M.Tech (MACHINE DESIGN)

FOR
MASTER OF TECHNOLOGY TWO YEAR POST GRADUATE COURSE
(Applicable for the batches admitted from 2018-2019)

ANURAG GROUP OF INSTITUTIONS
(AUTONOMOUS)
Venkatapur, Ghatkesar, Hyderabad – 500 088
Applicable for the students of M. Tech. (Regular) programme from the Academic Year 2018-19 and onwards

The M.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M.Tech. DEGREE

2.1 A student shall be declared eligible for the award of the M.Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years, failing which he shall forfeit his seat in M.Tech. programme.

2.2 The student shall register for all 88 credits and secure all the 88 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 COURSES OF STUDY

The following specializations are offered at present for the M.Tech. programme of study.

1. CAD/CAM
2. Computer Networks and Information Security
3. Computer Science
4. Computer Science and Engineering
5. Construction Management
6. Electrical Power Systems
7. Electronics and Communication Engineering
8. Embedded Systems
9. Machine Design
10. Power Electronics and Electrical Drives
11. Software Engineering
12. Structural Engineering
13. VLSI System Design
14. Wireless and Mobile communication
4 Course Registration

4.1 A ‘Faculty Advisor or Counselor’ shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 Academic Section of the College invites ‘Registration Forms’ from students with in 15 days from the commencement of class work through ‘ON-LINE SUBMISSIONS’, ensuring ‘DATE and TIME Stamping’. The ON-LINE Registration Requests for any ‘CURRENT SEMESTER’ shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the ‘PRECEDING SEMESTER’.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the ‘WRITTEN APPROVAL’ from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5 ATTENDANCE

The programmes are offered on a unit basis with each subject being considered a unit.

5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the End Semester examination. A student shall not be permitted to appear for the Semester End Examinations (SEE) if attendance is less than 75%.

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below75%) in each semester shall be granted by the College Academic Committee on genuine medical grounds and valid reasons on representation by the candidate with supporting evidence.

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.
5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end semester examination of that subject and their registration shall stand cancelled.

5.5 A prescribed fees hall be payable towards condonation of shortage of attendance.

5.6 A candidate shall get minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

5.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present Semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission in to the same class.

6 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of Internal Evaluation and End Semester Examination.

6.1 For the theory subjects 75 marks shall be awarded for the performance in the Semester End Examination and 25 marks shall be awarded for Continuous Internal Evaluation (CIE). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other, immediately after the completion of Semester instructions. Each mid-term examination shall be conducted for a total duration of 120 minutes with Part A as compulsory question (10 marks) consisting of 5 sub-questions carrying 2 marks each, and Part B with 3 questions to be answered out of 5 questions, each question carrying 5 marks.

There shall be an optional third midterm examination during the preparation cum external practical examinations period subject to the following.

i. Interested students have to register for the third mid examination by paying prescribed registration fee.

ii. Third midterm examination covers entire semester syllabus carrying 25 marks. The average of best two midterm examinations shall be taken as the final marks secured by each candidate. If he/she is absent for any test, he/she shall be awarded zero marks for that test.
The details of the Question Paper pattern for End Examination (Theory) are given below:

- The Semester End Examination will be conducted for 75 marks. It consists of two parts. i) Part-A for 25 marks, ii) Part-B for 50 marks.

- Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 5 marks each.

- Part-B to be answered 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.

6.1 For practical subjects, 75 marks shall be awarded for performance in the Semester End Examinations and 25 marks shall be awarded for day-to-day performance as Internal Marks.

6.2 The practical end semester examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Chairman, Board of Studies in respective Branches.

6.3 There shall be two seminar presentations during I year I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

6.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce is intended to assess the students’ understanding of various subjects he has studied during the M.Tech. course of study. The Head of the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consisting of Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Principal from the panel of 3 examiners recommended by Chairman, Board of Studies in respective Branches. There are no internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

6.5 Technical Paper Writing shall cover concepts of abstract, introduction, material and methods, conclusion, references, acknowledgement etc of advanced topics in a branch of Engineering through the medium of attending seminars/ referring to peer reviewed journals, which will enhance the skill of writing technical reports. The students shall not be required to give oral presentation of technical paper. The report shall be presented as a printed document for evaluation. Evaluation shall be made solely by the teacher, but may be moderated by committees appointed by the Head of the Department.
6.6 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

6.7 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 6.6) he has to reappear for the Semester End Examination in that subject.

6.8 A candidate shall be given one chance to re-register for the subjects if the internal marks secured by a candidate is less than 50% and failed in that subject for maximum of two subjects and should register within four weeks of commencement of the class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate’s attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stands cancelled.

6.9 In case the candidate secures less than the required attendance in any subject, he shall not be permitted to write the Semester End Examination in that subject. He shall re-register for the subject when next offered.

