PROGRAM STRUCTURE

AND

DETAILED SYLLABUS

R20 REGULATIONS

M.Tech (POWER ELECTRONICS AND ELECTRICAL DRIVES)

FOR

MASTER OF TECHNOLOGY TWO YEAR POST GRADUATE COURSE

(Applicable for the batches admitted from 2020-2021)

ANURAG UNIVERSITY

Venkatapur, Ghatkesar, Hyderabad-500088.

www.anurag.edu.in

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Academic Regulations for M.Tech.(Regular) with effect from the Academic Year 2020-21.

1. Eligibility for Admissions

1. Admission to the M.Tech. program shall be made subject to eligibility, qualification and specialization as prescribed by the Anurag University (AU) from time to time.
2. 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 prescribed by the Telangana State Private Universities Act (Establishment and Regulations) No.11 of2018.

2. Courses of Study

The following specializations are offered for the M.Tech program of study:

1. Computer Science and Engineering
2. Electrical Power Systems
3. Embedded Systems
4. Machine Design
5. Power Electronics and Electrical Drives
6. Structural Engineering
7. VLSI System Design

3. Course Registration

3.1 Every student is required to be present and register online at the commencement of each semester on the day fixed for and notified in the academic calendar. The students will choose the courses for registration in consultation with the Faculty Advisor. The students may also consult the Head of the Department / Dean of the School.

3.2 The registration will be organized departmentally under the supervision of the Head of the Department in coordination with Faculty Advisor.

3.3 A student, who does not register on the day announced, may be permitted to register, in consideration of any compelling reason, within the first week. Similarly, a student may be permitted to change the registration for a course within the first week only in consultation with respective faculty advisor. No late registration/change of registration shall be permitted after the first week

from the scheduled date.

3.4 Only those students will be permitted to register who have: (a) cleared all University and Hostel dues of the previous semesters (b) paid all required fees for the current semester, and (c) not been debarred from registering for a specified period on disciplinary action or any other ground.

3.5 A candidate shall be given one chance to re-register and attend the classes for a maximum of two courses, if the CIE marks secured by a candidate are less than 50% and failed in those subjects but fulfilled the attendance requirement. A candidate must re-register for failed courses within four weeks of commencement of the class work and secure the required minimum attendance to appear for SEE. In the event of the student taking this chance, his CIE marks and SEE marks obtained in the previous attempt stand cancelled.

3.6 Dropping of courses: Within four weeks after the commencement of the semester, the student may, in consultation with the faculty advisor, drop one or more courses. The dropped courses shall be registered in the subsequent semesters as and when it is offered.

4. Attendance

4.1 Attendance in all classes (lectures/tutorials, laboratories etc.) is compulsory. A student will not be permitted to appear in the semester end examination on grounds of unsatisfactory attendance. Minimum required attendance in each theory / laboratory course is 75% (including the days of attendance in sports, games, and NCC and NSS activities) for appearing in the semester end examination. Students are advised to monitor the status of their attendance in the online system from time to time. Absence without obtaining sanction of leave will be considered as an act of indiscipline.

4.2 Condonation of shortage of attendance in each course up to 10% (65% and above and below 75%) in each semester shall be granted on genuine medical grounds and valid reasons on representation by the candidate with supporting documentary evidence.

4.3 Shortage of attendance below 65% in each course shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any course are not

eligible to appear for their semester end examination of that course and their registration shall stand cancelled.

4.5 However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Vice-Chancellor may condone the deficiency in attendance to the extent of 15% (as against 10% condonation for others) on medical grounds subject to submission of medical certificate to this effect. Such condonation shall be availed only twice during the program of study.

4.6 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.7 A candidate shall get minimum required attendance at least in three (3) theory courses in the present semester to get promoted to the next semester.

4.8 Promotion Rules:

4.8.1 A student shall be promoted from I Year to II Year only if he/she fulfills the academic requirements of securing 50% of average credits up to I Year II Semester, from all the examinations, whether or not the candidate takes the examinations.

4.8.2 A student shall register and put up required attendance in all 88 credits and earn all 88 credits for the award of degree.

4.8.3 Students, who fail to earn 88 credits as indicated in the course structure within four academic years from the year of their admission, shall forfeit their admission.

4.9 When a student is detained due to shortage of attendance in any semester, no grade allotments or SGPA/CGPA calculations will be done for that entire semester in which he/she got detained.

4.10 When a student is detained due to lack of credits in any year, he / she may be readmitted after fulfillment of the academic requirements, with the academic regulations of the batch into which he / she gets readmitted.

4.11 For readmitted candidates, if there are any professional electives / open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the set of elective courses offered under that category.

5. Assessment of Academic Performance

5.1 The performance of a student in a semester shall be evaluated course-wise for a maximum of 100 marks in each theory and practical course. In addition, Seminars, Comprehensive Viva-Voce, Technical Paper writing, Project Work Reviews and Project Work shall be evaluated for 100 marks each. The distribution of marks for Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) along with the minimum pass percentage shall be as follows:

Course	Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	Minimum Requirements to	academic Pass a Course
			*Minimum Pass Percentage (SEE)	*Minimum Pass Percentage (CIE+SEE)
Theory	40	60	40	50
Laboratory / Practicals	50	50	40	50
Seminars	100	0	-	50
Comprehensive Viva-Voce	-	100	50	**50**
Technical Paper Writing	100	-	-	50
Project Reviews	100	-	-	50

*Provided a relaxation of 10% of maximum marks shall be given to physically challenged students.

5.2 Each theory course in a semester is evaluated for 100 marks, with the following weightages:

5.2.1 Continuous Internal Evaluation(CIE)

The CIE for Theory Courses has the following three components, comprising of 40 marks:

a. Midterm Examinations for 20marks
b. Quizzes for 10marks
c. Assignment / Seminars / Projects / Group Activities for10 marks
d. Mid-term Examinations

There shall be two midterm examinations of 20 marks each. The average of the two examinations shall be taken as the marks secured by each candidate. Each midterm examination shall be conducted for the duration of 90 minutes and the question paper consists of Part-A (Short Answers for 5 marks) consists of 5 questions carrying 1 mark each, and Part-B (Long Answers for 15 marks) containing 5 questions of which student has to answer 3 questions; each question carrying 5 marks.

The First midterm examination shall be conducted for 2.5 units of syllabus at the end of 8 weeks of instruction and Second midterm examination shall be conducted for remaining 2.5 units at the end of 16 weeks of instruction.

In case any student has missed one of the two examinations, or wants to improve in one of the examinations, an optional third midterm examination will be conducted. This optional third midterm examination will be conducted during the preparation cum external practical examinations period subject to the following conditions:

1. Interested students have to register for the third mid examination by paying the prescribed registration fee.
2. Third midterm examination covers entire semester syllabus carrying 20marks

a. Quizzes:

There shall be a total of five quizzes of 10 marks each. The quiz is to be conducted at the end of each of the five units of instruction. The average of the five quizzes shall be taken as the final marks secured by each candidate.

5.2.2 Assignment / Seminars / Projects / Group Activities:

The faculty will evaluate the students for 10 marks by conducting any of the following in two phases covering at least two units in each phase: Assignments / Seminars / Projects / Group Activities. This should be completed before the conduct of second mid-term examination.

5.2.3 Semester End Examination

a. The semester end examination will be conducted for 60 marks. The question paper will consist of two parts viz.,i) Part-A for 20marks, ii) Part –B for 40 marks.

b. Part-A is compulsory, which consists of ten questions (numbered from 1 to 10), two questions from each unit carrying 2 marks each.

c. Part-B consists of five questions (numbered from 11 to 15) shall be set by covering one question (may contain sub-questions) from each unit of the syllabus carrying 8 marks each. For each question there will be an“either”“or”choice (that means there will be two questions from each unit and the student shall have to answer any one of them).

5.3 Each laboratory course in a semester is evaluated for 100 marks, with the following weightages:

a. Throughout the semester the student will be evaluated for 50 marks under CIE as follows**:**

i. Preparation for Lab – 10 marks.
ii. Observation – 10 marks.
iii. Completion of Experiment – 5 marks.
iv. Record –5 marks.
v. Skill Test – 20 Marks

Before the end of instruction a Skill Test will be conducted for 20 marks. The practical SEE shall be conducted for 50 marks with an examiner along with the lab faculty. The examiner shall be appointed by the Dean (Examinations) of the University.

5.4 There shall be two seminar presentations during I Year I Semester and I Year II Semester. For each Seminar there will be only internal evaluation of 100 marks. Students shall present a seminar before the faculty members assigned for the purpose.

5.5 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 courses he has studied during the program. Comprehensive viva-voce will be taken by the faculty members assigned for the purpose.

