CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution)

ACADEMIC REGULATION R-18

FOR CBCS BASED M. TECH. (REGULAR) DEGREE PROGRAMMES

(Applicable for the students of M. Tech. programme admitted into I year from Academic Year 2018-19 onwards)

1.0 Eligibility for Admissions

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by Government of Telangana State from time to time.

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

2.0 Award of M. Tech. degree

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

2.2 The M. Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the degree.

2.3 The student shall register for all 68 credits and secure all the 68 credits.

2.4 The medium of instruction and examination shall be English.

3.0 A. Courses of Study

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

1. Embedded Systems
2. Power Electronics
3. Structural Engineering
4. Computer Science & Engineering

and any other course as approved by the College/ University/AICTE from time to time.

B. Departments offering M.Tech. programmes with specializations mentioned below:

Sl. No.	Department	M.Tech Course
1	ECE	Embedded Systems
2	EEE	Power Electronics
3	Civil	Structural Engineering
4	CSE	Computer Science & Engineering

4.0 Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the PG Programme, its Course Structure and Curriculum, Choice/Option for Courses, based on his competence, progress, pre-requisites and interest.

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

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER

obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries - during ON-LINE Registration for the Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, thereby causing discrepancy, the decision of Head of the Department shall be final.

4.5 Course Options exercised through ON-LINE Registration are final and cannot be changed /inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Course (subject to offering of such a Course), or for another existing Course (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the first week from the commencement of Class-work for that Semester.

5.0. <u>Attendance</u>

The programs are offered on a unit basis with each course t being considered a unit.

5.1 The minimum instruction period for each semester shall be 90 clear instruction days.

5.2 A student shall be eligible to write semester end examinations of a course if he acquires a minimum of 75% of attendance in that course.

5.3 Condonation of shortage of attendance in each Course up to 10%

(65% and above and below 75%) in each semester may be granted by the Institute Academic Committee on valid medical reasons.

5.4 Shortage of attendance below 65% shall not be condoned.

5.5 Students whose shortage of attendance is not condoned in any semester for a course(s) are not eligible to write their end semester examination of those courses and their registration for these courses shall stand cancelled. They have to register for these courses later when offered.

5.6 A fee as prescribed by the Institute Academic Committee shall be payable towards condonation of shortage of attendance.

5.7 A candidate shall put in a minimum required attendance, in at least 3 theory Courses in I semester for promoting to II semester.

5.8 In order to qualify for the award of the M. Tech. Degree, the candidate shall complete all the academic requirements of the courses, as per the course structure.

5.9 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester as applicable. They may re-register for the semester when offered next. If a candidate fulfils the attendance requirement in the present semester, he shall not be eligible for re- registration into the same class.

6.0 Evaluation

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

6.2 For the theory courses 70 marks shall be awarded based on the performance in the Semester End Examination and 30 marks shall

be awarded based on the Internal Evaluation. For internal evaluation there shall be the two internal examinations conducted- one in the middle of the semester and the other immediately after the completion of instruction period. Each internal examination shall be conducted for a total duration of 120 minutes. The final marks secured by the student in 'internal evaluation' for the semester are arrived at by giving a weightage of 70% to the best secured 'internal examination' and 30% weightage to the least secured 'internal examination'. A student who is absent for any internal examination for any reason what so ever shall be deemed to have secured 'zero' marks in the test/ examination and no make-up test/ examination shall be conducted.

6.3 Question paper pattern for evaluation

I. Internal Examination

Part A (10 Marks)

5 questions of 2 marks each (All questions are compulsory).

Part B (20 Marks)

4 Questions to be answered out of 6 questions, each question carries 5 marks.

II. External Examination

Part A (20 Marks)

5 questions (1 question from each unit) of 4 marks each (Compulsory questions)

Part B (50 Marks)

5 questions (1 question from each unit with internal choice) each question carries 10 marks.