7 Examinations and Assessment - The Grading System

7.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

7.2 As a measure of the student’s performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

<table>
<thead>
<tr>
<th>% of Marks Secured (Class Intervals)</th>
<th>Letter Grade (UGC Guidelines)</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% and above</td>
<td>O (Outstanding)</td>
<td>10</td>
</tr>
<tr>
<td>( ≥ 90%, ≤ 100% )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 90% but not less than 80%</td>
<td>A+ (Excellent)</td>
<td>9</td>
</tr>
<tr>
<td>( ≥ 80%, &lt; 90% )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 80% but not less than 70%</td>
<td>A (Very Good)</td>
<td>8</td>
</tr>
<tr>
<td>( ≥ 70%, &lt; 80% )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 70% but not less than 60%</td>
<td>B+ (Good)</td>
<td>7</td>
</tr>
<tr>
<td>( ≥ 60%, &lt; 70% )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 60% but not less than 50%</td>
<td>B (Above Average)</td>
<td>6</td>
</tr>
<tr>
<td>( ≥ 50%, &lt; 60% )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(≥ 50%, &lt; 60%)</td>
<td>Below 50% ( &lt; 50% )</td>
<td>F (Fail)</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Absent</td>
<td>Ab</td>
<td>0</td>
</tr>
</tbody>
</table>

7.3 A student obtaining F Grade in any Subject shall be considered ‘failed’ and is be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

7.4 A student not appeared for examination then ‘Ab’ Grade will be allocated in any Subject shall be considered ‘failed’ and will be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

7.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of ‘Grade Improvement’ or ‘SGPA/ CGPA Improvement’.

7.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

**Credit Points (CP) = Grade Point (GP) x Credits .... For a Course**

7.8 The Student passes the Subject/ Course only when he gets GP≥6 (B Grade or above).

7.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

\[
SGPA = \left( \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \right) \quad \text{For each Semester,}
\]

where ‘i’ is the Subject indicator index (takes into account all Subjects in a Semester), ‘N’ is the no. of Subjects ‘REGISTERED’ for the Semester (as specifically required and listed under the Course Structure of the parent Department), C is the no. of Credits allotted to the ith Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

7.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered
Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

\[ \text{CGPA} = \left( \frac{\sum_{j=1}^{M} C_j G_j}{\sum_{j=1}^{M} C_j} \right) \ldots \text{for all S Semesters registered} \]

(ie., upto and inclusive of S Semesters, \( S \geq 2 \)),

where ‘M’ is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has ‘REGISTERED’ from the 1st Semester onwards up to and inclusive of the Semester S (obviously \( M > N \)), ‘j’ is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C is the no. of Credits allotted to the jth Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11 For Calculations listed in Item 7.6 – 7.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations.

8. **EVALUATION OF PROJECT/DISSERTATION WORK**

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M.Tech. Programme.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the II year and the
duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

8.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

8.8 For Project work Review I in II Year I Sem. there is an internal marks of 100, the evaluation should be done by the PRC for 50 marks and Supervisor will evaluate for 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Work Review I. If he fails to fulfill minimum marks, he has to reappear as per the recommendations of the PRC.

8.9 For Project work Review II in II Year II Sem. there is an internal marks of 100, the evaluation should be done by the PRC for 50 marks and Supervisor will evaluate for 50 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Work Review II. If he fails to fulfill minimum marks, he has to reappear as per the recommendations of the PRC.

8.10 After approval from the PRC, a soft copy of the thesis should be submitted for ANTI-PLAGIARISM check and the plagiarism report should be submitted to the examination branch and be included in the final thesis. The thesis will be accepted for submission, if the similarity index is less than 30%. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to TWO. The candidate has to register for the project work and work for two semesters. After attempts, the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of thesis before submissions.

8.11 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College, after submission of a research paper related to the project work in a UGC approved journal. A copy of the submitted research paper shall be attached to thesis.

8.12 For Project Evaluation (Viva Voce) in II Year II Sem. there is an external mark of 100 and the same evaluated by the External examiner appointed by the Institution. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.13 If he fails to fulfill as specified in 8.12, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill, he will not be eligible for the award of the degree.

8.14 The thesis shall be adjudicated by one examiner selected by the Institution. For this, Chairmen, BOS of the respective departments shall submit a panel of 3
examiners, who are eminent in that field with the help of the concerned guide and senior faculty of the department.

8.15 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

8.16 If the report of the examiner is favourable, Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.

8.17 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva-Voce examination.

9. **AWARD OF DEGREE AND CLASS**

9.1 A Student who registers for all the specified Subjects/Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of Credits 88 (with CGPA ≥ 6.0), shall be declared to have ‘QUALIFIED’ for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 **Award of Class**

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M.Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

<table>
<thead>
<tr>
<th>Class Awarded</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>≥ 7.75</td>
</tr>
<tr>
<td>First Class</td>
<td>6.75 ≤ CGPA &lt; 7.75</td>
</tr>
<tr>
<td>Second Class</td>
<td>6.00 ≤ CGPA &lt; 6.75</td>
</tr>
</tbody>
</table>

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10. **WITHHOLDING OF RESULTS**

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

11. **TRANSITORY REGULATIONS**

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of two earlier or equivalent subjects at a time as and when offered.