5.6 There shall be a Technical Paper Writing that covers concepts of abstract, introduction, material and methods, conclusion, references, acknowledgement etc. The report shall be presented as a printed document for evaluation. Evaluation shall done by the faculty member assigned for the purpose

5.7 There shall be a project work review I and II in 2nd Year first and second semester respectively. For the Project work Reviews there is an internal marks of 100, the evaluation should be done by the Project Review Committee (PRC) for 50 marks and Supervisor will evaluate for 50 marks.

5.8 A candidate shall be given one chance to re-register for the courses if the internal marks secured by a candidate is less than 50% and failed in that course for maximum of two times. In the event of the student taking another chance, his / her CIE and SEE marks obtained in the previous attempt stands cancelled.

5.9 If there is a complaint in awarding the CIE marks, the University shall nominate a committee to look into the matter.

5.10 Candidates shall be permitted to apply for recounting/revaluation of SEE theory-scripts within the stipulated period with payment of prescribed fee.

5.11 Recounting: The totaling of the marks awarded shall be verified in the answer script and corrected if there is any mistake.

5.12 Revaluation

a) The answer scripts of the candidate who applied for revaluation are evaluated by two subject experts independently other than the original evaluator.

b) If the difference of marks between these two valuations is 15% or more, it will be sent for third valuation to another subject expert.

c) Nearest of two valuations out of three will be considered and the average of these two will be taken as the final marks obtained.

d) If the difference of the final marks and original marks after revaluation is 15% or more of maximum marks, then the revaluation marks are considered for declaring the result.

e) If the revaluation marks are less than the original marks, the original marks are retained and there is no change in the result.

5.13 Challenge Valuation:

The candidates who have applied for revaluation and are not satisfied with the result are only eligible to apply for challenge valuation by paying the prescribed fee in the form of DD payable to the Registrar, AU.

a) On receipt of the DD, a photocopy of the answer booklet shall be given to the student.

b) The paper will be evaluated in the presence of the student by a senior faculty member appointed by the University.

c) If there is any change in the marks >= 15% of the maximum marks, the new marks will be awarded to the student. Otherwise, there will be no change in original secured marks.

d) If the change in marks (equal or above 15% of the maximum marks) occurs, the amount paid towards challenge valuation will be refunded.Otherwise, the student will forfeit the total amount which he/she has paid.

6. The Grading System

6.1 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:

% of Marks Secured (Class Intervals)	Letter Grade (as per UGC Guidelines)	Grade Points
90% and above (≥ 90%, ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80%, < 90%)	**A**$^{+}$(Excellent)	9
Below 80% but not less than 70% (≥ 70%, < 80%)	**A** (Very Good)	8
Below 70% but not less than 60% (≥ 60%, < 70%)	**B**$^{+}$(Good)	7
Below 60% but not less than 50% (≥ 50%, < 60%)	**B** (Above Average)	6
Below 50% (< 50%)	F (Fail)	0
Absent	Ab	0

6.2 In general, a student shall not be permitted to repeat any course(s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA improvement'.

6.3 The 'Credit Points' (CP) for a course, is computed by multiplying the Grade Point with Credits for that particular course.

Credit Points (CP) = Grade Point (GP) x Credits

6.4 The Student passes the course only when he/she gets GP ≥ 6 (B Grade or above).

6.5 The Semester Grade Point Average (SGPA) is calculated as follows

$$SGPA = \frac{\{\sum_{i=1}^{N} C_i G_i\}}{\{\sum_{i=1}^{N} C_i\}}$$

where 'i' is the course indicator index (takes into account all courses in a semester), 'N' is the no. of courses 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 course, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that course.

6.6 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 calculated as follows:

$$CGPA = \frac{\{\sum_{j=1}^{M} C_j G_j\}}{\{\sum_{j=1}^{M} C_j\}}$$

Where 'M' is the total no. of courses (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 course indicator index (takes into account all courses from 1 to S Semesters), C is the no. of credits allotted to the j^{th} course, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th} course. 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.

6.7 For CGPA and SGPA calculations performance in failed courses (securing F Grade) will also be taken into account, and the Credits of such courses will also be included in the multiplications and summations.

7. Passing Standards

7.1 A student shall be declared successful or 'passed' in a Semester, only when he/she gets a SGPA ≥ 6.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he/she gets a CGPA ≥ 6.00; subject to the condition that he/she secures a GP ≥ 6 (B Grade or above) in every registered course in each Semester.

7.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, No. of credits, grade earned etc.), credits earned, SGPA and CGPA.

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 Chairman, Project Supervisor and two senior faculty members.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, 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/she 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 University.

8.8 After approval from the PRC, a soft copy of the thesis should be submitted for 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 two attempts, the admission is liable to be cancelled.

8.9 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.

8.10 If he/she fails to fulfill the condition as specified in 8.9, he/she shall reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill the above said condition, he/she will not be eligible for the award of the degree.

8.11 The thesis shall be adjudicated by one examiner appointed by the Dean-Examinations from the list of panel of examiners approved by the Vice-Chancellor. For this, Chairman, Board of Studies 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.

8.12 If the report of the examiner is unfavorable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

8.13 If the report of the examiner is favorable, 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.

8.14 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 courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Program (PGP), and secures the required number of Credits 88 (with CGPA $\geq$ 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/she admitted.

9.2 Award of Class

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

CGPA	Class	Condition
≥8.00	First Class with Distinction	• Should have passed all the courses in 'first appearance' in a semester examinations and should complete the program in 2 years of time. • 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.
≥6.75 - <8.00	First Class	• The Students who secure CGPA≥8.00 , but not fulfilling above conditions for "First Class with Distinction" shall be awarded "First Class"
≥ 6.00 -< 6.75	Second class	

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/her, the result of the student will be withheld and he/she will not be allowed into the next semester. His/her degree will be withheld in such cases.

11 Transitory Regulations

11.1 Discontinued, detained or failed candidates are eligible for readmission / re-registration as and when offered next as per the University admission procedure.

11.2 The candidate who fails in any course has to complete the same course / equivalent course in the maximum stipulated time as per the Regulations in vogue.

12 Convocation

12.1 The University shall conduct convocation to confer the degree(s).

12.2 The University shall institute Prizes and Awards to meritorious students during convocation.

13 Amendments

The regulations hereunder are subject to amendments as may be made by Academic Council from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program).

ANNEXURE – I: Disciplinary Action against Students – Provisions

A. Student's behavior and discipline will be assessed and will receive the same attention as the academic work. Discipline includes the observance of good conduct and orderly behavior by the students of the University;

B. All students pursuing a Program at the University shall observe code of conduct and maintain discipline and must consider it as a duty to behave decently at all places;

C. Every student shall always carry the Identity card issued by the university. Every student shall have to produce or surrender the identity card, as and when required by the proctorial staff, teaching and library staff and the officials of the university. The loss of the identity card, whenever it occurs, shall immediately be reported in writing to the Registrar.

D. Any violation of the code of conduct or breach of any rules and regulations of the university is construed as an act of indiscipline and shall make him/her liable for disciplinary action;

E. The following acts are treated as gross indiscipline;

   a) Disobeying the teacher/officials or misbehaving in the class;
   b) Quarrelling or fighting in the University campus, hostels amongst themselves, indulging in any activity which amounts to ragging or Harassment of other students;
   c) Quarrelling or fighting with a University employee(s) or any other public utility functionaries in the campus;
   d) Indecent behavior in the University campus or outside causing inconvenience to others;
   e) Visiting socially unacceptable websites, smoking or consuming liquor or banned substances like drugs etc. ;
   f) Damage to the University property;
   g) Indulging in acts of theft, forgery, stealing and misappropriating;
   h) Any other activity that defames the University;
      i. Use of mobile in the class/academic area.
      ii. irregularity in attending classes, persistent idleness, negligence or indifference towards the work assigned;
      iii. Any other conduct which is considered to be unbecoming of a student.