6.4 For practical courses, 70 marks shall be awarded based on the performance in the End Semester Examinations. 30 marks shall be awarded for day to day performance in the practicals as internal marks. Laboratory end examination for M. Tech. courses for 70 marks must be conducted with two Examiners, one of them being the Laboratory Course Teacher and the second examiner shall be External Examiner. External Examiner shall be appointed by the Controller of Examinations from other institutions or industry.

6.5 There shall be Mini project with seminar presentation during II semester. For Mini project with seminar, a student under the supervision of a faculty member, shall do a mini project and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will only be internal evaluation for 50 marks. A candidate has to secure for each seminar a minimum of 50% of maximum marks to be declared successful. If he fails to secure minimum marks, he has to re-appear during the supplementary examinations.

6.6 Each student shall start the Project Work during the IV Semester as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of the Department.

a) The Project Work shall be divided and carried out in 2 phases : Phase – I (Project-I) during III Semester, and Phase – II (Project-II) during IV Semester, and the student has to prepare two independent Project Work Reports – one each during each phase. First Report shall include the Project Work carried out under Phase – I, and the Second Report (Final Report) shall include the Project Work carried out under Phase – I and Phase – II put together. Phase – I and Phase – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each Phase of the Project Work, 40 marks shall be for the Continuous Internal Evaluation(CIE), and 60 marks shall be for the End Semester Viva-voce Examination (SEE). The marks earned under CIE for both Phases of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance during the two Project Work Phases/periods); and the marks earned under SEE shall be

awarded by the Project Viva-voce Committee/ Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Phase - I, the Viva-voce shall be conducted at the end of the III Semester, before the commencement of the semester End Examinations, at the Department Level by a Committee comprising of the HoD or One Professor and Supervisor (no external examiner), and the Project Phase – II Viva-voce (or Final Project Viva-voce) shall be conducted by a Committee comprising of an External Examiner, the Head of the Department and the Project Supervisor at the end of the IV Semester, before the commencement of the semester End Examinations. The External Examiner shall be nominated by the CoE from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

d) If a student does not appear for any of the two Viva-Voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Phase-I and/or Project Phase-II Viva-voce examinations, as and when they are scheduled in that semester; if he fails in such 'one reappearance' evaluation

also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate. For the registration of Project Phase-II the student must have passed Project Phase-I.

A candidate shall be deemed to have secured the minimum academic requirement in a course if he secures a minimum of 40% marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

6.7 In case the candidate does not secure the minimum academic

requirement in any course (as specified in 5.9) he has to reappear for the Semester End Examination in that course.

6.8 A candidate shall be given one chance to re-register for the Courses if the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the Course(s) and secure the required minimum attendance. The candidate's attendance in the re-registered Course(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those Courses(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled.

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

7.0 Examinations and Assessment – The Grading System

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

7.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades

(UGC Guidelines) and corresponding range of percentage of marks shall be followed:

% of Marks Secured (class intervals)	Letter Grade (UGC Guidelines)	Grade Points

80% and above (≥ 80%, ≤ 100%)	**O (Outstanding)**	**10**
Below 80% but not less than 70% (≥ 70%, <80%)	**A^+ (Excellent)**	**9**
Below 70% but not less than 60% (≥ 60%, <70%)	**A (Very Good)**	**8**
Below 60% but not less than 55% (≥ 55%, <60%)	**B^+ (Good)**	**7**
Below 55% but not less than 50% (≥ 50%, < 55%)	**B (above Average)**	**6**
Below 50% (< 50%)	**F (FAIL)**	**0**
Absent	**AB**	**0**

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

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

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

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

7.7 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course. The corresponding 'Credit Points '(CP) are computed by multiplying,

the Grade Point with Credits for that particular Courses.
Credit Points (CP) = Grade Point (GP) x Credit … For a Course.

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

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

SGPA = { ∑Ni=1 Ci Gj } / { ∑Ni =1 Ci} ….For each Semester.

