UNIT - I:

Fundamentals of Experimentation: Role of experimentation in rapid scientific progress, historicalperspective of experimental approaches, Steps in experimentation, principles of experimentation, Error analysis

UNIT - II:

Simple comparative experiments: Basic concepts of probability & statistics, comparison of two meansand two variances, comparison of multiple (more than two) means and ANOVA

UNIT - III:

Experimental designs: Factorial designs, fractional factorial designs, orthogonal arrays, standardorthogonal arrays and interaction tables, modifying orthogonal arrays, selection of suitable orthogonal array design, analysis of experimental data

UNIT - IV:

Response surface methodology: Concept, linear model, steepest ascent, second order model,linear regression

UNIT - V:

Taguchi's Parameter Design: Concept of robustness, noise factor, objective function & S/Nratios, inner array & outer array design, data analysis

Text Books:

1. Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008
2. Ross P J , Taguchi techniques for Quality Engineering, McGraw-Hill Book Company, NY, 2008

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M. Tech. (Machine Design) I Year II Semester

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<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">ADVANCED OPTIMIZATION TECHNIQUES AND APPLICATIONS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Operations Research</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
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Course Objectives: The objectives of this course are to:

1. learn numerical optimization techniques for single variable optimization problems
2. understand multi-variable optimization problems for unconstrained problems
3. gain knowledge to create GP model and solve it by using arithmetic geometric inequality theorem
4. make use of sensitivity analysis
5. relate stochastic programming problem for finding mean, variance of random variables

Course Outcomes: At the end of this course, students will be able to:

1. formulate appropriate optimization techniques and solve a variety of examples taken from various fields of engineering
2. solve various multivariable unconstrained problems
3. arrive at GP model and solve it
4. apply sensitivity analysis to study the effect of changes in parameters of LPP on the optimal solution without reworking
5. implement chance constrained algorithm and solve stochastic linear program

UNIT- I:

Single Variable Non-Linear Unconstrained Optimition: One dimensional Optimization methods:- Uni-modal function, elimination method, Fibonacci method, golden section method, nterpolation methods- quadratic & cubic interpolation methods.

UNIT – II:

Multi Variable Non-Linear Unconstrained Optimization: Direct search method – Univariant Method – pattern search methods – Powell‘s – Hook – Jeeves, Rosenbrock search methods – gradient methods, gradient of function, steepest decent method, Fletcher reeves method. Variable metric method.

UNIT – III:

Geometric Programming: Polynomials – arithmetic – geometric inequality – unconstrained G.P – constrained G.P

Dynamic Programming: Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory. Allocation, scheduling replacement.

UNIT- IV:

Linear Programming: Formulation – Sensivity analysis. Change in the constraints, cost coefficients , coefficients of the constraints, addition and deletion of variable, constraints. Simulation – Introduction – Types – Steps – application – inventory – queuing – thermal system.

UNIT- V:

Integer Programming: Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method.

Stochastic Programming: Basic concepts of probability theory, random variables – distributions – mean, variance, correlation, co variance, joint probability distribution – stochastic linear, dynamic programming.

Text Books:

1. Optimization theory & Applications/ S.S Rao/ New Age International
2. Introductory to operation research/Kasan & Kumar/Springar

Reference Books:

1. Optimization Techniques theory and practice / M.C Joshi, K.M Moudgalya/ Narosa Publications.
2. Operation Research/H.A. Taha/TMH
3. Optimization in operations research/R.L Rardin
4. Optimization Techniques/Benugundu & Chandraputla/Person Asia

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">ANALYSIS AND SYNTHESIS OF MECHANISMS</td><td>PEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Kinematics of Machinery, Design of Machine Elements.</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. learn how to analyze the motions of mechanisms
2. find the radius of curvature of polodes
3. have knowledge on the graphical techniques commonly used in the synthesis of mechanisms
4. indicate mechanisms through various graphical methods
5. gain knowledge of analytical methods in the synthesis of mechanisms

Course Outcomes: At the end of this course, students will be able to:

1. analyze the plane motion mechanism based on the concepts of inflection circle
2. evaluate polode curvature of the given four bar mechanism and plot coupler curves
3. design mechanisms by using graphical methods and to plot Burmester's curve
4. develop new mechanisms using graphical methods by involving function generation and path generation methods
5. design mechanisms using analytical methods implementing various function generation and path generation methods