F. Rules for Students Conduct & Behavior in Campus and Outside;

G. The rules and regulations, academic calendar shall be provided to all the students

H. In general, Dean, Student Affairs will deal with the welfare and discipline of all students in the campus including Hostel and also outside the campus and will ensure maintenance of good conduct. He/ She will be assisted by other members of faculty/ staff/ wardens as nominated;

I. Conduct and Behavior:

a) Students should attend all their classes and strictly observe class timings. They should likewise carry out other out-door and extracurricular duties assigned to them. Their attendance and leave is governed by the regulations pertaining to them;

b) Students must give their undivided attention to their academic work and must be respectful to their teachers and supervisors;

c) Students must conduct themselves with due decorum in the classes, laboratories, Library etc. and move in an orderly and disciplined manner in the campus;

d) Students should not indulge in abusive behavior/ violence of any kind with fellow students, teaching faculty and employees of the University within or outside the University. Violence by any student or group of students will lead to severe disciplinary action;

e) No meeting of the students other than those organized under the aegis of the various recognized students' activities shall be called without the prior permission in writing from the Dean, Student Affairs;

f) Neither meetings/functions within the University campus shall be organized nor any outsider address the students without the prior permission in writing from the Registrar;

g) No students shall use unfair means at any of the examinations and tests or attempt or threaten the staff to get undue advantage;

h) Students must pay all fees and other dues on specified dates. If they do not do so, they render themselves liable to penalties as in force from time to time;

i) Students must take good care of all University property. Any damage to University property shall be viewed as indiscipline. Such student(s), in addition to facing the disciplinary action, shall have to replace the damaged property and make good the losses caused due to their action. Students must use the furniture and fittings with due care and must not deface buildings, roads, furniture and fittings etc. in any manner;

j) Students must handle the laboratory equipment, instruments and machinery with great care. Any damage or breakage of such equipment etc., due to improper use are negligent handling will have to be made good by the students concerned;

k) Ragging in any form is unlawful and strictly prohibited. If a student found ragging shall be punished as per the Anti-Ragging Act;

l) The University shall have a zero-tolerance policy towards Ragging and shall lay down strict guidelines on the same as per policies of the UGC in vogue and in compliance to directions of Hon’ble Supreme Court;

m) Mobile cellular phone may be carried by the students. However, they shall be kept in silent mode during the classes. Violation will lead to confiscation of the mobile phone;

n) All the students are required to observe the decorum in the dress code as prescribed by the University. Students not adhering to the prescribed dress code may be denied entry to the University campus;

o) Smoking, consumption/possession of liquor, intoxicants, drugs, cigarettes, hookah etc., inside or outside the Campus is strictly prohibited. Any violation will invoke severe penalty including rustication from the Hostel/ University.

J. Policy to prevent Sexual Harassment:

a) The University shall be committed to treating every employee and student with dignity and respect. It shall seek to create a work environment that is free from sexual harassment of any kind, whether verbal, physical or visual;

b) A policy shall be prescribed by the University to provide guidelines for prompt redressal of complaints related to sexual harassment which should be in full compliance with "The Sexual Harassment of Women at Workplace (Prevention, Prohibition & Redressal)" Act, 2013;

c) All references / complaints and redressal mechanism pertaining to any matter will be handled within the ambit of the said Act and the Rules framed thereunder. The policy so prescribed shall be communicated to all employees and students.

K. Grievance and Redressal Mechanisms:

The University shall constitute various Grievance and Redressal committees and its guidelines as specified by the statutory authorities of the University.

ANNEXURE – II: Malpractices Rules

S.No	Nature of Malpractice Improper conduct during examinations	Punishment
	***If the candidate*:**	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, 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/she 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)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(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.	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/she will be handed over to the police and a case is registered against him/her.
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 disappearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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.
3.	Impersonates any other candidate in connection with the examination.	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 practicals 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 end 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/she will be handed over to the police and a case is registered against him/her.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination. Takes away answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 SEEs. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	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	Cancellation of the performance in that subject.
6	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 inside or outside the examination hall or causing any injury to himself / herself or to any others or threatens 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 others, 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.	They shall be expelled from examination halls and cancellation of their performance in that subject 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 will be registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears the script or any part-thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work & 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.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 and forfeits these at.
9.	Who is not a candidate for the particular examination or any person not connected with the University indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 and forfeits the seat. Person(s) who do not belong to the University will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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.
11.	Found copying,on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the malpractice committee for further action on suitable punishment as per rules.	

ANNEXURE –III: Definitions

In these Regulations, unless the context otherwise requires:

a. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year

b. Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses)

c. Course: Usually referred to, as a 'course' is a component of a program. All courses neednot carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work/outreach activities/ project work/vocational training/viva/seminars/term papers/assignments/ presentations/self- study etc., or a combination of some of these

d. Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students

e. Credit: A unit by which the course work is measured. It determines the numberof 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

f. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale

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

h. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters i.e., O, A+, A, B+, B, C and F

i. Semester Grade Point Average (SGPA): It is a measure of academic performance in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places

j. Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student. The CGPA is the ratio of total credit points secured by a student in all semesters and the sum of the total credits. It shall be expressed up to two decimal places

k. Program: An academic program of the University

l. Semester: Each semester shall consist of 16 weeks of instruction.

m. Transcript or Grade Card or Certificate: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester

n. Types of courses: The courses in a program may be of three kinds: Core, Elective and Foundation

o. Core course: This is the course which is to be compulsorily studied by a student as a core requirement of a program in a branch of study

p. Elective course: This is the course to be chosen from a pool of courses. Elective course may be (a) Supportive to the branch of study (b) Providing an expanded scope (c) Enabling an exposure to some other branch/domain (d) Nurturing student's proficiency/skill

q. Foundation course:This course may be of two kinds, compulsory foundation and elective foundation

r. Compulsory Foundation courses: These are the courses based upon the content that leads to knowledge enhancement. They are mandatory for all disciplines

s. Elective Foundation courses: These are value-based and are aimed at man-making education

t. The academic regulations should be read as a whole for the purpose of any interpretation.

u. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chancellor is final.

ANURAG UNIVERSITY

Venkatapur (V), Ghatkesar (M), Medchal (dist)

COURSE STRUCTURE AND SYLLABUS

M. Tech PEED I Year I Semester

CODE	Category	Course Title	L	T	P	C
A31025	PC-I	Machine Modeling and Analysis	4	0	0	4
A31026	PC-II	Modern Control Theory	4	0	0	4
A31027	PC-III	Power Electronic Converters	4	0	0	4
A31028 A31029 A31030	PE-I	1.SpecialMachines 2.Energy Storage Systems 3.Programmable Logic Controllers and Applications	3	0	0	3
A31031 A31032 A31033	PE-II	1.Dynamics of Electrical Machines 2.Electrical and Hybrid Vehicles 3.Smart GridTechnologies	3	0	0	3
A31034 A31035 A31036 A31037	OE-I	1.Cost Management of Engineering Projects 2.Composite Materials 3.Energy from Waste 4. Introduction to AI & ML	3	0	0	3
A31209	Laboratory-I	Machine Modeling and Analysis Lab	0	0	4	2
A31210		Seminar – I	0	0	3	2
Total			**21**	**0**	**7**	**25**

M. Tech PEED I Year II Semester

CODE	Category	Course Title	L	T	P	C
A32022	PC-IV	Power Electronic Control of Drives	4	0	0	4
A32023	PC-V	Advanced Power Electronic Devices andConverters	4	0	0	4
A32024	PC-VI	Power Electronic Applications toRenewable Energy	4	0	0	4
A32025 A32026 A32027	PE-III	1.Electric Traction Systems 2.PowerQualityAnalysisand Mitigation Techniques 3.Microgrid Technologies	3	0	0	3
A32028 A32029 A32030	PE-IV	1.HVDC & FACTS 2.Switched Mode Power Supplies (SMPS) 3.AI Techniques in Electrical Engineering	3	0	0	3
A32031 A32032 A32033	OE-II	1.Business Analytics 2.Industrial Safety 3.Operations Research	3	0	0	3
A32210	Laboratory-II	Electric Drives & Simulation Lab	0	0	4	2
A32211		Seminar –II	0	0	3	2
Total			**21**	**0**	**7**	**25**

M. Tech PEED II Year ISemester

CODE	Course Title	L	T	P	C
A33207	Technical Paper Writing	0	3	0	2
A33208	Comprehensive Viva-Voce	0	0	0	4
A33209	Project work Review I	0	0	22	8
Total		**0**	**3**	**22**	**14**

M. Tech PEED II Year II Semester

CODE	Course Title	L	T	P	C
A34205	Project work Review II	0	0	24	8
A34206	Project Evaluation (Viva-Voce)	0	0	0	16
Total		**0**	**0**	**24**	**24**

M. Tech – I Year – I Sem. (PEED)

MACHINE MODELLING AND ANALYSIS

(Professional core - I)

Prerequisites: Electrical Machines (DC and AC), Control Theory

Course Objectives:

- To comprehend the basic two-polemachine.
- To identify the methods and assumptions in modeling ofmachines.
- To write voltage and torque equations for differentmachines.
- To recognize the different frames for modeling of different ACmachines.
- To express the voltage and torque equations in State spaceform

Course Outcomes:

- Write the voltage equation and torque equations for different machines like DC machine, induction motor and Synchronousmachines.
- Model different machines using phase and Active transformations.
- Identify the different reference frames for modeling ofmachines.

Unit-I:

Basic Two-pole DC machine - primitive 2-axis machine – Voltage and Current relationship – Torque equation.

Unit-II:

Mathematical model of separately excited DC motor and DC Series motor in state variable form – Transfer function of the motor - Numericalproblems.

Mathematical model of D.C. shunt motor D.C. Compound motor in state variable form – Transfer function of the motor - NumericalProblems

Unit-III:

Liner transformation – Phase transformation (a, b, c to α, β, o) – Active transformation (α .β, o to d, q). Circuit model of a 3 phase Induction motor – Linear transformation - Phase Transformation – Transformation to a Reference frame – Two axis models for induction motor. dq model based DOL starting of InductionMotors.