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), Ci is the no. of Credits allotted to the ith Course, and Gi represent the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Course.

7.10 The Cumulative Grade Point Average (CGPA) is measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in All registered Courses in All Semesters, and the Total Number of Credits registered in All the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, as the end of each Semester, as per the formula.
CGPA = {∑M j=1 C j G j } / {∑M j=1 C j} } …. For all S Semester registered
{ it., upto and inclusive of S Semester, S ≥2).
Where 'M' is the TOTAL no. of Subject (as specifically required and listed under the Course Structured of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards

upto and inclusive of the Semester S (Obviously M > N), 'j ' is the Subject indicator index (takes into account all Courses from 1 to S Semesters),C j is the no. of Credits allotted to the jth Courses from Gj represent the Grade Points (GP) corresponding to the Letter Grade awarded for the jth Course. After registration and completion of II Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11. For Calculations listed in item 7.6 – 7.10, performance in failed Courses (securing F Grade) will also be take into account, and the credits of such Courses will also be included in the multiplications and summations.

8.0 Evaluation of Project/Dissertation Work

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

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

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

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the changes of topic/supervisor leads to a major changes 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 III semester 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 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM check and the plagiarism report should be included in the final thesis. If the result of above check is less than 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.

8.9 For Project Work,
Review-I will be conducted in III Semester and carries a maximum internal marks of 40. The evaluation should be done by the PRC for 20 marks and Project Supervisor for 20 marks. The Supervisor and PRC will examine the Literature Survey in the same domain, Problem Definition, Objective, Scope of Work. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review I. If he fails to secure minimum required marks he has to reappear during the supplementary examination.

8.10 Project Work Review II in IV Semester carries 40 internal marks. The evaluation should be done by the PRC for 20 marks and the Project Supervisor for 20 marks. The PRC will examine the overall progress of the Project Work and decide the eligibility of the Project for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project

Work Review II. If he fails to fulfill minimum marks, he has to reappear for Review-II during the supplementary examination.

8.11 The thesis shall be adjudicated by the committee consisting of one senior faculty selected by the Head of the Department, the guide concerned, Head of the Department and external examiner.

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

8.13 For Project Work Evaluation (Viva Voice) will be conducted on acceptance of the Thesis in IV Semester. This is an external evaluation for 60 marks and will be evaluated by the committee. The External Examiner for the committee shall be appointed by the Controller of Examinations. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva Voice) examination for its successful completion.

8.14 If he fails to secure minimum marks as specified in 8.13, he will reappear for the Viva Voice examination only after three months. In the reappeared examination also if the candidate fails to secure minimum prescribed marks the registration for the programme stands cancelled and he will not be eligible for the award of the degree.

8.15 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva Voice examination.

9.0 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 Programme (PGP), and secured the required number of 88 Credits (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 the specialization for which he took admission.

9.2 Award of Class

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

Class Awarded	CGPA
First Class and Distinction	$\geq$ 7.75
First Class	6.75 $\leq$ CGPA $>$ 7.75
Second Class	6.00 $\leq$ CGPA $<$ 6.75

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

10. Withholding of Results

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

11. Transitory Regulations

11.1 For Students detained due to shortage of attendance and credits

i) The Student who has not registered in a particular semester for any reason, or has been detained for want of attendance may be considered eligible for readmission to the same semester in the next Academic Year or subsequent academic years. The student who has been detained for lack of credits can be readmitted to the next Academic Year only on obtaining minimum required credits.

ii) A Student who has been detained in I year I Semester of R15

Regulations due to lack of attendance, shall be permitted to join I year I Semester of R18 Regulations and is required to complete the study MBA/M.Tech programme within the stipulated period of four academic years from the date of first admission in I Year I Semester.