11.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R18 Academic
12  **GENERAL**

12.1 **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

12.2 **Credit Point:** It is the product of grade point and number of credits for a course.

12.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”.

12.4 The academic regulation should be read as a whole for the purpose of any interpretation.

12.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the Decision of the Academic Council is final.

12.6 The Academic Council may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Academic Council.
<table>
<thead>
<tr>
<th>Nature of Malpractices/Improper conduct</th>
<th>Punishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the candidate:</td>
<td></td>
</tr>
<tr>
<td>1. (a) Possesses or keeps accessible in the examination hall, any paper, note books, programmable calculators, cell phones, pager, palm, computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only</td>
</tr>
<tr>
<td>(b) Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.</td>
</tr>
<tr>
<td>2. Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidates has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the candidate is to be cancelled and sent to the controller of examinations, AGI.</td>
</tr>
<tr>
<td>3. Impersonates any other candidate in connection with the examination.</td>
<td>The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination(including practical’s and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.</td>
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</tr>
<tr>
<td>4. <strong>Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.</strong></td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidates has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</td>
</tr>
<tr>
<td>5. <strong>Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.</strong></td>
<td>Cancellation of the performance in that subject.</td>
</tr>
<tr>
<td>6. <strong>Refuses to obey the orders of the Chief Superintendent/Assistant-Superintendent/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any office relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.</strong></td>
<td>In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subjects and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders. They will be handed over to the police and a police case is registered against them.</td>
</tr>
<tr>
<td>7. <strong>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</strong></td>
<td>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidates has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester examinations. The continuation of the course by the candidate is subject to the academic</td>
</tr>
<tr>
<td></td>
<td>Posses any lethal weapon or firearm in the examination hall.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8.</td>
<td>If student of the college, who is not a candidate for the particular examination or any person not connected with college indulges in any malpractice or improper conduct mentioned in clause 6 to 8</td>
</tr>
<tr>
<td>9.</td>
<td>Comes in a drunken condition to the examination hall.</td>
</tr>
<tr>
<td>10.</td>
<td>Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.</td>
</tr>
<tr>
<td>11.</td>
<td>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Malpractices committee, AGI for further action to award suitable punishment.</td>
</tr>
</tbody>
</table>
## ANURAG GROUP OF INSTITUTIONS
(AUTONOMOUS)

M.Tech (MACHINE DESIGN)

### COURSE STRUCTURE

### I YEAR I SEMESTER

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Title</th>
<th>Int. marks</th>
<th>Ext. marks</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A31001</td>
<td>Computer Aided Geometric Modeling for Design</td>
<td>25</td>
<td>75</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>A31002</td>
<td>Mechanical Behavior of Engineering Materials</td>
<td>25</td>
<td>75</td>
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### I YEAR II SEMESTER

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ANURAG GROUP OF INSTITUTIONS
M.Tech I Year – I Sem. (Machine Design)

COMPUTER AIDED GEOMETRIC MODELING FOR DESIGN (PC- 1)

UNIT- I:
CAD Tools: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software.


UNIT- II:
Geometric modelling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spline curve, NURBS, Curve manipulations.

UNIT- III:
Surface Modeling: Classification of surface entities, Surface representation methods, Parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, Parametric representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spline surface, Coon surface, Blending surface, Surface manipulations.

UNIT- IV:

UNIT- V:
Transformations: 2-D and 3-D transformations: translation, scaling, rotation, reflection, concatenation, homogeneous coordinates, Perspective projection, orthotropic projection, Hidden surface removal, shading, rendering.

CAD/ CAM Data Exchange: Evaluation of data exchange format, Data exchange formats: IGES, PDES, CGM, STEP Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), Least material condition (LMC), Regardless of feature size (RFS).

REFERENCES:
1. CAD/CAM Concepts and Applications/ Alavala/ PHI.
3. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
4. CAD/CAM /Groover M.P./ Pearson education
5. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
6. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
ANURAG GROUP OF INSTITUTIONS  
M.Tech I Year – I Sem. (Machine Design)  

MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS (PC-2)

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  
**Fatigue:** definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, Fatigue of Welded structures: Factors effecting the fatigue lives of welded joints. Mean stress R ratio, strain and load control. S-N curves. Goodman’s rule and Miners rule. Micro mechanisms of fatigue damage, fatigue limits and initiation and propagation control leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT-V  
REFERENCES:
1. Mechanical Metallurgy / Dieter / McGraw Hill
4. Plasticity for structural Engineers / W.F. Chen and D.J., Ha,
9. Elements of Fracture Mechanics/Prasanth Kumar/TMH
UNIT - I
Shear Centre: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections.
Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending.

UNIT - II

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 Uniform Strength, Rotating Cylinders.