UNIT – I:

Advanced Kinematics of Plane Motion- I: Introduction to plane motion. The Inflection circle,Euler – Savary Equation, Analytical and graphical determination of d_i, Bobillier's Construction, Collineation axis, Hartmann's Construction,Inflection circle for the relative motion of two moving planes, Application of the Inflection circle to kinematic analysis

UNIT – II:

Advanced Kinematics of Plane Motion - II: Polode curvature, Hall's Equation, Polodecurvature in the four bar mechanism, coupler motion, relative motion of the output and input links, Determination of the output angular acceleration and its Rate of change, Freudenstein'scollineation –axis theorem, Carter –Hall circle, The circling – point curve for the Coupler of a four bar mechanism

UNIT – III:

Introduction To Synthesis-Graphical Methods - I: The Four bar linkage ,Guiding a bodythrough Two distinct positions, Guiding a body through Three distinct positions, The Roto center triangle , Guiding a body through Four distinct positions, Burmester's curve

UNIT – IV:

Introduction To Synthesis-Graphical Methods - II: Function generation-Generaldiscussion, Function generation: Relative – Roto center method, Overlay's method, Functiongeneration- Velocity – pole method, Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem

UNIT – V:

Introduction To Synthesis - Analytical Methods: Function Generation: Freudenstien'sequation, Precision point approximation, Precision – derivative approximation, Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition, Method of components, Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link, Method of components

Text Books:

1. Kinematics and Dynamics of plane mechanisms/ Jeremy Hirschhorn/McGraw-Hill, 1962
2. Theory of Machines and Mechanisms/ J. E Shigley and J.J .Uicker Jr./ McGraw-Hill, 1995

Reference Books:

1. Design of machinery / Robert L Norton third edition/ McGraw-Hill 2004
2. Theory of Mechanisms and Machines/ Amitabh Ghosh and Ashok Kumar Mallik/ E. W. P. Publishers
3. Kinematic Linkage Design/ Allen S.Hall Jr./ PHI,1964
4. Kinematics and Dynamics of Machinery/Charles E Wilson/Pearson/3rd Edition

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">COMPUTATIONAL METHODS IN ENGINEERING</td><td>OEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Matrix, algebra, numerical integration, Ordinary and Partial differential equations,</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. study the solution of system of linear equations, area bounded by the curvesand evaluation of definite integrals
2. learn the Finite difference approximations of ordinary differential equations and optimization techniques to minimize or maximize the functions
3. study the Finite Difference approximations of parabolic and elliptic partial differential equations
4. learn the Finite Difference approximations of hyperbolic partial differential equations
5. study the least square and Regression Analysis

Course Outcomes: At the end of this course, students will be able to:

1. a) explain the concepts of matrix determinant, rank, inverse to solve the system of linear equations

   b) apply Simpson's rules to find the area bounded by the curves

   c) evaluate definite integral of a function using Gaussian quadrature
2. a) maximize/minimize the functions

   b) solve the ordinary differential equations through finite difference techiniques
3. solve the parabolic and elliptic partial differential equations by applying finite difference techniques
4. solve the hyperbolic partial differential equations
5. a) construct the linear and nonlinear curves using least square approximations

   b) estimate the relationship between a dependent and independent variable using regression analysis

UNIT-I: Introduction to Numerical Methods Applied To Engineering Problems: Examples, solving sets of equation–Matrix notation–Determination andinversion – Iterative methods – Relaxation methods – System of non-linear equations – computer programs. **Numerical Integration:** Newton-Cotes integration formulas – Simpson 's rules, Gaussian quadrature. Adaptive integration.

UNIT-II: Optimization: One dimensional unconstrained optimization, multidimensionalunconstrained optimization – direct methods and gradient search methods, constrained optimization.

Boundary Value Problems and Characteristic Value Problems: Shooting method–Solution through a set of equations – Derivative boundary conditions – Rayleigh - Ritz method – Characteristic value problems,

UNIT-III: Numerical Solutions of Partial Differential Equations: Laplace 's equations – Representation as a difference equation – Iterative methods for Laplace 's equations – poison equation – Examples – Derivative boundary conditions – Irregular and non-rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

Parabolic partial differential equations: Explicit method–Crank-Nicolson method–Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.