iii) A student who has been detained in II semester of I Year or any semester of II year of R15 regulations for want of attendance shall be permitted to join the corresponding semester of R18 regulations and is required to complete the study of MBA/M.Tech within the stipulated period of four academic years from the date of first admission in I Year I Semester. The R18 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

iv) A student of R15 Regulations who has been detained due to lack of credits shall be promoted to the next Academic Year of R18 Regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. The student is required to complete the study of MBA/M.Tech within the stipulated period of four academic years from the year of first admission.

v) After re-admission the student is required to study the course as prescribed in the new regulations for the re-admitted programme at that level and thereafter.

vi) A student who has failed in any course(s) under any regulation has to pass those course(s) in the same regulations.

vii) In case the course(s) offered in subsequent semesters are repetitive, substitute courses identified by the BOS for replacement of completed courses by the students will be given. The students will be suggested to register the said substitute course(s) in the new regulation. One Internal

examination for the substitute course(s) may be conducted before commencement of end semester examinations.

viii) The marks/credits/SGPA are transferred and converted (as per applicable regulations) for all subjects of old regulation if necessary and treated as successfully cleared in the new prescribed program course structure.

ix) For readmitted students the courses studied and cleared in earlier Regulation and not offered those courses in new applicable Regulation are not considered for SGPA & CGPA calculation when secured credits are greater than maximum credits for the award of degree.

x) The decision of BOS is final in case of any ambiguity in identifying the equivalent/substitute courses

xi) The decision of Academic council is final in case of any ambiguity in transitory regulations

11.2 **For Transferred Students**

i) The students seeking transfer to CMRCET from various other Universities/Institutions have to pass the failed course(s) which are equivalent to the course(s) of CMRCET, and also have to pass the course(s) of CMRCET which the students have not studied at the earlier institution. Further the students have passed some of the course(s) at the earlier institutions, and if the same course(s) are prescribed in different semesters of CMRCET and repeated, then substitute courses(with equal credits) identified by BOS may be given to the students

ii) For not cleared course(s) in the previous Institute, equivalent course(s) will be identified by the BOS for pursuing the same. The students will be suggested to pursue the course and to register the said equivalent course(s) in the new regulation and to qualify in examinations.

iii) Marks/Grades/Credits obtained in the courses completed in previous Institution are to be converted in to equivalent Grades/Credits/SGPA/CGPA as per CMRCET regulations.

iv) One Internal examination for the course(s) not studied in previous institution and taken as additional/substitute courses in CMRCET may be conducted before commencement of end semester examinations.

v) If necessary the student may be given additional course(s) in place of the course(s) studied in earlier Institution which are not part of CMRCET regulation to balance and meet the credit requirement for the award of degree as per applicable regulation

vi) The students who seek transfer to CMRCET from various other Universities/Institutions, and satisfy credits requirement as per earlier institution but not satisfy the credit requirements as per CMRCET after finalizing equivalent course(s), may be permitted to continue the programme. However such a student has to meet the requirement of credits for promotion to the next year as per CMRCET applicable regulations.

vii) For transferred students the courses studied and cleared in earlier Institution and not offered those courses in CMRCET are not considered for SGPA & CGPA calculation when secured credits are greater than maximum credits for the award of degree.

viii) In case of any ambiguity in identifying the equivalent/substitute courses, the decision of BOS is final.

ix) The decision of Academic council is final in case of any ambiguity in transitory regulations

12. General

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

11.2 The academic regulation should be read as a whole for the

purpose of any interpretation.