Unit-IV:

Voltage and current Equations in stator reference frame – equation in Rotor reference frame – equations in a synchronously rotating frame – Torque equation - Equations I state – spaceform.

Unit-V:

Circuits model of a 3ph Synchronous motor – Two axis representation of Syn. Motor. Voltage and current Equations in state – space variable form – Torque equation.

dq model based short circuit fault analysis- emphasis on voltage, frequency and recovery time.

TEXT BOOKS:

1. MatrixAnalysisofelectricalMachinesAsokKumarMukhopadhyay.NewageInternational(p)Ltd 2007.
2. Generalized Machine theory P.S. Bimbhra, Khanna Publishers,2002

REFERENCES BOOKS:

1. Thyristor control of Electric Drives - Vedam Subramanyam, Tata McGraw-Hill Education,1988
2. Power System Stability and Control – Prabha Kundur,EPRI.
3. Analysis of electric machinery and Drive systems- Paul C. Krause , Oleg Wasynezuk, Scott D. Sudhoff, third edition, IEEEpress

M. Tech – I Year – I Sem. (PEED)

MODERN CONTROL THEORY

(Professional core - II)

Prerequisites: Linear control systems

Course Objectives:

- To explain the concepts of basic and modern control system for the real time analysis and design of controlsystems.
- 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 andcategorization.
- To apply the comprehensive knowledge of optimal theory for ControlSystems.

Course Outcomes:

- Understand the concepts of state variableanalysis
- Apply the knowledge of basic and modern control system for the real time analysis and design of controlsystems.
- Analyze the concept of stability of nonlinear systems and optimalcontrol

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'smethod.

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.

TEXT BOOKS:

1. Modern Control System Theory by M.Gopal – New Age International-1984
2. Control System Engineering, Nagrath and Gopal - New Age International – FourthEdition

REFERENCES BOOKS:

1. Modern Control Engineering by Ogata. K – Prentice Hall -1997
2. Advanced Control Theory A. NagoorKani, RBA Publications,1999
3. Optimal control by Kirck ,DoverPublications

M. Tech – I Year – I Sem. (PEED)

POWER ELECTRONIC CONVERTERS

(Professional Core - III)

Prerequisite: Power Electronics

Course Objectives:

- To understand the principle of operation of modern power semiconductordevices.
- To comprehend the concepts of different power converters and theirapplications
- To analyze and design switched mode regulators for various industrialapplications.

Course Outcomes:

- Choose appropriate device for a particular convertertopology.
- Use power electronic simulation packages for analyzing and designing powerconverters.

UNIT-I:

AC VOLTAGE CONTROLLERS

Single phase AC voltage controllers with Resistive, Resistive,inductive and Resistive-inductive-inducede.m.f. loads – ac voltage controllers with PWM Control – Effects of source and load inductances - Synchronous tap changers.

Three phase AC voltage controllers – Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – Applications & Problems.

UNIT-II:

CYCLO-CONVERTERS

Singlephasetosinglephasecyclo-converters–analysisofmidpointandbridgeConfigurations–Three phase to three phase cyclo-converters –analysis of Midpoint and bridge configurations – Limitations – Advantages – Applications & Problems - MatrixConverter.

UNIT-III:

SINGLE PHASE & THREE PHASE CONVERTERS

Single phase converters – Half controlled and Fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – single phase dual converters

– power factor Improvements Techniques– Extinction angle control – symmetrical angle control,PWM –single phase sinusoidal PWM – single phase series converters – overlap analysis – Applications &Problems.

Three phase converters – Half controlled and fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – three phase dual converters

– power factor Improvements Techniques– three phase PWM - twelve pulse converters –Applications – Problems – Design ofconverters.

UNIT-IV:

D.C. TO D.C. CONVERTERS

Analysis of step-down and step-up dc to dc converters with Resistive and Resistive-inductive loads – SwitchedmoderegulatorsAnalysisofBuckRegulators-Boostregulators–buckandboostregulatorsCuk regulators – Condition for continuous inductor current and capacitor voltage – comparison of regulators –Multi output boost converters – advantages – Applications –Problems.

UNIT-V:

PULSE WIDTH MODULATED INVERTERS

Principle of operation – performance parameters – single phase bridge inverter- evaluation of output voltage and current with resistive, inductive and Capacitive loads– Voltage control of single phase inverters – single PWM – Multiple PWM – sinusoidal PWM – modified PWM – phase displacement Control – Advanced modulation techniques for improved performance – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – Advantages – Applications & Problems.

Threephaseinverters–analysisof180degreeconductionforoutputvoltageAndcurrentwithresistive, inductive loads – analysis of 120 degree Conduction – voltage control of three phase inverters – sinusoidal PWM – Third Harmonic PWM – 60 degree PWM – space vector modulation – Comparison of PWM techniques – harmonic reductions –Problems.

TEXT BOOKS:

1. Mohammed H. Rashid “Power Electronics” Pearson Education Third Edition – First Indian reprint2004.
2. Ned Mohan, Tore M. Undeland and William P. Robbins, “Power Electronics” - John Wiley & Sons – SecondEdition.

REFERENCES BOOKS:

1. Milliman Shepherd and Lizang – “Power converters circuits” – Chapter 14 (Matrix converter) PP-415-444,
2. M.H.Rashid - Power electronics hand book–
3. Marian P. Kaźmierkowski, Ramu Krishnan, FredeBlabjerg Edition:” Controlinpower electronics” illustrated Published by Academic Press, 2002.
4. NPTEL online course, Power Electronics, by Prof. B. G. Fernandez, https://www.youtube.com/playlist?list=PLA07ACBDE053A8229

M. Tech – I Year – I Sem. (PEED)

SPECIAL MACHINES

(Professional Elective – I)

Course objectives:

- To understand the working and construction of specialmachines
- To know the use of special machines in different feed-backsystems
- To understand the use of digital controllers for differentmachines

Course Outcomes:

- To understand the operation of different specialmachines
- To select different special machines as part of control systemcomponents
- To use special machines as transducers for converting physical signals into electricalsignals
- To design digital controllers for differentmachines

UNIT–I:

Stepper Motors: Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, energization with two phase at a time- essential conditions for the satisfactory operation of a 2-phase hybrid step motor - very slow - speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

UNIT-II:

Variable Reluctance Stepping Motors: Variable reluctance (VR) Stepping motors, single-stack VR step motors, Multiple stack VR motors-Open-loop control of 3-phase VR step motor-closed-Loop control of step motor, discriminator (or rotor position sensor) transilator, major loop-characteristics of step motor in open-loop drive – comparison between open-loop position control with step motor and a position control servo using a conventional (dc or ac) servo motor- Suitability and areas of application of stepping motors-5- phase hybrid stepping motor - single phase - stepping motor, the construction, operating principle torque developed in themotor.

Switched Reluctance Motor: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of $L(\theta)$-θ profile - power converter for SR motor-A numerical example – Rotor sensing mechanism and logic control, drive and power circuits, position sensing of rotor with Hall problems-derivation of torque expression, general linear case.

UNIT–III:

Permanent Magnet Materials and PM DC Machines: Introduction, Hysteresis loops and recoil line-stator frames (pole and yoke - part) of conventional PM dc Motors, Equivalent circuit of PM Generator and Motor- Development of Electronically commutated dc motor from conventional dc motor.

Brushless DC Motor: Types of construction – principle of operation of BLDM- sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution)- Methods or reducing Torque Pulsations, 180 degrees pole arc and 120 degree current sheet.

UNIT-IV:

Linear Induction Motor: Development of a double sidedLIMfrom rotary type IM- A schematic of LIM drive for electric traction development of one sidedLIM with back iron-field analysis of a DSLIM fundamentalassumptions.

UNIT-V:

Permanent Magnet Axial Flux (Pmaf) Machines: Construction, Armature windings – Toroidal Stator and Trapezoidal Stator Windings, Torque and EMF equations, Phasor diagram and output equation.

TEXT BOOKS/REFERENCE BOOKS:

1. Special electrical machines, K. Venkataratnam, - Universitypress.
2. Special electrical machines, E. G. Janardanan, -PHI.
3. R. K. Rajput, “Electrical machines”-5thedition.
4. V. V. Athani, “Stepper motor: Fundamentals, Applications and Design”- New age Internationalpub.

M. Tech – I Year – I Sem. (PEED)

ENERGY STORAGE SYSTEMS

(Professional Elective – I)

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:

- 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 storagesystems.

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 Supercapacitors.

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 fuelcell.