UNIT-IV: Hyperbolic Partial Differential Equations: Solving wave equation by finite differences-stability of numerical method – method of characteristics wave equation in two space dimension-computer programs.

UNIT- V: Curve Fitting and Approximation of Functions: Least square approximation fitting of non-linear curves by least squares – regression analysis – multiple linear regression, nonlinear regression – computer programs.

Text Books:

1. Numerical Methods for Engineers/ Steven C.Chapra, Raymond P.Canale/ Tata Ma-Graw Hill
2. Applied numerical analysis / Curtis F.Gerald, partick.O.Wheatly /Addison-wesley, 1989

Reference Books:

1. Numerical methods / Douglas J.Faires, Riched Burden / Brooks-cole publishing company, 1998 Second edition
2. Numerical mathematics and computing/ Ward cheney& David Kincaid / Brooks-cole publishing company 1999 fourth edition
3. Mathematical methods for physics and engineering / Riley K.F.M.P.Hobson& Bence S.J./ Cambridge university press,1999

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year I Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">DATABASE MANAGEMENT SYSTEM</td><td>OEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">Any programming language.</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. provide a sound introduction to Database management systems, Databases and its applications
2. familiarize the participant to give a good formal foundation on the relational model of data
3. present SQL and procedural interfaces to SQL comprehensively
4. give an introduction to systematic database design approaches conceptual design, logical design, schema refinement and physical design
5. introduce the concepts of transactions and transaction are processing and the issues and techniques relating to concurrency and recovery manager

Course Outcomes: At the end of this course, students will be able to

1. design Entity-Relationship Model for enterprise level databases
2. develop the database and provide restricted access to different users of database and formulate the Complex SQL queries.
3. analyze various Relational Formal Query Languages and various Normal forms to carry out Schema refinement
4. use suitable Indices and Hashing mechanisms for real time implementation
5. analyze various concurrency control protocols and working principles of recovery algorithms

UNIT-I: Database System Applications, database system VS file system- view of data- data abstraction – instances and schemas – data models – the ER Model – Relational model – other models – Database languages – DDL – DML – database Access for applications programs – database users and administrator – transaction management – database system structure – storage manager – the query processor – history of database systems – database design and ER diagrams – Beyond ER design entities of ER model – concept design with the ER model – conceptual design for large enterprises.

UNIT-II: Relational Model: introduction to the relational model–integrity constraint overrelations – enforcing integrity constraints – querying relational data – logical database design – introduction to views – destroying / altering tables and views.

Relational Algebra and Calculus : relational algebra–selection and projection setoperations – renaming – joins – division – examples of algebra overviews – relational calculus – tuple relational calculus – domain relational calculus – expressive power of algebra and calculus.

UNIT–III: Form of basic SQL Query – examples of basic SQL Queries – introduction to nested queries – correlated nested queries set – comparison operators – Aggressive operators -Null values – comparison using null values – logical connectivity's – AND, OR and NOTR – impact on SQL constructs – Outer joins – disallowing NULL values – complex integrity constraints in SQL Triggers and Active Database. Schema refinement – problems caused by redundancy – decompositions – problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join decomposition – Dependency preserving Decomposition – Schema refinement in database design – Multi valued dependencies – forth Normal Form.

UNIT-IV: Overview of Transaction Management: ACID properties–Transactionsand schedules – concurrent execution of transaction – lock based concurrency control – performance locking – transaction support in SQL – Introduction to crash recovery.

Concurrency Control: Serializability and recoverability–introduction to lock management – lock conversions dealing with dead locks – specialized locking techniques concurrency without locking.

Crash Recovery: introduction to ARIES–the log–other recovery related structures–thewrite-Ahead Log Protocol – check pointing – recovering form a system crash – media recovery – other approaches and interaction with concurrency control.

UNIT-V: Overview of Storage and Indexing : data on external storage–Fileorganization and indexing – cluster indexing, primary and secondary indexes – index data structures – hash based indexing tree base indexing –comparison of file organizations – indexes and performance Tuning.