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

11.4 The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

MALPRACTICES RULES
DISCIPLINARY ACTION FOR
IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/ Improper conduct	Punishment
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 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.
1. (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 will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other Courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the Courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate	The candidate who has

	in connection with the examination.	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 Courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the Remaining Courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other Courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end semester Examinations. 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	Cancellation of the

	offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	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 anykind in and around the college or organizes a walk out or instigates others to examination hall walkout, or threatens the officer-in- charge or any person on Duty in or outside the examination hall of any injury, to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in-charge, or any person on Duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other Courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the Courses of that semester/year. The candidates are also debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of 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 Courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of

		that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University 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 Courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	If the student belongs to the college, expulsion from the examination hall an cancellation of performance in that subject and all other Courses hall and all other Courses that candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College 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

		Courses the candidate has already appeared including practical examinations and project work and shall not be permitted for other remaining examinations of the Courses of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other Courses the candidate has appeared including practical examinations and project work of that semester/year.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Academic Committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

Punishments to the candidates as per the above guidelines.

Malpractice identified at Spot center during valuation

The following procedure is to be followed in case of malpractice cases detected during valuation, scrutiny etc. at spot center.

1 Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.

2 A notice is to be served to the candidate(s) involved through the Principal to his address and to the candidate(s) permanent address regarding the malpractice and seek explanations.

3 The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

4 Based on the explanation and recommendation of the committee, action may be initiated.

5 <u>Malpractice committee:</u>

i.	Controller of Examinations	Chairman
ii.	Assistant controller of Evaluation	Member
iii.	Chief Examiner of the subject/ subject expert	Member
iv.	Concerned Head of the Department	Member
v.	Concerned Invigilator	Member

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

R-18 M.Tech (Power Electronics) Course Structure

SEMESTER-I

SI. No	Core/ Elective	Course Code	Course	L	T	P	C
1	Core 1	B30301	Power Converters	3	0	0	3
2	Core 2	B30302	Modeling and Analysis of Electrical machines	3	0	0	3
3	PE 1	PE 1	Professional Elective –I	3	0	0	3
4	PE 2	PE 2	Professional Elective –II	3	0	0	3
5		B30212	Research Methodology and IPR	2	0	0	2
6	Lab 1	B30309	Electrical Systems Simulation –I Laboratory	0	0	4	2
7	Lab 2	B30310	Power Converters Laboratory	0	0	4	2
8	Audit-1	C30001	English For Research Paper Writing	2	0	0	0
		Total credits		**18**			

SEMESTER – II

SI.No	Core/ Elective	Course Code	Course	L	T	P	C
1	Core 3	B30311	Solid state AC Drives	3	0	0	3
2	Core 4	B30312	Solid state DC Drives	3	0	0	3
3	PE 3	PE 3	Professional Elective – III	3	0	0	3

4	PE 4	PE 4	Professional Elective – IV	3	0	0	3
5	PROJ	B30336	Mini Project with Seminar	2	0	0	2
6	Lab 3	B30319	Electrical Systems Simulation –II Laboratory	0	0	4	2
7	Lab 4	B30320	Simulation of Electrical Drives Laboratory	0	0	4	2
8	Audit-II	C30002	Value Education	2	0	0	0
			Total credits	**18**			

SEMESTER-III

SI. No	**Core/ Elective**	**Course Code**	**Course**	L	T	P	C
1	PE5		Professional Elective –V	3	0	0	3
2	OE		OPEN ELECTIVE	3	0	0	3
3	Major Project	B30337	Phase-I Dissertation	0	0	20	10
		Total Credits : 16					

SEMESTER-IV

SI. No	**Core/ Elective**	**Course Code**	**Course**	L	T	P	C
1	Major Project	B30338	Phase-II Dissertation	0	0	32	16
			Total Credits : 16				

Professional Elective –I

S. No	Course Code	Course
1	B30303	Advanced Power Electronic Devices
2	B30304	Distributed Generation
3	B30305	Advance Digital signal processing

Professional Elective –II		
S. No	**Course Code (new)**	**Course**
1	B30306	Modern Control Theory
2	B30307	Energy Management and Audit
3	B30308	CAD of Electrical Apparatus

Professional Elective –III		
S. No	**Course Code**	**Course**
1	B30313	Smart Grid
2	B30314	FACTS
3	B30315	Soft Computing Techniques