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 – I Year – I Sem. (PEED)

PROGRAMMABLE LOGIC CONTROLLERS AND APPLICATIONS

(Professional Elective – I)

Course Objectives:

- To understand the generic architecture and constituent components of a Programmable Logic Controller.
- To develop a software program using modern engineering tools and technique forPLC.
- To apply knowledge gained about PLCs to identify few real life industrialapplications

Course Outcomes:

- Develop and explain the working of PLC with the help of a blockdiagram
- Execute, debug and test the programs developed for digital and analogoperations.
- Reproduce block diagram representation on industrial applications usingPLC.

Unit-I:

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit-II:

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation.

Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction, and flow chart for spray process system.

Unit-III:

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

Unit-IV:

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift

register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

Unit-V:

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS/REFERENCE BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W Webb and Ronald A Reiss Fifth edition,PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR Hackworthand

   F.D Hackworth – Jr- Pearson, 2004.

M. Tech – I Year – I Sem. (PEED)

DYNAMICS OF ELECTRICAL MACHINES

(Professional Elective - II)

Course Objective: This course deals with generalized modeling and analysis of different electrical machines used for industrial drive applications.

Course Outcomes:

- Understand electrical machines and itscharacteristics
- Analyze the behavior of electrical machines under steady state and transient stateModel electrical machines under dynamicconditions

UNIT- I:

Basic Machine Theory: Electromechanical Analogy – Magnetic Saturation – Rotating field theory – Operation of Inductor motor – equivalent circuit – Steady state equations of DC machines – operations of synchronous motor – Power angle characteristics

UNIT- II:

Electrodynamical Equation & Their Solutions: Spring and Plunger system - Rotational motion – mutually coupled coils – Lagrange's equation – Application of Lagrange's equation solution of Electro dynamical equations.

UNIT- III:

Dynamics of DC Machines: Separately excited d. c. generations – stead state analysis – transient analysis – Separately excited d. c. motors – stead state analysis – transient analysis – interconnection of machines – Ward Leonard system of speed control.

UNIT- IV:

Induction Machine Dynamics: Induction machine dynamics during starting and braking – accelerating time – induction machine dynamic during normal operation – Equation for dynamical response of the induction motor.

UNIT- V:

Synchronous Machine Dynamics: Electromechanical equation – motor operation – generator operation

– small oscillations – general equations for small oscillations – representation of the

oscillation equations in state variableform.

TEXT BOOKS/REFERENCE BOOKS:

1. Sen Gupta D.P. and J. W **"**Electrical Machine Dynamics "Macmillan Press Ltd1980.
2. Bimbhra P.S. "Generalized Theory of Electrical Machines "Khanna Publishers2002.

M. Tech – I Year – I Sem. (PEED)

ELECTRICAL& HYBRID VEHICLES

(Professional Elective – II)

Course Objectives:

- To study the concepts and drive train configurations of electric drive vehicles To provide different electric propulsion systems and energy storagedevices
- To explain the technology, design methodologies and control strategy of hybrid electricvehicles
- To emphasize battery charger topologies for plug in hybrid electricvehicles

Course Outcomes:

- Understand the concepts and drivetrain configurations of electric drive vehicles Interpret different electric propulsion systems and energy storagedevices
- Appreciate the technology, design methodologies and control strategy of hybrid electricvehicles
- Realize battery charger topologies for plug in hybrid electricvehicles

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 MilitaryVehicles.

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 – I Year – I Sem. (PEED)

SMART GRID TECHNOLOGIES

(Professional Elective – II)

Prerequisites: Electrical Distribution Systems, Power Systems

Course Objectives:

- To understand various aspects of smartgrid
- To study various smart transmission and distribution technologies
- To appreciate distribution generation and smartconsumption
- To know the regulations and market models for smartgrid

Course Outcomes:

- Understand technologies for smartgrid
- Appreciate the smart transmission as well distribution systems
- Realize the distribution generation and smartconsumption
- Know the regulations and market models for smartgrid

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, NouredineHadjsaïd, "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 – I Year – I Sem. (PEED)

MACHINE MODELLING AND ANALYSIS LAB

Prerequisite: Electrical Machines, Machine Modeling Analysis

Course Objectives:

- Identifying the methods and assumptions in modeling of machines.
- Recognize the different frames for modeling of AC machines.
- To write voltage and torque equations in state space form for different machines.

Course Outcomes: At the end of the course, the student is able to:

- Develop the mathematical models of various machines like, induction motor and Synchronous machines, permanent magnet synchronous motor, brushless DC motor using modeling equations.
- Analyze the developed models in various reference frames.

List of Experiments

1. Develop a dynamic model of open loop controlled dc motor
2. Develop a dynamic model of closed loop controlled dc motor
3. Convert ABC voltages into stationary frame
4. Convert ABC voltages into synchronous frames
5. Convert ABC voltages into rotor reference frames
6. Develop dynamic model of 3-phase Induction motor and generator
7. Develop a mathematical model for V/f controlled 3-phase Induction motor
8. Develop a mathematical model for 3-phase Synchronous motor
9. Develop a mathematical model for 3-phase Permanent Magnet Synchronous motor
10. Develop a mathematical model for Brushless DC Motor
11. Develop a dynamic model for closed loop control of Induction Motor
12. Develop a dynamic model for closed loop control of Synchronous motor

Note: Conduct any 10 experiments from the above using anysimulation tool

M. Tech – I Year – I Sem. (PEED)

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective-I)

Prerequisite: None

UNIT- I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making;Relevantcost,Differentialcost,IncrementalcostandOpportunitycost.Objectivesof aCosting 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 nontechnical activities. Detailed Engineering activities. Pre-project execution main clearances and documents 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- III

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.StandardCostingandVarianceAnalysis.Pricingstrategies:ParetoAnalysis.Targetcosting, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT- IV

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT- V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TEXT BOOKS/ REFERENCE BOOKS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management &CostAccounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

M. Tech – I Year – I Sem. (PEED)

COMPOSITE MATERIALS

(Open Elective-I)

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, WestGermany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.
3. Hand Bookof CompositeMaterials-ed-Lubin.
4. Composite Materials – K. K.Chawla.
5. Composite Materials Science and Applications – Deborah D. L.Chung.
6. CompositeMaterialsDesignandApplications–DanialGay,SuongV. Hoa,andStephenW.Tasi.

M. Tech – I Year – I Sem. (PEED)

ENERGY FROM WASTE

(Open Elective-I)

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 Typesofbiogas Plants–Applications-Alcoholproductionfrombiomass-Biodieselproduction-Urbanwastetoenergy conversion - Biomass energy programmeinIndia.

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 – I Year – I Sem. (PEED)

INTRODUCTION to AI & ML

(Open Elective-I)

Course Objectives:

1. To have an understanding of the basic issues of problem solving by using search policies.
2. To have a basic understanding on topics of AI such as learning, agents and robotics, expert systems, and planning.
3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
4. To understand the latest trends in machine learning
5. To design appropriate machine learning algorithms for problem solving.

Course Outcomes:

Students will be able to

1. Ability to apply basic AI search algorithms to solve problems.
2. Formalize a given problem in the language/framework of different AI methods (e.g. as a logical theory, as a planning problem, etc)
3. Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
4. Apply the back propagation algorithm and genetic algorithms to various problems
5. Usage of Bayesian concepts to machine learning

UNIT–I: Introduction to Artificial Intelligence: Introduction and Foundations of Artificial Intelligence, Brief History, Risks and Benefits, Intelligence Agents: Agents and Environments, Nature of Environments, Structure of Intelligence Agents.
Problem Solving by Search: Formalism of State Space, Search Algorithms, Uninformed Search Strategies, Informed (Heuristics) Search Strategies, Heuristics Functions. Local Search: Hill Climbing Adversarial Search: Two-Agent Games, MiniMax Search Algorithm.
UNIT-II: Knowledge Representation: Knowledge-Based Agents, Propositional Logic: Syntax, Semantics, Inference and Proofs, Proof by Resolution, Model Checking, First-Order Logic:Syntax and semantics, Usage of First-Order Logic, Knowledge Engineering process, Inferences: Propositional vs First-Order Inference, Backward Chaining and Forward Chaining.
UNIT-III: Learning and Applications: Learning Forms: Introduction to Supervised Learning, and Unsupervised Learning, Reinforcement Learning: Passive and Active Learning, Generalization, Policy Search and its Applications, Introduction to Learning using ANN.,
UNIT IV: Neural Networks and Genetic Algorithms :Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.
UNIT V: Bayesian and Computational Learning ;Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Text Books:

1. Stuart Russell Peter Norvig "Artificial Intelligence" A Modern Approach ,Third Edition Pearson Education .
2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

Reference Books:

1. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
3. EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
4. Stephen Marsland, ―Machine learning: An Algorithmic Perspective, CRC Press, 2009.
5. http://www.cs.cmu.edu/~tom/mlbook.html
6. https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf

M. Tech – I Year – II Sem. (PEED)

POWER ELECTRONIC CONTROL OFDRIVES

(Professional Core –IV)

Prerequisites: Power Electronics, AC and DC Machines, ControlSystems

Course Objectives

- To understand the drive system and converter, chopper fed DC separately excitedmotor
- To understand principle operation of scalar control of ac motor and corresponding speed-torque- slipcharacteristics
- To comprehend the vector control for ac motor drive (IM andSM)
- To explain the static resistance control and Slip power recoverydrive
- To explain synchronous motor drive characteristics and its controlstrategies
- To comprehend the brushless dc motor principle ofoperation.