UNIT - IV
Theory of Plates: Introduction; Stress resultants in a flat plate; Kinematics: Strain-Displacement relations 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 load 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 a solution 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.
REFERENCES:
1. Advanced Mechanics of materials/Seely and Smith/ John Willey
2. Advanced Mechanics of materials / Boresi & Sidebottom/wiely international
3. Advanced strength of materials / Den Hortog J.P./Torrent
4. Theory of Plates /Timoshenko/
5. Strength of materials / Sadhu singh/ Khanna Publishers
7. Theory of Plates & Shells / Timoshenko/ McGraw Hill/ 2\textsuperscript{nd} Edition
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.

REFERENCES:
   Addison/Wesley / NewYork..
4. Optimization for Engineering Design Algorithms and Examples/ Kalyanamoy Deb/Prentice Flail of India.
VIBRATION ANALYSIS OF MECHANICAL SYSTEMS (PE- 1)

UNIT-I
SINGLE AND TWO DEGREE FREEDOM SYSTEMS: Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, Principal modes-undamped and damped free and forced vibrations; undamped vibration absorbers.

UNIT-II

UNIT-III

UNIT-IV

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.

REFERENCES:
1. Mechanical Vibrations/Groover/Nem Chand and Bros
2. Elements of Vibration Analysis by Meirovitch, TMH, 2001
5. Mechanical Vibrations/Debabrata Nag/Wiley
7. Mechanical Vibrations and sound engineering/ A.G.Ambekar/ PHI
ANURAG GROUP OF INSTITUTIONS
M.Tech I Year – I Sem. (Machine Design)

MECHANICS OF METAL FORMING (PE- 1)

UNIT I:
FUNDAMENTALS OF METAL FORMING: Classification of forming processes, mechanism of metal forming, temperature of metal working, hot working, cold working, friction and lubricants.
Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations.

UNIT II:
FORGING: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging.
Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes.

UNIT III:
DRAWING: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing.
Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.

UNIT IV:
ADVANCED METAL FORMING PROCESSES: HERF, Electromagnetic forming, residual stresses, in-process heat treatment, computer applications in metal forming.
Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

UNIT V:
JIGS AND FIXTURE DESIGN: Principles of location, six-point location principle, clamping elements and methods.

REFERENCES:
2. Principles of Metal Working / Sunder Kumar
3. Principles of Metal Working processes / G.W. Rowe
4. ASM Metal Forming Hand book.
UNIT – I

UNIT – II
MICROMECHANICS: Unidirectional composites, constituent materials and properties, elastic properties 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, man layup, pultrusion, RTM.

UNIT – III

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.
REFERENCES:

UNIT I:

UNIT II:
MACHINING PROCESS: Overview of various machining processes - 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: Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances - use of solidification simulation in casting design - product design rules for sand casting.

UNIT III:

UNIT-IV
ASSEMBLE ADVANTAGES: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.
AUTOMATIC ASSEMBLY TRANSFER SYSTEMS: Continuous 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 guidelines 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 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 combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.
REFERENCES:
4. Computer Aided Assembly London/ A Delbainbre/.
UNIT- I
Introduction: Introduction to Prototyping, Traditional Prototyping Vs Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC and other related technologies, Classification of RP, Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3D View, etc., Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT,STEP.

UNIT-II
RP Processes:
  c) Extrusion Based RP Processes: Fused Deposition Modelling (FDM), Principles, Plotting and path control, Applications of Extrusion-Based Processes
  d) Printing RP Processes: 3D printing (3DP), Research achievements in printing deposition, Technical challenges in printing, Printing process modeling, Application of Printing Process
  e) Sheet Lamination RP Processes: Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications
  f) Beam Deposition RP Processes: Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Processing-structure-properties, relationships, Benefits and drawbacks.

UNIT-III
Rapid tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods

UNIT-IV
Reverse engineering: Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development
UNIT-V
Errors in RP processes and applications: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc., Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP

REFERENCES:
6 T.S.Srivatsan, T.S.Sudharshan, CRC Press 2015
List of Open Electives Offered by Various Departments, Effective from AY 2018-19

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<th>S. No</th>
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CIVIL ENGINEERING
M.Tech I Year – I Sem.

OPEN ELECTIVE – I

COMPUTATIONAL METHODS IN ENGINEERING

UNIT-I:

UNIT-II:
OPTIMIZATION: One dimensional unconstrained optimization, multidimensional unconstrained 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:

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, non linear regression – computer programs.
REFERENCES:
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
UNIT - I
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II

UNIT - III
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony. Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT - IV
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

UNIT - V
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA. Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

TEXT BOOKS

REFERENCE BOOKS
ELECTRICAL AND ELECTRONICS ENGINEERING
RENEWABLE ENERGY SYSTEMS
(Open Elective - I)

Course Objectives:
- To recognize the awareness of energy conservation in students
- To identify the use of renewable energy sources for electrical power generation
- To collect different energy storage methods
- To detect about environmental effects of energy conversion

Course Outcomes:
- Upon the completion of this course, the student will be able to
  - find different renewable energy sources to produce electrical power
  - estimate the use of conventional energy sources to produce electrical energy role-play
  - the fact that the conventional energy resources are depleted
  - arrange Store energy and to avoid the environmental pollution

Unit-I:
Photo voltaic power generation, spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

Unit-II:
Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology.
Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

Unit-III:
Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.
Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

Unit-IV:
Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.
Global energy position and environmental effects: energy units, global energy position.
Unit-V:
Types of fuel cells, \( \text{H}_2-\text{O}_2 \) Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures steam stations and pollution, pollution free energy systems.