Professional Elective –IV		
S. No	**Course Code**	**Course**
1	B30316	Power Quality

2	B30317	Digital Control Systems
3	B30318	Switched Mode Power Conversion

Professional Elective –V		
S. No	**Course Code**	**Course**
1	B30321	Neural and Fuzzy Control of Power Converter
2	B30322	Special Electrical Machines
3	B30323	PLC And Distributed Control System

Open Elective		
S. No	**Course Code**	**Course**
1	B30230	Application Specific Integrated Circuits Design
2	B30231	Embedded Systems
3	B30331	Renewable Energy Sources
4	B30332	Industrial Safety
5	B30431	Green Building
6	B30432	Construction Project Management
7	B30532	Big Data and Analytics
8	B30533	Programming in Python

GRAND TOTAL CREDITS 68

(B30301)POWER CONVERTERS

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I SINGLE PHASE AC-DC CONVERTER

Static Characteristics of power diode, SCR and GTO, half controlled and fully controlled converters with R-L, R-L-E loads and freewheeling diodes – continuous and discontinuous modes of operation - inverter operation-single phase dual converter –Sequence control of converters – performance parameters: harmonics, ripple, distortion, power factor – effect of source impedance and overlap-reactive power and power balance in converter circuits

UNIT II THREE PHASE AC-DC CONVERTER

Semi and fully controlled converter with R, R-L, R-L-E - loads and freewheeling diodes – inverter operation and its limit – performance parameters – effect of source impedance and overlap – 12 pulse converter-three phase dual converter.

UNIT III DC-DC CONVERTERS

Principles of step-down and step-up converters – Analysis of buck, boost, buck-boost and Cuk converters – time ratio and current limit control – Full bridge converter – Resonant and quasi – resonant converters.

UNIT IV AC – AC CONVERTERS

Static Characteristics of TRIAC- Principle of phase control: single phase and three phase controllers – various configurations – analysis with R and R-L loads. Principle of operation – Single phase and Three-phase Dual converters - Single phase and three phase cyclo-converters – power factor Control – Introduction to matrix converters.

UNIT V INVERTERS

Single-phase and three-phase inverters- 1200 and 1800 modes of operation- PWM techniques: single- multiple- and sinusoidal PWM techniques- selective harmonic elimination- space vector modulation-current source inverter- multi-level inverters- techniques for reduction of harmonics.

REFERENCES

1. Ned Mohan,T.M Undeland and W.P Robbin, "Power Electronics: converters, Application and
design" John Wiley and sons.Wiley India edition, 2006.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Pierson Prentice Hall
India, New Delhi, 2004.
3. Cyril W.Lander, "power electronics", Third Edition McGraw hill-1993
4. P.C Sen.," Modern Power Electronics ", Wheeler publishing Co, First Edition, New Delhi-1998.
5. P.S.Bimbra, "Power Electronics", Khanna Publishers, Eleventh Edition, 2003.
6. Power Electronics by Vedam Subramanyam, New Age International publishers, New Delhi
Second Edition, 2006.

Course Outcomes: By the end of the course students will be able to

1. Design and analyze various rectifier circuits.
2. Modulate AC voltage & frequency for various load applications.
3. Illustrate different types of choppers
4. Design and analyze various inverter circuits.

(B30302)MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

M. Tech – I Sem. PE **L T P C**
3 0 0 3

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 - Numerical problems.

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

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.

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 – space form.

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.

TEXT BOOKS:

1. Thyristor control of Electric Drives - Vedam Subranmanyam.
2. Analysis of electric machinery and Drives systems - Paul C. Krause, Oleg wasynezuk, Scott D. Sudhoff.