Course Outcomes:

- Analyze drive characteristics and converter as well chopper fed dcdrives
- Develop induction motor for variable speed operations using scalar and vector controltechniques.
- Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives
- Develop Controllers for synchronous motor and variable reluctance motor can bedeveloped

- UNIT- I:

Introduction to drive systems: Basic power electronic drive system, components – Single Phase semi & full converter feed separately excited DC motor for continuous & discontinuous modesof operation.

DC Motor Speed Control: Three Phase full converter fed separately excited motor for one, two and four quadrant applications for speed control, closed loop operation; dc chopper controlled separately excited motor for one, two and four quadrant application for speed control of closed loop operation

UNIT- II:

Stator Side Control of Induction Drives: Scalar control – Voltage fed inverter control – Open loop volts/Hz control – speed control slip regulation – speed control with torque and flux control – current controlled voltage fed inverter drive – current – fed inverter control – Independent current and frequency control – Speed and flux control in Current –Fed inverter drive – Volts/Hz control of Current –fed inverter drive.

UNIT–III:

Rotor Side Control of Induction Drives: Slip power recovery drives – Static Kramer Drive – Phasor diagram – Torque expression – speed control of Kramer Drive – Static Scheribus Drive – modes of operation.

Vector control of Induction Motor Drives: Principles of Vector control – Vector control methods – Direct methods of vector control – Indirect methods of vector control

UNIT – IV:

Vector Control of PMSM:

Model of PMSM. Vector control PMSM drive– Control strategies – Constant torque angle control – Unity power factor control – Constant mutual flux linkage control.

Controllers: Flux weakening operation – Maximum speed – Direct flux weakening algorithm – Constant Torque mode controller – Flux Weakening controller – indirect flux weakening – Maximum permissible torque.

UNIT – V:

Variable Reluctance Motor Drive: Variable Reluctance motor drive – Torque production in the variable reluctance motor Drive characteristics and control principles – Current control variable reluctance motor servo drive.

Brushless DC Motor Drives: Three phase full wave Brushless dc motor – Sinusoidal type of Brushless dc motor- current controlled Brushless dc motor Servodrive.

TEXT BOOKS/REFERENCES BOOKS:

1. Fundamentals of Electrical Drives – G. K. Dubey – Narora publications –1995.
2. Electric Motor Drives Pearson Modeling, Analysis and control – R. Krishnan – Publications – 1st edition –2002.
3. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1stedition
4. Power Electronics and Control of AC Motors – MD Murthy and FG Turn Bull Pergman Press 1stedition
5. Power Electronics and AC Drives – BK Bose – Prentice Hall Eagle wood diffs New Jersey - 1st edition
6. Power Electronic circuits Deices and Applications – M H Rashid – PHI –1995

M. Tech – I Year – II Sem. (PEED)

ADVANCED POWER ELECTRONIC DEVICES AND CONVERTERS

(Professional Core - V)

Course Objectives:

- To understand the characteristics and principle of operation of modern power semi conductor devices.
- To analyze and design switched mode regulator for various industrialapplications.
- To analyze different power converters and know theirapplications

Course Outcomes:

- To choose appropriate device for a particular convertertopology.
- To analyze and design various power converters andcontrollers

UNIT-I:

Modern Power Semiconductor Devices: Modern power semiconductor devices – MOS turn Off Thyristor (MTO) – Emitter Turn off Thyristor (ETO) – Integrated Gate-Commutated thyristor (IGCTs) – MOS-controlled Thyristors (MCTs) – Insulated Gate Bipolar Transistor (IGBT) – MOSFET – comparison of theirfeatures.

Unit-II:

D.C. to D.C. Converters: Analysis of step – down and step-up dc to dc converters with resistive and Resistive –inductive loads – Switched mode regulators – Analysis of Buck Regulators – Boost regulators-buck and boost regulators – Cuk regulators – Condition for Continuous inductor current and capacitor voltage – comparison of regulators – Multi-output boost converters – Advantages -Applications.

Unit-III:

PWM Techniques: single PWM – Multiple PWM – sinusoidal PWM – modified PWM – phase displacement Control – Advanced modulation techniques for improved performance – Trapezoidal, staircase, stepped, harmonic injection and delta modulations – Advantage –application.

Third Harmonic PWM – 60 degree PWM – space vector modulation – Comparison of PWM techniques – harmonic reductions.

UNIT-IV:

Multilevel Inverters: Two level voltage source inverter - Multilevel concept – Classification of multilevel inverters – Diode clamped multilevel inverter – principle of operation – main features – improved diode Clamped inverter – principle of operation – Flying capacitors multilevel inverter – principle of operation – main features. Cascaded multilevel inverter – principle of operation – main features – Multilevel inverter applications – reactive power compensation – back to back intertie system – adjustable drives – Switching device currents – de link capacitor voltage balancing – features of Multilevel inverters – comparisons of multilevel converters.

UNIT-V:

Resonant Pulse Inverters: Resonant pulse inverters – series resonant inverters – series resonant inverters with unidirectional switches – series resonant inverters with bidirectional Switches – analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverters – for series loaded inverter – for parallel loaded inverter –For series and parallel loaded inverters – parallel resonant inverters – Voltage control of resonant inverters.

Resonant converters: Resonant converters – Zero current switching resonant converters – L type ZCS resonant converter – M type ZCS resonant converter – zero voltage switching resonant converters – comparison between ZCS and ZVS resonant Converters – Two quadrant ZVS resonant converters – resonant de-link Inverters – evaluation of L and C for a zero current switching inverter.

TEXT BOOKS:

1. Power Electronics – Mohammed H. Rashid – Pearson Education Third Edition – First Indian reprint2004.
2. Power Electronics – Ned Mohan, Tore M. Undeland and William P. Robbins – John Wiley and Sons – SecondEdition.

REFERENCE BOOKS:

1. Power Electronics – Daniel W. Hart, McGraw HillPublications.
2. Power Electronics Devices, Circuits and Industrial applications, V. R. Moorthi, Oxford UniversityPress
3. Power Electronics, Dr. P. S. Bimbhra, KhannaPubishers.
4. Elements of Power Electronics, Philip T. Krein, Oxford UniversityPress.
5. Power Electronics, M. S. Jamil Asghar, PHI PrivateLimited.
6. Principles of Power Electronics, John G. Kassakian, Martin F. Schlect, Geroge C. Verghese, PearsonEducation.
7. Fundamentals of Power Electronics, Robert W. Erickson, Dragan and Maksimobic,Springer.

M. Tech – I Year – II Sem. (PEED)

POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY

(Professional Core – VI)

Course Objectives:

- To understand the various Non-Conventional sources ofenergy
- To explain the DC to DC converters for Solar PV source ofenergy
- To explain the inverters and its control techniques for a grid connected system
- To understand the characteristics of a solar PV and wind powersources
- To explain the types of distributed generators and batteries in DG and micro gridsystem

Course Outcomes:

- To acquire knowledge on Non-Conventional energysources
- To analyze various technologies and for renewable energysystems
- To develop stand alone DG sets and micro grid systems from renewable energysources

UNIT - I

Introduction to renewable sources: world energy scenario, Wind, solar, hydro, geothermal, availability and power extraction.

Introduction to solar energy: Photovoltaic effect, basics of power generation, P-V &I-V characteristics, effect of insolation, temperature, diurnal variation, shading, Modules, connections, ratings, Power extraction (MPP) tracking and MPPT schemes; standalone systems, grid interface, storage, AC-DC loads.

UNIT - II

DC-DC converters for solar PV: buck/boost/buck-boost /flyback /forward/cuk, bidirectional converters, Interleaved and multi-input converters.

UNIT - III

Grid connected Inverters: 1ph, 3ph inverters with & w/o x'mer, Heric, H6, Multilevel Neutral pointclamp, Modular multilevel, CSI; Control schemes: unipolar, bipolar, PLL and synchronization, power balancing / bypass, Parallel power processing; Grid connection issues: leakage current, Islanding, harmonics, active/reactive power feeding, unbalance.

UNIT - IV

Introduction to wind energy: P-V, I-V characteristic, wind power system: turbine-generator-inverter, mechanical control, ratings; Power extraction (MPP) and MPPT

schemes. Generators for wind: DC generator with DC to AC converters; Induction generator with & w/o converter.

UNIT - V

Synchronous generator with back to back controlled/ uncontrolled converter; Doubly fed induction generator with rotor side converter topologies; permanent magnet based generators. Battery: Types, charging discharging. Introduction to AC and DC microgrids.