TEXT BOOKS:

REFERENCES:
ELECTRICAL INSTALLATION & SAFETY
(Open Elective - I)

Course Objectives:
- The course should enable the students to:
- Understand Electrical Wiring with IE rules. Residential Building Electrification, Electrification of commercial Installation, Electrification of factory unit Installation
- Protection against electric shocks, Safety Measures & Prevention of Accidents

Course Outcomes:
- The students will be able to:
- Acquire the knowledge of different types wires and wiring systems, I.E. rules and Electric supply act.
- Explain the importance of earthling, rating of wires & cables, procedures for residential, commercial electrification.
- Able to estimate the length of wire, cable, conduit, earth wire, and earthing and also cost of residential, commercial electrification.

Unit-I: Electrical Wiring with IE rules.
Introduction, Define types of wires; Different types of wiring system; Comparison of different types of wiring; Different types and specifications of wiring materials; Accessories and wiring tools; Prepare I.E. rules for wiring, including Electricity supply act 2003 & 2005;

Unit-II: Residential Building Electrification
General rules guidelines for wiring of Residential Installation and positioning of equipment’s; Principles of circuit design in lighting and power circuits.; Procedures for designing the circuits and deciding the number of circuits.; Method of drawing single line diagram.; Selection of type of wiring and rating of wires & cables.; Load calculations and selection of size of conductor.; Selection of rating of main switch, distributions board, protective switchgear ELCB and MCB and wiring accessories.; Earthing of Residential Installation.

Unit-III: Electrification of commercial Installation
Concept of commercial Installation.; Differentiate between electrification of Residential and commercial Installation.; Fundamental considerations for planning of an electrical Installation system for commercial building.; Design considerations of electrical Installation system for commercial building.; Load calculations & selection of size of service connection and nature of supply.; Deciding the size of cables, bus bar and bus bar chambers.; Mounting arrangements and positioning of switch boards, distribution boards main switch etc.; Earthing of the electrical Installation; Selection of type wire, wiring system & layout.

Unit-IV: Electrification of factory unit Installation
Concept of Industrial load; Concept of Motor wiring circuit and single line diagram. Important guidelines about power wiring and Motor wiring.; Design consideration of Electrical Installation in small Industry/Factory/workshop.; Motor current calculations.;
Selection and rating of wire, cable size conduct.; Deciding fuse rating, starter, distribution boards main switch etc.; Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing.

**Unit-V: Protection against electric shocks**
Electric shock- General, Protection against direct contact, Protection against indirect contact, Protection of goods in case of insulation fault, Implementation of the TT system, Implementation of the TN system, Implementation of the IT system. Protection provided for enclosed equipment: codes IP and IK, IP code definition, Elements of the IP Code and their meanings, IK Code definition, IP and IK code specifications for distribution switchboards

**Safety Measures & Prevention of Accidents**- Concept of electrical safety, electrical accidents, its causes & preventions.; Safety signs and symbols used in industry.; Electrical shocks and factors affecting the severity of it, method of rescuing electrocuted person & different methods of artificial respiration.; Electrical safety as per I.E. Rules 1956.; Do's & don’ts regarding safety while working on electrical installations.; Concept of Permit system, its preparation & regulation for attending to electrical work.; Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers, types of fire extinguishers.

**TEXT BOOKS:**

- c) Electrical estimating & costing 2nd addition By Surjit singh
MECHANICAL ENGINEERING

COMPUTER ORIENTED NUMERICAL METHODS

(Open Elective – 1)

Unit - I:


UNIT - II:


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 Rectangular Plates.

UNIT – IV:


UNIT – V:


TEXT BOOKS:

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.
4  C Language and Numerical methods by C. Xavier – New age international publisher.
5  Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers, New Delhi.
Course Objective:
This course is aimed to generate interest and awareness in cyber security field, which is important in the world of information security due to the wide variety of computer crimes that take place in cyber space. The course deals with various types of attacks framed by an attacker, and the security which need to be implemented at various levels along with latest trends in cyber security.

UNIT-I:

UNIT-II:

UNIT-III:

UNIT-IV:
UNIT-V:

TEXT BOOKS:
2. Cyber Security ,Understanding Cyber crimes, Computer Forensics and Legal Perspectives, Sunita Belapure and Nina Godbole, Wiley India Pvt Ltd. 2011

REFERENCES:
UNIT-I
DATA BASE MANAGEMENT SYSTEM


UNIT-II
RELATIONAL MODEL: introduction to the relational model – integrity constraint over relations – enforcing integrity constraints – querying relational data – logical database design – introduction to views – destroying / altering tables and views.