Storage data: Disks and Files: the Memory Hierarchy–redundant Arrays of independent–Disks – disk space management – buffer manager – files of records – page formats – record formats.

Tree structure Indexing: introduction for tree indexes–indexed sequential access methods

(ISAM)-B+ Tress: A dynamic Index structure.

Hash based Indexing: Static Hashing–extendable hashing–Linear Hashing–Extandablevs Linear hashing.

Text Books:

1. Database Management Systems/ Raghurama Krishnan, Johannes Gehrke/ TATA McGraw hills 3rd Edition
2. Database systems Concepts/ Silberschatz, Korth/ McGraw hill, IV Edition

Reference Books:

1. Database Management Systems/ P.Radha Krishna/ Hi-TECH Publications 2005
2. Introduction to Database Management Systems / C.J.Date/ Pearson Education
3. Database Systems design, Implemantation and Management/ Rob & Coronel/ 5th Edition, Thomson
4. Database Management Systems/ Elmasri Navrate/ Pearson Education
5. Database Management Systems /Mathew Leon, Leon Vikas
6. Database Systems / Connoley/ Pearson Education

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">PEDAGOGY STUDIES</td><td>Audit Course</td></tr>
<tr><td rowspan="3">Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Prerequisite: Research Methodology and Teaching Learning Methods.

Course Objectives: Students will be able to:

1. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Syllabus:

Units Content Hours:

1. **Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questionsand Overview of methodology and Searching.
   Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education
2. **Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage:** quality assessment of included studies
   - How can teacher education (curriculum and practicum) and the schoolcurriculum and guidance materials best support effective pedagogy?
   - Theory of change, Strength and nature of the body of evidence for effective pedagogicalpractices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies

3. **Professional development:** alignment with classroom practices and follow-up support
    - Peer support
    - Support from the head teacher and the community
    - Curriculum and assessment
    - Barriers to learning: limited resources and large class sizes
4. **Research gaps and future directions:**
    - Research design
    - Contexts
5. **Model Curriculum of Engineering & Technology PG Courses [Volume-I] [46]**
    - Pedagogy
    - Teacher education
    - Curriculum and assessment
    - Dissemination and research impact

Suggested Reading:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>PCC/PEC/OEC</td></tr>
<tr><td></td><td colspan="6">COMPUTER AIDED TESTING, ANALYSIS AND MODELLING LAB.</td><td>PCC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2">--</td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">2</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td></td><td colspan="7">Course Objectives: The objectives of this Lab. are to:
1. study the microstructure of ferrous and non-ferrous metals
2. conduct heat treatment studies on carbon steels
3. impart knowledge on modelling
4. familiarize in using software packages for various analysis of structures
5. appraise in using software packages for various composite structures

Course Outcomes: At the end of this Lab. students will be able to:
1. analyze the microstructure of ferrous and non-ferrous metals
2. evaluate the effect of heat treatment on carbon steels
3. draft, model and assemble the components
4. apply software packages for various analysis of structures
5. utilize software packages for the analysis of various composite structures</td></tr>
</table>

TESTING

1. Preparation and study of the Micro Structure of ferrous metals and alloys
2. Preparation and study of the Microstructure of nonferrous metals and alloys
3. Effect of tempering time on the hardness of quenched carbon steels
4. Effect of tempering temperature on the hardness of a hardened carbon steels
5. Preparation of metallic specimens by electro polishing
6. Study of work hardening characteristics of a pure metal
7. Determination of carbon percentage in the given ferrous specimen

MODELING

1. Surface modeling
2. Solid modeling
3. Drafting
4. Assembling

ANALYSIS OF STRUCTURES USING FEA PACKAGES

1. Static Analysis
2. Modal Analysis
3. Harmonic Analysis
4. Spectrum Analysis
5. Buckling Analysis
6. Analysis of Composites
7. Fracture mechanics
8. Transient analysis

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

Course Code	Course Title						Open Electives to be offered to other Departments
	INDUSTRIAL SAFETY						OEC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives: The objectives of this course are to:

1. impart knowledge of different aspects of engineering safety
2. focus on tools, techniques and methodologies need for prevention of accidents
3. discuss advantages and applications of corrosion prevention methods
4. know the importance of fault tracing methods
5. study preventive and periodic maintenance of mechanical and electrical components