TEXT BOOKS:

1. Sudipta Chakraborty, Marcelo G. Simes, and William E. Kramer. Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration. Springer Science & Business, 2013.
2. Nicola Femia, Giovanni Petrone, Giovanni Spagnuolo, Massimo Vitelli, Power Electronics and control for maximum Energy Harvesting in Photovoltaic Systems, CRC Press, 2013. Chetan Singh Solanki, Solar Photovoltaics: fundamentals, Technologies and Applications, Prentice Hall of India, 2011.

REFERENCE BOOKS:

1. N. Mohan, T.M. Undeland&W. P. Robbins, Power Electronics: Converter, Applications & Design, John Wiley &Sons,1989
2. Muhammad H. Rashid, Power Electronics: Circuits, Devices, and Applications, Pearson Education India,2004
3. E. Guba, P. Sanchis, A. Ursa, J. Lpez, and L. Marroyo, Ground currents in single-phase transformerless photovoltaic systems, Progress in Photovoltaics: Research and Applications, vol. 15, no. 7,2007.
4. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd.,2011.
5. Ali Keyhani, Design of Smart Power Grid Renewable Energy Systems, Wiley-IEEEPress,2011.

M. Tech – I Year – II Sem. (PEED)

ELECTRIC TRACTION SYSTEMS

(Professional Elective - III)

Course Objectives:

- To understand various systems of track electrification, power supply system and mechanics of electrictrain.
- To identify a suitable drive for electrictraction.

Course Outcomes:

- Understand Traction systems and itsmechanics
- Identify the power supply equipment for tractionsystems
- Analyze various types of motors used in traction and differentiate AC and DC tractiondrives

UNIT – I

Traction Systems : Electricdrives - Advantages & disadvantages - System of track electrification - DC, 1- Phase low frequency, 3-Phase low frequency and composite systems, Problems of 1-phase traction system - Current unbalance, Voltage unbalance, Production of harmonics, Induction effects, Booster transformer - Rail connected booster transformer. Comparison between AC and DC systems.

UNIT – II

Traction mechanics: Types of services, Speed - time curves - Construction of quadrilateral and trapezoidal speed time curves, Average & schedule speeds. Tractive effort - Speed characteristic, Power of traction motor, specific energy consumption - Factors affecting specific energy consumption, Coefficient of adhesion, slip - Factors affecting slip, magnetically suspended trains.

UNIT – III

Power supply arrangements : High voltage supply, Constituents of supply system - Substations, Feeding post, Feeding & sectioning arrangements, Remote control center, Design considerations of substations, Over headequipment - principle of design of OHE, Polygonal OHE - Different types of constructions, Basic sag & tension calculations, Dropper design, Current collection gear forOHE.

UN IT – IV

Traction motors : Desirable characteristics, D.C. series motors, A.C. series motors, 3-Phase induction motors, linear induction motors, D.C. motor series & parallel control - Shunt bridge transition

– Drum controller, Contact type bridge transition control, Energy saving, Types of braking in A.C. and D.C. drives, Conditions for regenerative braking, Stability of motors under regenerativebraking.

UNIT – V

Semi conductorconverter controlled drives: Advantages of A.C. Traction - Control of D.C. motors - single and two stage converters, Control of ac. motors - CSI fed squirrel cage induction motor, PWM VSI induction motor drive, D.C. traction — Chopper controlled D.C. motors, composite braking, Diesel electric traction — D.C. generator fed D.C. series motor, Alternator fed D.C. series motor, Alternator fed squirrel cage induction motor, Locomotive and axlecodes.

TEXT BOOKS:

1. Partab.H - Modern Electric Traction, Dhanpat Rai & Sons –1998.
2. Dubey. G.K. - Fundamentals of Electrical Drives, Narosa Publishing House -2001.
3. C. L. Wadhwa — Generation, Distribution and Utilization of Electrical Energy, New Age International -2006.
4. J.B. Gupta - Utilization of Electrical Power and Electric Traction, S. K. Kataria& Sons publications, 9^{th}edition2004.

M. Tech – I Year – II Sem. (PEED)

POWER QUALITY ANALYSIS & MITIGATION TECHNIQUES

(Professional Elective - III)

Prerequisite: Digital Signal
Processing Course Objectives:

- To describe various power quality issues in powersystem
- To analyze the power quality issues using appropriate techniques
- To give an insight to various measurement techniques and conduct power qualityanalysis.
- To evaluate and implement various mitigation techniques for power qualityimprovement.

Course Outcomes:

- 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 unbalancedloads
- Design of filters and compensators for harmonic reduction, load balancing and power factor improvement
- Evaluate power quality at an Industry/Data centre/Hospital and Developsolution and design a component or a product applying all the relevant standards withrealistic 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 – I Year – II Sem. (PEED)

MICRO GRID TECHNOLOGIES

(Professional Elective - III)

Course Objectives:

- Understand the integration of renewablesources
- Design modern control technologies for microgrids in Islanded and grid connectedoperation.

Course Outcomes:

- Understanding of the microgrid types andconfigurations
- Applications of power electronics in Microgrid and acquire the knowledge of multifunctiongridconnectedconverters
- Analyze the various types of control in micro grid in islanded and grid connectedoperation
- Design an optimized Microgrid considering the role of powermarket

UNIT – I:

Introduction: Microgrid Configurations – CERTS Microgrid Test Bed – DC Microgrid- HFAC Microgrid – LFAC Microgrid – Hybrid DC- and AC- Coupled Microgrid

Power Electronics in Microgrid: Grid Connected Mode – Islanded mode – Battery Charging mode – design of power converters– Brick Busses Software Frame work- Multi Function grid Connected inverters

UNIT- II:

Control in Microgrid: Impact ofloadcharacteristics– Local control – Centralized Control- Decentralized Control- islandedoperation–PQControl-Droopcontrolmethods– Frequency/VoltageControl–Inverter Output Impedance

UNIT- III:

Microgrid Energy Management Systems: Load Sharing and Power Management Strategy - Stand-alone – Grid connected – energy storage - Voltage Control and Active Power Management

Power Quality Enhancement: Compensators and controllers for power quality issues – Power Quality Improvement technologies– Impact of DG integration on Power Quality.

UNIT- IV:

Optimization in Microgrid: Stochastic Optimization for Operating Cost- Unit Commitment- Congestion Management- Role of Microgrid in Power Market

UNIT-V:

Protection in Microgrid: Device Discrimination-Islanding detection, Effect on Feeder Reclosure, Protection for an Islanded Microgrid having IIDG Units- Adaptive relaying scheme

TEXT BOOKS:

1. Suleiman M,Sharkh, Mohammad A.Abu-Sara Georgios I. Orfanoudakis, Babar Hussain,"Power Electronic Converters for Microgrid", Wiley-IEEE Press, 2014
2. A.Mahmoud, A.L- Sunni and Faud,M, "Control and Optimization of Distributed Generation Systems"ISBN: 978331916910, Springer Publishers,2015.

REFERENCE BOOKS:

1. Nikos Hatziargyiou, "Microgrids: Architectures and Control" ISBN: 978-1-118-72068-4,Wiley-IEEE Press, December 2013.
2. S.Chowhury, S.P.Chowdury and Peter Crossley, "Microgrids and Active Distribution Networks" ISBN978-1-84919-014-5, IET renewable Energy series, 2011.
3. Ritwi K Majumder, "Microgrid: Stability Analysis and Control" VDM Publishing 2010
4. Shin'yaObara, "Optimum Design of Renewable Energy Systems: Microgrid and Nature Grid Methods", AEEGT Book Series, 201

M. Tech – I Year – II Sem. (PEED)

HVDC & FACTS

(Professional Elective – IV)

Prerequisites: Power Electronics, Power Systems

Course Objectives:

- To understand the control aspects of HVDCSystem
- To study HVDC Transmissionsystem
- To know the importance of controllable parameters and types of FACTS controllers & theirbenefits
- To understand the fundamentals of FACTSControllers.

Course Outcomes:

- Compare EHV AC and HVDC system and to describe various types of DClinks
- Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems
- Choose proper FACTS controller for the specific application based on systemrequirements
- Analyze the control circuits of Shunt Controllers, Series controllers &Combined controllers for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping

UNIT - I

HVDC transmission: HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter station and various equipments. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations

UNIT -II

Control of HVDC system: Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics- introduction, generation, ac filters and dc filters.

Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems,

Voltage Source Converter based HVDC systems

UNIT - III

Facts concepts: Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT - IV

Static shunt and series compensators: Shunt compensation - objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators - SVC, STATCOM, SVC and STATCOM comparison. Series compensation - objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

UNIT - V

Combined compensators: Unified power flow controller (UPFC) - Introduction, operating principle, independent real and reactive power flow controller and control structure. Interline power flow controller (IPFC), Introduction to Active power filtering, Concepts relating to Reactive power compensation and harmonic current compensation using Active power filters.