UNIT – III

UNIT-IV
UNIT-V


Tree structure Indexing: introduction for tree indexes – indexed sequential access methods (ISAM)-B+ Trees: A dynamic Index structure.

Hash based Indexing: Static Hashing – extendable hashing – Linear Hashing – Extandable vs Linear hashing.

REFERENCES:
4. Introduction to Database Management Systems / C.J.Date/ Pearson Education
6. Database Management Systems/ Elmasri Navrate/ Pearson Education.
7. Database Management Systems /Mathew Leon, Leon Vikas/
8. Database Systems / Connoley/ Pearson Education
LIST OF 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 spring mass system.


4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.

5. Study the lateral vibrations of beam for different damping.

6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors.

7. Direct Kinematic analysis of a robot.

8. Inverse Kinematic analysis of a robot.

9. Trajectory planning of a robot in joint space scheme.

ANURAG GROUP OF INSTITUTIONS
M. Tech I Year – II Sem. (Machine Design)

ENGINEERING DESIGN (PC - 4)

UNIT - I
DESIGN PHILOSOPHY: Design process, Problem formation, Introduction to product design, Various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections, Notches and stress concentration, design for safety and Reliability

UNIT – II
Embodiment & Modelling: introduction, size and strength, scheme drawing, form design, provisional materials and process determination, design for assembly and manufacture, industrial design, principles. Mathematical modelling, optimization, scale models, simulation, principles.

UNIT - III

UNIT - IV
Failure Theories: Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr’s theory, Modified Mohr’s theory, Fracture mechanics theory., Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep: Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles, Fatigue failure theories ,cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation

UNIT - V
Surface Failures: Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength, Problem formulation for design optimization

Detail design: introduction, factor of safety, selection procedure for bought out components, Robust design, principles

REFERENCES:
2. Engineering design principles/ Ken hurst/ Elsevier
5. Engineering by design/ Gerard Voland/ pearson
7. Mechanical design/ Manjula B Waldron, Kenneth J. Waldron/ springer international edition
UNIT - I:
Introduction to FEM, basic concepts, historical background, 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:
1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions, and problems.
Analysis of Trusses: Plane Trusses and Space Truss elements and problems

UNIT - III:

UNIT - IV:

UNIT - V:

REFERENCES:
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice Hall
7. Finite Element Method – Krishna Murthy / TMH
8. Finite Element Analysis – Bathe / PHI
UNIT – I
ADVANCED KINEMATICS OF PLANE MOTION- I: Introduction to plane motion. The Inflection circle, Euler – Savary Equation, Analytical and graphical determination of d, 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, Polode curvature 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’s collineation –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 body through 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

UNIT – V

REFERENCES:
UNIT - I:
Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint 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, Work cell controller. **Robot Applications:** Material transfer, Machine loading/unloading, Processing operations, Assembly and Inspection, Future Applications.
REFERENCE BOOKS:

1. Introduction to Robotics Mechanics & Control/ John J. Craig/ Pearson
2. Industrial robotics / Mikell P. Groover / McGraw Hill.
4. Robot Technology Fundamentals, James G. Keramas, CENGAGE
6. Robot Analysis/ Lung Wen Tsai / John Wiley & Sons
9. Robotics by saha/ TMG
10. Robotic Engineering/ Richard D. Klafter, Thomas A. Chmielewski/ PHI
UNIT - I
Introduction: Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and customer – behavior analysis

UNIT - II
Concept generation and concept selection: Activity of concept generation – Structured approaches

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

UNIT – V
REFERENCE BOOKS:

UNIT - I
Fuzzy Set Theory and Fuzzy Logic Control:
Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control-
Fuzzification – Defuzzificatiuon- Knowledge base- Decision making logic- Membership functions –
Rule base.
UNIT - II
Adaptive Fuzzy Systems:
Performance index- Modification of rule base0- Modification of membership functions-
Simultaneous modification of rule base and membership functions- Genetic algorithms-
Adaptive fuzzy system-Neuro fuzzy systems.
UNIT - III
Artificial Neural Networks:
Introduction- History of neural networks- multilayer perceptions- Back propagation
algorithm and its Variants- Different types of learning, examples.
UNIT - IV
Mapping and Recurrent Net works:
Counter propagation –Self organization Map- Congnitron and Neocognitron- Hopfield
Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning
UNIT - V
Case Studies:
Application of fuzzy logic and neural networks to Measurement- Control- Adaptive
Neural Controllers – Signal Processing and Image Processing

TEXT BOOK:
1. Vallum B.R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB
   Publications, New Delhi, 1996