Course Outcomes: At the end of this course, students will be able to:

1. identify the basic safety terms
2. recognize types and applications of tools used for maintenance
3. prevent corrosion and wear by various methods
4. explain the concepts of fault tracing and its importance
5. describe the advantages and applications of preventive and periodic maintenance of mechanical and electrical components

UNIT-I:

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods

UNIT-II:

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment

UNIT-III:

Wear and Corrosion and Their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

UNIT-IV:

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes

UNIT-V:

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services
2. Maintenance Engineering, H. P. Garg, S. Chand and Company

Reference Books:

1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman& Hall London

ANURAG UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

Course Code	Course Title						Open Electives to be offered to other Departments
	OPERATIONS RESEARCH						OEC
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives: The objectives of this course are to:

1. understand linear programming models in practical applications
2. familiarize the transportation problems by using different methods
3. learn the Johnson method for processing of jobs and machines and replacement policy concepts in industry
4. know the concepts of game theory and inventory control techniques to classify inventory items
5. acquaint with the concepts of queuing methods and simulation tools for optimization

Course Outcomes: At the end of this course, students will be able to:

1. solve linear programming and simplex method problems in real time applications
2. adapt the assignment method for optimum resource allocation and transportation method with optimum transportation cost for industry applications
3. analyze sequencing and replacement models and apply them for optimization
4. apply game theory for optimal decision making and inventory models to optimize the cost
1. formulate different real life probabilistic situations using Monte Carlo simulation technique and apply queuing theory concepts in industry

UNIT–I:

Introduction to Operations Research –Linear Programming - Mathematical Formulation – Graphical method –Simplex method, Duality. Sequencing Models: Problem with N jobs and 2 machines –n jobs and 3 machines problem

UNIT-II:

Game Theory: Competitive games -Useful terminology -Rules for game theory -Two person zero sum game –Property of dominance -Graphic solution –Algebraic method

Queuing Models: Poisson arrivals and Exponential service times –Single channel models and Multi-channel models. **Inventory Control:** Necessity for maintaining inventory -Inventory costs-Inventory models with deterministic demand -inventory models with probabilistic demand

UNIT-III:

Project Management: Introduction -Phases of project management-Construction of Network diagrams-Critical path method (CPM) and Project evaluation and review technique (PERT)

Simulation: Basic concepts, Advantages and disadvantages -Random number generation -Monte Carlo Simulation applied to queuing problems

UNIT-IV:

Dynamic Programming: Multistage decision process, principles of optimality, application of dynamic programming, examples

Optimization Techniques: Introduction to optimization techniques. Non – linear programming problem: Kuhn – Tucker conditions with min cost flow and max cost flow problems

UNIT-V:

Linear Programming: Sensitivity analysis – change in the constraints, cost coefficients, coefficients of the constraints. Parametric Programming

Geometric Programming, Flow in Networks, Elementary Graph Theory1

Text books:

1. Kanti Swarup, P K Gupta, Man Mohan, Operations Research, Sultan Chand &Sons, 2014
2. Sharma J K -Operations Research, Pearson

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall of India 2010

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SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Machine Design) I Year II Semester

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Open Electives to be offered to other Departments</td></tr>
<tr><td></td><td colspan="6">COMPOSITE MATERIALS</td><td>OEC</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Contact Hours Per Week</td><td>CIE</td><td>SEE</td><td>Credits</td></tr>
<tr><td rowspan="2"></td><td>L</td><td>T</td><td>D</td><td>P</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Course Objectives: The objectives of this course are to:

1. introduce the concept of composite materials and classify composite materials
2. familiarize the functional requirements of reinforcement and matrix
3. elaborate the mechanical behavior of composites
4. give exposure to manufacturing of composites
5. extend the knowledge of laminate strength and laminate failure

Course Outcomes: At the end of this course, students will be able to:

1. apply the concept of composite materials and classify composite materials
2. describe the functional requirements of reinforcement and matrix
3. analyze the mechanical behavior of composites
4. implement failure criteria to various composites
5. relate laminar strength to laminate strength

UNIT–I:

Introduction: Definition – Classification and characteristics of Composite materials, Advantages and application of composites, Functional requirements of reinforcement and matrix, Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance

UNIT–II:

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions

UNIT–III:

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications

UNIT–IV:

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications

UNIT–V:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight

strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin
2. Composite Materials – K.K.Chawla
3. Composite Materials Science and Applications – Deborah D.L. Chung
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W

Department of Mechanical Engineering
Courses for B. Tech. Honors in Additive Manufacturing under R20 Regulations

Sl. No.	Code	Course Title	Semester	Hours per week			Credits
				L	T	P	
1		3D Printing - Machines, Tooling & Systems	IV	3	-	-	3
2		Materials and applications of 3D printing	V	3	-	-	3
3		Relevant course from NPTEL	VI or VII	2	-	-	2
4		Relevant course from NPTEL	VI or VII	2	-	-	2
5		Additive Manufacturing Lab.	VI or VII	-	-	4	2
6		Project Work	VI or VII	-	-	-	6
Total							**18**

Courses for B. Tech. Minor in 3D Printing under R20 Regulations

Sl. No.	Code	Course Title	Semester	Hours per week			Credits
				L	T	P	
1		Fundamentals of CAD	IV	3	-	-	3
2		3D Printing - Machines, Tooling & Systems	V	3	-	-	3
3		Relevant course from NPTEL	VI or VII	3	-	-	3
4		Relevant course from NPTEL	VI or VII	3	-	-	3
5		Relevant course from NPTEL	VI or VII	3	-	-	3
6		Computer Aided Drafting Lab.	VI or VII	-	-	3	1.5
7		3D-Printing Lab.	VI or VII	-	-	3	1.5
Total							**18**

ITEM 4

PRESENTATION OF THE AMENDMENTS TO THE PhD RULES & REGULATIONS BY DEAN, R&D

Amendments to AU-Ph.D. Rules and Regulations

The following Amendments to the Ph.D. Rules and Regulations of Anurag University is proposed for approval of the Academic Council:

Amendment 1: Inclusion of one external member in to Departmental Research Committee (DRC) from reputed educational institutions / industry nominated by Hon. Vice-Chancellor. The DRC is responsible for monitoring the Research Progress of the Scholar (The Composition of DRC is 4 to 5 internal members and one external member).

In anticipation of the approval of the Academic Council, the Vice-Chancellor has accorded approval to constitute Departmental Research Committees (DRCs) for PhD in the following departments. The same is placed before the Academic Council for its approval.

Department of Chemical Engineering

S. No	**Name of the Faculty**	**Designation**	**DRC**
1	Prof. M. Mukunda Vani	Prof & HoD, Chairperson BoS	Chairperson & Convenor
2	Dr. N. Anil	Associate Professor	Internal Member
3	Dr. M. B. Venkata Ramana Reddy	Assistant Professor	Internal Member
4	Dr. T. Vijaya Kumar	Assistant Professor	Internal Member
5	Prof V.V Basava Rao	Head, Department of Chemical Engg., College of Tech., Osmania University, profbasavarao_1964@yahoo.com, 9989156705.	External Member

Department of Civil Engineering

S. No	**Name of the Faculty**	**Designation**	**DRC**
1	Dr. K. Ramachandra Reddy	Professor and Chairperson BoS	Chairperson
2	Dr. B. Narender	Associate Professor and HoD	Convenor
3	Dr. P. Pradeep Kumar	Associate Professor	Internal Member
4	Dr. K. Madhusudan Reddy	Associate Professor	Internal Member
5	Dr K J N Sai Nitesh	Assistant Professor	Internal Member
6	Prof.P Rajasekhar	Professor, Dept. of Civil Engg, College of Engg, Osmania University	External Member

Department of Computer Science and Engineering

S. No	Name of the Faculty	Designation	DRC
1	Dr. V Vijaya Kumar	Professor & Chairperson BoS	Chairperson
2	Dr. G Vishnu Murthy	Professor &HoD	Convenor
3	Dr. Sandeep Singh Rawat	Professor - CSE	Internal Member
4	Dr. M Sridevi	Associate Professor - CSE	Internal Member
5	Dr. A Mallikarjuna Reddy	Associate Professor - CSE	Internal Member
6	Dr. K. Shyamala	Professor Department of CSE, Osmania University	External Member