TEXT BOOKS:

1 Hingorani,L.Gyugyi, 'Concepts and Technology of Flexible AC Transmission System', IEEE Press New York, 2000 ISBN –0780334588.
2 Padiyar, K.R., 'HVDC transmission systems', Wiley Eastern Ltd.,2010.

REFERENCES:

1 Song, Y.H. and Allan T. Johns, 'Flexible AC Transmission Systems (FACTS)', Institution of Electrical Engineers Press, London,1999.
2 Mohan Mathur R. and Rajiv K.Varma , 'Thyristor - based FACTS controllers forElectrical
3 Transmission systems', IEEE press, Wiley Inter science ,2002.
4 PadiyarK.R., 'FACTS controllers for Transmission and Distribution systems' New Age International Publishers, 1st Edition,2007.
5 Enrique Acha, Claudio R.Fuerte-Esqivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho 'FACTS – Modeling and simulation in Power Networks' John Wiley &Sons,2002.
6 Jos Arrillaga, 'High voltage Direct Current Transmission' IET Power and Energy Series29

M. Tech – I Year – II Sem. (PEED)

SWITCHED MODE POWER SUPPLIES (SMPS)

(Professional Elective – IV)

Prerequisites: Power Electronics, Electronic devices and circuits

Course objectives:

- To understand various modes of operation of DC-DCConverter
- To analyze control aspects ofconverter
- To design various Switched Mode Power Supply component
- To get awareness on EMI, Protection of convertersystem

Course Outcomes:

- Analyze various modes of operation of Dc-Dc converter Design different controllers forconverter
- Design various components of dc-dcconverter
- Analyze dc-dc converter in view of EMI and thermalconsiderations

UNIT – I

Basic Converter Circuits: Buck Regulator, Buck- Boost Regulator, Boost Regulator, Cuk Converters and Resonant Converters. Choice of switching frequency.

UNIT – II

Isolated SMPS: Fly back Converter, Forward Converter, Half-Bridge and Full Bridge Converters, Push- Pull Converter and SMPS with multiple outputs. Choice of switching frequency.

UNIT – III

Control Aspects: PWM Controllers, Isolation in feedback loop, Power Supplies with multiple output. Stability analysis using Bode Diagrams.

UNIT – IV

Design Considerations: Selection of output filter capacitor, Selection of energy storage inductor, Design of High Frequency Inductor and High frequency Transformer, Selection of switches. Snubber circuit design, Design of driver circuits.

UNIT – V

Electro Magnetic Interference (EMI): EMI Filter Components, Conducted EMI suppression, Radiated EMI suppression,Measurement.
Protection: Over current protection, over voltage protection, Inrush current protection.

Thermal Model: Thermal Resistance, Cooling Considerations, Selection of Heat sinks, Simple Heat sink calculations.

TEXT BOOKS:

1 SwitchedModePowerSupplies,DesignandConstruction,H.W.Whittington,B.W.Flynnand D. E. MacPherson, Universities Press, 2009 Edition.
2 Mohan N. Undeland. T & Robbins W., Power Electronics Converters, Application and Design. John Wiley, 3rd edition,2002
3 Umanand L., Bhat S.R., Design of magnetic components for switched Mode Power Converters. , Wiley EasternLtd.,1992
4 Robert. W. Erickson, D. Maksimovic .Fundamentals of Power Electronics., Springer International Edition,2005 Course Material on Switched Mode Power Conversion, V.Ramanarayanan.

REFERENCE BOOKS:

1. KreinP.T .Elements of Power Electronics., Oxford UniversityPress
2. M. H. Rashid, Power Electronics. Prentice-Hall ofIndia

M. Tech – I Year – II Sem. (PEED)

AI TECHNIQUES IN ELECTRICAL ENGINEERING

(Professional Elective – IV)

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.
- Topracticetheconceptoffuzzinessinvolvedinvarioussystemsandcomprehensivekno wledgeof 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 Electrical Engineering
- Develop genetic algorithm for applications in Electrical Engineering.

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 – I Year – II Sem. (PEED)

ELECTRIC DRIVES & SIMULATION LAB

Pre-requisites: All core subjects

Course Objectives:

- Show awareness of the impact of power electronic control circuits on utility supply
- To observe the difference of the conventional and power electronic control of drives.
- Have a better understanding of the close relationship between hardware and simulation models of actual systems.
- To familiarize the student with various power electronic converter topologies and their speed Control application (open loop and closed loop operation)

Course Outcomes: Student will be able to

- Conduct experiments on drives for different modes of operation using different converter topologies.
- Select the suitable controller for getting the desired speed performance of drive.
- Validate the results

A. List of Experiments in Electric Drives Lab

1. Speed Measurement and closed loop control using PMDC motor.
2. Thyristorised drive for PMDC Motor with speed measurement and closed Loop control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for 1Hp DC motor with closed loop control.
5. 3-Phase input, thyristorised drive, 3 HP DC motor with closed loop
6. 3-Phase input IGBT, 4 quadrant chopper drive for DC motor with closed Loop control equipment.
7. Cyclo-converter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single-phase fully controlled converter with inductive load.
10. Single phase half wave controlled converter with inductive load.

B. List of Experiments in Simulation Lab

1. Simulation & analysis of Boost converters with RL load.
2. Simulation & analysis of Boost converters with RL load.

3. Simulation & analysis of Buck-Boost converters with RL load
4. Single-Phase Inverter using PWM Controller with RL Load.
5. Simulation & analysis of three phase PWM inverter fed Induction Motor.
6. Simulation & analysis of Multi Level inverter fed Induction Motor
7. Analysis of single Phase full Converter using R, L and E Loads
8. Analysis of three Phase full Converter using R, L and E Loads
9. Single and three phase AC Voltage Controller with R, L Load
10. Simulation of three phase Inverter fed Permanent Magnet synchronous Motor

NOTE: Any 8 Experiments from Section A and 7 Experiments from Section B to be performed

M. Tech – I Year – II Sem. (PEED)

BUSINESS ANALYTICS

(Open Elective-II)

Pre-requisite: None

Courseobjectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of anorganization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decisionmaking.
- To become familiar with processes needed to develop, report, and analyze businessdata.
- Use decision-making tools/Operations researchtechniques.
- Mange business process using analytical and managementtools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospaceetc.

Course Outcomes:

- Students will demonstrate knowledge of dataanalytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support businessdecision-making.
- Students will demonstrate the ability to translate data into clear, actionableinsights.

UNIT- I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III

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- IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models,
ForecastingModelsforStationaryTimeSeries,ForecastingModelsforTimeSerieswithaLinearTrend, 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 BudgetModel.

UNIT- V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, personsEducation.

M. Tech – I Year – II Sem. (PEED)

INDUSTRIAL SAFETY

(Open Elective-II)

Course Objectives:

- To provide information regarding different elements of industrial water pollution and Methods oftreatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear andtear.

Course Outcomes:

- Know how to take safety measures in executingworks
- Identify the need for maintenance (or) replacement ofequipment
- Understand the need for periodic and preventivemaintenance

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 andsafety, washrooms,drinkingwaterlayouts,light,cleanliness,fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment andmethods.

UNIT- II

Fundamentalsofmaintenanceengineering: Definitionandaimofmaintenanceengineering,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 greasecup,
ii. Pressure greasegun,
iii. Splashlubrication,
iv. Gravitylubrication,
v. Wick feedlubrication
vi. Side feedlubrication,
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 onemachinetool,
II. Pump
III. Aircompressor
IV. Internal combustionengine,
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, commontroublesandremediesof electricmotor,repaircomplexitiesanditsuse,definition,need,steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

I. Machinetools,
II. Pumps,
III. Aircompressors,
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 InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, McGraw HillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman &HallLondon.

M. Tech – I Year – II Sem. (PEED)

OPERATIONS RESEARCH

(Open Elective-II)

Pre-requisite: None

Course Outcomes:

- Students should able to apply the dynamic programming to solve problems of discreet and continuousvariables.
- Students should able to apply the concept of non-linearprogramming
- Students should able to carry out sensitivityanalysis
- Student should able to model the real-world problem and simulateit.

UNIT- I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT- II

FormulationofaLPP-Graphicalsolutionrevisedsimplexmethod-dualitytheory–

dualsimplexmethod

- sensitivity analysis - parametricprogramming

UNIT- III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT

UNIT- IV

Scheduling and sequencing - single server and multiple server models – deterministic

inventory models

- Probabilistic inventory control models - GeometricProgramming.

UNIT- V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

TEXT BOOKS/ 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 Optimization: Operations Research, Jain Brothers, Delhi,2008
4. Hitler Libermann Operations Research: McGraw Hill Pub.2009
5. Pannerselvam, Operations Research: Prentice Hall of India2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010