REFERENCE BOOKS:
1. Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
3. Fuzzy sets Fuzzy logic, Klor, G. J anfd Yuan B.B Prentice Hall oif India Pvt. Ltd.,
   New Delhi
4. Neural Networks and Fuzzy systems, Kosko. Prentice hall of India Pvt. Ltd., New
   Delhi 1994
5. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reifrank M.,
   Narosa Publications House, New Delhi 1996
6. Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New
   Delhi 1994
UNIT - I:
**Fundamentals of Experimentation:** Role of experimentation in rapid scientific progress, historical perspective of experimental approaches, Steps in experimentation, principles of experimentation

UNIT - II:
**Simple comparative experiments:** Basic concepts of probability & statistics, comparison of two means and two variances, comparison of multiple (more than two) means and ANOVA

UNIT - III:
**Experimental designs:** Factorial designs, fractional factorial designs, orthogonal arrays, standard orthogonal 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, regression.

UNIT - V:
**Taguchi’s Parameter Design:** Concept of robustness, noise factor, objective function & S/N ratios, inner array & outer array design, data analysis

**REFERENCE BOOKS:**
UNIT - I:
**Introduction:** Definition, Principles, significance of SHM, potential applications in civil, naval, aerospace & manufacturing Engineering

UNIT - II:
**Operational Evaluation:** Sensor technology, piezoelectric wafer active sensors, data acquisition and cleaning procedures, elastic waves in solid structures, guided waves

UNIT - III:
**Feature Extraction methods:** Identifying damage sensitive properties, signal processing, Fourier and short term Fourier transform, wavelet analysis

UNIT - IV:
**Pattern Recognition:** State-of-Art damage identification and pattern reorganization methods, neural networks, Feature extraction algorithms

UNIT - V:
**Case studies:** SHM based flaw detection in mechanical structures- Integrity and damage recognition in plates and pipes, defect identification in weld joints, Wear monitoring in cutting tools

**REFERENCE BOOKS:**

UNIT - I:

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, 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 complaint 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.

**REFERENCE:**
3. Vehicle stability/ Dean Karnopp/ Dekker Mechanical Engineering
6. Fundamental of Vehicle Dynamics/ Gillespie/ T.D, SAE USA.
List of Open Electives Offered by Various Departments, Effective from AY 2018 - 19

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of the Department</th>
<th>Open Elective (S) Offered for Other Departments</th>
<th>Subject Code</th>
</tr>
</thead>
</table>
| 1.    | Civil Engineering (Open Elective – II) | 1. Finite Element Method  
2. Advanced Optimization Techniques and Applications                                      | A32050 A32010   |
| 2.    | Electronics and Communication Engineering (Open Elective-II) | 1. Industrial Instrumentation  
2. Principles of Computer Communications and Networks  
3. Signal Analysis and Condition Monitoring                                 | A32051 A32052 A32011 |
| 3.    | Electrical and Electronics Engineering (Open Elective – II) | 1. Energy From Waste  
2. Distributed Generation and Microgrid  
3. Reliability Engineering                                                    | A32053 A32054 A32055 |
| 4.    | Mechanical Engineering (Open Elective – II) | Engineering Research Methodology                                                              | A32056          |
| 5.    | Computer Science and Engineering (Open Elective – II) | Machine Learning                                                                              | A32057          |
CIVIL ENGINEERING
FINITE ELEMENT METHOD
(Open Elective – II)

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

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

UNIT - IV

UNIT - V
Introduction to non – linear finite analysis – basic methods – application to Special structures.
TEXT BOOKS:
1. A First Course in a Finite Element by Daryl L. Logan, CL Engineers.

REFERENCES:
1. Introduction to Finite element Method by Tirupathi Chandra Patla and Belugunudu
2. Finite element Methods by O.C. Zienkiewicz
3. Finite element analysis, theory and programing by GS Krishna Murthy.
4. Introduction to Finite element Method by JN Reddy
UNIT I

UNIT II

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

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.

REFERENCES:
1. Optimization theory & Applications/ S.S Rao/ New Age International
2. Introductory to operation research/Kasan & Kumar/Springar
4. Operation Research/H.A. Taha/TMH
5. Optimization in operations research/R.L Rardin
6. Optimization Techniques/Benegro & Chandraputla/Person Asia
UNIT – I

METROLOGY, VELOCITY AND ACCELERATION MEASUREMENT:

UNIT – II

FORCE AND PRESSURE MEASUREMENT: Force measurement – Different methods – Gyroscopic

UNIT – III

FLOW MEASUREMENT AND LEVEL MEASUREMENT: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type, vertex shedding type, Hotwire anemometer type, Laser Doppler Velocity-meter. Basic Level measurements – Direct, Indirect, Pressure, Buoyancy, Weight, Capacitive Probe methods

UNIT – IV


UNIT – V

TEXT BOOKS:


REFERENCES:

Prerequisite: Nil

Course Objectives:
- To understand the concept of computer communication.
- To learn about the networking concept, layered protocols.
- To understand various communications concepts.
- To get the knowledge of various networking equipment.