Department of Electronics and Communication Engineering

S.No	Name of the Faculty	Designation	DRC
1	Dr. K.S. Rao	Professor, Director & Chairperson BoS	Chairperson
2	Dr. S. Sathees Kumaran	Professor & HoD	Convenor
3	Dr. M.Santhosh	Associate Professor	Internal Member
4	Dr. T. Rajesh	Associate Professor	Internal Member
5	Dr. K. Hari Priya	Associate Professor	Internal Member
6	Dr. P. Chandra Sekhar	Professor, Department of Electronics and Communication Engineering, Osmania University, Hyderabad, Mail id: sekharpaidimarry@gmail.com, Tel:- No: 9866695963	External Member

Department of Electrical and Electronics Engineering

S.No	Name of the Faculty	Designation	DRC
1	Dr. PVN Prasad	Professor, Chairperson BoS	Chairperson
2	Dr. T. Anil Kumar	HoD, Associate Professor	Convener
3	Dr. D. Mohan Reddy	Professor	Internal Member
4	Dr. G. Venu Madhav	Associate Professor	Internal Member
5	Dr. C. Nagamani	Assistant Professor	Internal Member
6	Dr. E.Vidya Sagar	Associate Professor, Dept. of Electrical Engg., Osmania University, Hyderabad, Mail id:evsueou@gmail.com Tel:-9985256268	External Member

Department of Information Technology

S. No	Name of the Faculty	Designation	DRC
1	Dr. Sudheer Reddy K.	Professor, Head , Chairperson - BoS	Chairperson & Convener
2	Prof. P.V.Kumar	Professor	Internal Member
3	Dr. A. Prasanth Rao	Professor	Internal Member
4	Dr. D. Lakshmi Padmaja	Associate Professor	Internal Member
5	Dr. PV Sudha	Professor, Dept. of CSE, Osmania University, Hyderabad, Mail id:- sudha392623@yahoo.com, Tel:-942754480	External Member

Department of Mechanical Engineering

S.No.	Name of the Faculty	Designation	DRC
1	Dr A. V. Sitarama Raju	Professor & Chairman, BoS	Chairperson
2	Dr.S. Madhu	Professor & HoD	Convenor
3	Dr. R. Venkat Reddy	Professor	Internal Member
4	Dr. P Ravikanth Raju	Associate Professor	Internal Member
5	Dr. Md. Sikindar Baba	Associate Professor	Internal Member
6	Dr. Sriram Venkatesh	Professor, Department of Mechanical Engineering, Osmania University, Hyderabad, Mail id: venkatmech@yahoo.com, Tel:- 9440408333	External Member

School of Pharmacy

S. No	Name of the Faculty	Designation	DRC
1	Dr. Vasudha Bakshi	Professor, HoD& Dean, Chairperson BoS	Chairperson & Convenor
2	Dr. G. Kiran	Professor	Internal Member
3	Dr. A. Padmanabha Rao	Associate Professor	Internal Member
4	Dr. A. Madhubabu	Associate Professor	Internal Member
5	Dr Chandaiah Godugu	Associate Professor, NIPER, mail id: chandra.niperhyd@gov.in, Tel:- 9553331860	External Member

School of Management

S.No	Name of the faculty	Designation	DRC
1	Dr. G.Sabitha	Associate Professor, Chairman -BoS, Convener - Career Guidance Cell	Chairperson
2	Dr.V.Vishnu Vandana	Asso. Professor&HoD; Coordinator - Entrepreneurship Development Cell	Convenor
3	Dr. K. Mamatha	Professor, TPO	Internal Member
4	Dr.Syed Mansoor Pasha	Assistant Professor	Internal Member
5	Dr.C. Mallesha	Assistant Professor	Internal Member
6	Dr. .K.G. Chandrika	Professor, Dept. of Business Management, Osmania University,	External Member

Department of Mathematics

S.No	Name of the Faculty	Designation	DRC
1	Dr.V.Srinivasa Rao	Professor, Chairperson BoS	Chairperson
2	Dr.K.Shiva Reddy	Professor, HoD	Convenor
3	Dr.Y.Dharmendar Reddy	Associate Professor	Internal Member
4	Dr.G.Ranjith Kumar	Associate Professor	Internal Member
5	Dr.P.Mangathai	Associate Professor	Internal Member
6	Dr.B.Surender Reddy	Professor, Dept. of Mathematics, Osmania University, Hyderabad,	External Member