Course Outcomes: The student:
- Can get the knowledge of networking of computers, data transmission between computers.
- Will have the exposure about the various communication concepts.
- Will get awareness about the structure and equipment of computer network structures.

UNIT – I


UNIT – II


UNIT – III

Analog and Digital Communication Concepts: Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction , Digital Carrier Systems.

UNIT – IV

Physical and data link layer Concepts: The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer , the logical link control and medium access control sub-layers.

UNIT – V

Network Hardware Components: Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.
TEXT BOOKS:

REFERENCE BOOKS:
UNIT-I

UNIT-II

UNIT-III

UNIT-IV
**PRACTICAL ANALYSIS OF TRANSIENTS**: Analysis as a periodic signal. Analysis by repeated playback (constant bandwidth). Analysis by repeated playback (variable bandwidth).

UNIT-V

REFERENCES:
4. Theory of Machines and Mechanisms/ Amitabh Ghosh & AK Malik/ EWP
Prerequisite: Renewable Energy Sources, Physics, Environmental Studies

Course Objectives:
- To classify solid waste sources
- To identify methods of solid waste disposal
- To study various energy generation methods
- To analyse biogas production methods and recycling of e-waste

Course Outcomes: Upon the completion of the subject, the student will be able to
- Understand technologies for generation of energy from solid waste
- Compare methods of solid waste disposal
- Identify sources of energy from bio-chemical conversion
- Analyze methods for management of e-waste

UNIT - I

UNIT – II
Land Fill method of Solid waste disposal Land fill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, Movement and control of landfill leach ate and gases, Environmental monitoring system for land fill gases.

UNIT – III

UNIT – IV
Biogas production, Land fill gas generation and utilization, Thermo-chemical conversion: Sources of energy generation, Gasification of waste using Gasifiers, Briquetting, Utilization and advantages of briquetting, Environmental benefits of Bio-chemical and Thermo-chemical conversion.

TEXT BOOKS:

REFERENCES:
5. AD Bhide, BB Sundaresan, Solid Waste Management in Developing Countries, INSDOC, New Delhi,1983
ELECTRICAL AND ELECTRONICS ENGINEERING
DISTRIBUTED GENERATION AND MICROGRID
(Open Elective – II)

Course Objectives

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Micro grid and its configuration
- To find optimal size, placement and control aspects of DGs

Course Outcomes: Upon the Completion of the course student will be able to

- Find the size and optimal placement DG
- Analyze the impact of grid integration and control aspects of DGs
- Model and analyze a micro grid taking into consideration the planning and operational issues of the DGs to be connected in the system.
- Describe the technical impacts of DGs in power systems

UNIT – I

Need for distributed generation - Renewable sources in distributed generation - Current scenario in distributed generation - Planning of DGs – Siting and sizing of DGs – Optimal placement of DG sources in distribution systems.

UNIT – II

Grid integration of DGs – Different types of interfaces - Inverter based DGs and rotating machine based interfaces - Aggregation of multiple DG units - Energy storage elements - Batteries, ultracapacitors, flywheels.

UNIT – III


UNIT-IV


UNIT – V

TEXT BOOKS:

ELECTRICAL AND ELECTRONICS ENGINEERING
RELIABILITY ENGINEERING
(Open Elective – II)

Course Objectives:

- To comprehend the concept of Reliability and Unreliability
- Derive the expressions for probability of failure, Expected value and standard deviation of Binomial distribution, Poisson distribution, normal distribution and weibull distributions.
- Formulating expressions for Reliability analysis of series-parallel and Non-series parallel systems
- Deriving expressions for Time dependent and Limiting State Probabilities using Markov models.

Course Outcomes: Upon the completion of this course, the student will be able to

- Apply fundamental knowledge of Reliability to modeling and analysis of series-parallel and Non-series parallel systems.
- Solve some practical problems related with Generation, Transmission and Utilization of Electrical Energy.
- Understand or become aware of various failures, causes of failures and remedies for failures in practical systems.

UNIT – I


UNIT – II


UNIT – III

Classification of engineering systems: series, parallel and series-parallel systems- Expressions for the reliability of the basic configurations. Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cutsets from Event tree.
UNIT – IV


UNIT – V

Approximate system Reliability analysis of Series systems, parallel systems with two and more than two components, Network reduction techniques. Minimal cutset/failure mode approach.

TEXT BOOKS:

REFERENCES:
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


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: Chisquare, student’s t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT – V

REFERENCES:
1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004
5. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
Prerequisites:
- Data Structures
- Knowledge on statistical methods

Course Objectives:
- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes:
- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

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 Tree Learning.

UNIT – II

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, Gibbs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm.


**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 the Hypothesis.

TEXT BOOKS:
1. Machine Learning – Tom M. Mitchell, MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biiing – Hwang Juang.

REFERENCE BOOK:
LIST OF EXPERIMENTS

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) Buckling Analysis.
4) Analysis of Composites.
5) Transient analysis