Department of Physics

S.No	Name of the Faculty	Designation	DRC
1	Dr. M.Srinivasa Reddy	Professor, HoD & chairman BoS	Chairperson & Convenor
2	Prof. M.Mutha Reddy	Professor, Dean Exams	Internal Member
3	Dr. R.V. Sudheer Kumar	Associate Professor	Internal Member
4	Dr.Y.Vijay Kumar (Expected To Join By 20.01.2021)	Assistant Professor	Internal Member
5	Prof. Maqbool Ahmed	Professor Department of Physics, Hyderabad Central University	External Member

Department of Chemistry

S. No	Name of the Faculty	Designation	DRC
1	Dr. Savita Belwal	Professor & HoD	Chairperson & Convenor
2	Dr. Tejaswi Jella	Assistant Professor	Internal Member
3	Dr. A. Ravi	Assistant Professor	Internal Member
4	Dr. M. Vijjulatha	Professor, Department of Chemistry, Osmania University, Hyderabad, Mail id:- vijjulathamanga@gmail.com Tel:-9866845408	External Member

Department of English

S.No	Name of the Faculty	Designation	DRC
1	Dr G V S Ananta Lakshmi	Professor & HoD, Chairperson BoS	Chairperson & Convenor
2	Dr V S V Laxmi Ramana	Professor	Internal Member
3	Dr M Srinivas Rao	Associate Professor	Internal Member
4	Dr V Padma	Associate Professor	Internal Member
5	Dr C.Muralikrishna	Professor, Department of English, Osmania University, Hyderabad, Mail id:- cmkrishn17@yahoo.co.in Tel:-9848249285	External Member

Amendment 2: Inclusion of Research Paper Writing Process (RPWP) Course in place of Research Methodology course (100 Marks-4-credits) as Recommended by Hon.Chancellor sir. RPWP is a Common course to all the candidates admitted for Ph.D. program. The aim of RPWP course is that the scholar is to learn the essentials of Research Methodology by doing literature survey / experiments / simulations etc., and then writing a paper related to his/her area of research. The scholar need to present two seminars before DRC, and the scholar will be evaluated by the DRC based on the two seminar presentations. The research scholar shall secure a minimum of 50% marks to pass this course.

ITEM 5

APPOINTMENTS DONE

(FOR INFORMATION)

Item 5: Appointments Done

The following appointments have been made, which is placed for information of the Academic Council.

1. Dr. P.V.N Prasad, Professor, Dept. of EEE has been appointed as the Dean, Academic & Planning vide Order dated 08.10.2020.
2. Dr. A. V. Sita Rama Raju, Professor, Dept. of Mechanical Engineering has been appointed as the Director, Internal Quality Assurance Cell (IQAC) vide Order dated 26.03.2020
3. Dr. N. Venkata Ramana, Advisor to team Universal India Private Limited has been appointed as the Co-supervisor of Shri. Ramanujam IVR, who has been admitted into the PhD program in the Dept. of Civil Engineering in the Academic Year 2020-21 vide Order dated 08.04.2021.

ITEM 6

REDISTRIBUTION OF TOTAL CREDITS AND CREDIT ALLOCATION FOR 'COMPREHENSIVE VIVA-VOCE' AND 'TECHNICAL PAPER WRITING' IN M.TECH PROGRAM

Item 6: Redistribution of total credits and credit allocation for 'Comprehensive Viva-Voce' and 'Technical Paper Writing' in M.Tech Program.

1. The 'Comprehensive Viva-Voce' and 'Technical Paper Writing' courses may be included in the scheme of M.Tech.
2. The total no. of credits may be reduced from 88 (25, 25, 14, 24) to 68 (21, 21, 12, 14).
3. The total no. of credits for the above two & Project Review I in III Sem. and Project Review II in IV Sem. may be distributed from 38 to 26.

ITEM 7

ANY OTHER MATTER WITH THE PERMISSION OF THE CHAIR