Course Outcomes: By the end of the course students will be able to

1. Analyze the steady state and dynamic state operation of DC machine through
   Mathematical modeling.
2. Transform of three phase variables to two phase variables.
3. Analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modeling
4. Analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modeling

(B30303)ADVANCED POWER ELECTRONIC DEVICES

(PROFESSIONAL ELECTIVE 1)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

UNIT II CURRENT CONTROLLED DEVICES

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and secondary breakdown; Power darlington - Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy – concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT & Thyristor.

UNIT III VOLTAGE CONTROLLED DEVICES

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static
and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and IGCT.

UNIT IV FIRING AND PROTECTING CIRCUITS

Necessity of isolation, pulse transformer, opto coupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

UNIT V THERMAL PROTECTION

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance –Electrical analogy of thermal components, heat sink types and design – Mounting types.

REFERENCES

1. B.W Williams 'Power Electronics Circuit Devices and Applications'.
2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India,
Third Edition, New Delhi, 2004.
3. MD Singh and K.B Khanchandani, "Power Electronics", Tata McGraw Hill, 2001.
4. Mohan, Undcland and Robins, "Power Electronics – Concepts, applications and Design,
John Wiley and Sons, Singapore, 2000.

Course Outcomes: By the end of the course students will be able to

1. Illustrate the switching characteristics of power semiconductor devices
2. Understand the static and dynamic characteristics of current controlled & voltage controlled power semiconductor devices
3. Understand the control and firing circuit for different devices.
4. Explain the thermal protection of semi conductor devices

(B30304)DISTRIBUTED GENERATION
(PROFESSIONAL ELECTIVE 1)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION

Conventional power generation: advantages and disadvantages, Energy crises, Nonconventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG)

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids,

UNIT V CONTROL AND OPERATION OF MICROGRID

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids,

regulatory standards, Microgrid economics, Introduction to smart microgrids.

REFERENCES

1. "Voltage Source Converters in Power Systems: modelling, Control and Applications", Amirnaser Yezdani, and Reza Iravani, IEEE John Wiley Publications.
2. "Power Switching Converters: Medium and High Power", DorinNeacsu, CRC Press, Taylor & Francis, 2006.
3. "Solar Photo Voltaics", Chetan Singh Solanki, PHI learning Pvt. Ltd., New Delhi,2009
4. "Wind Energy Explained, theory design and applications," J.F. Manwell, J.G. McGowan Wiley publication
5. "Biomass Regenerable Energy", D. D. Hall and R. P. Grover, John Wiley, New York, 1987.
6. "Renewable Energy Resources" John Twidell and Tony Weir, Tyalor and Francis Publications, Second edition.

Course Outcomes: By the end of the course students will be able to

1. Illustrate the concept of distributed generation
2. Analyze the impact of grid integration.
3. Study concept of Microgrid and its configuration
4. Understand the necessity DG integration with grid

(B30305)ADVANCE DIGITAL SIGNAL PROCESSING
(PROFESSIONAL ELECTIVE 1)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I : DISCRETE-TIME RANDOM SIGNALS

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

UNIT II : SPECTRUM ESTIMATION

Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion

UNIT III : LINEAR ESTIMATION AND PREDICTION

Forward and Backward linear prediction, Filtering – FIR Wiener filter-Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.

UNIT IV : ADAPTIVE FILTERS

Principles of adaptive filter – FIR adaptive filter – Newton‟s Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V : WAVELET TRANSFORM

Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.

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TEXTBOOKS:

1. Monson H, Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, Indian Reprint, 2007.

2. John G.Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson, Fourth 2007.
3. Dwight F. Mix, "Random Signal Processing", Prentice Hall, 1995.

REFERENCE:

1. Sophocles J. Orfanidis, "Optimum Signal Processing, An Introduction", Mc Graw Hill, 1990.

Course Outcomes: By the end of the course students will be able to

1. Understand the concepts related to stationary and non-stationary random signals
2. Emphasize the importance of true estimation of power spectral density
3. Design linear and adaptive systems for filtering and linear prediction
4. Understand the concept of wavelet transforms.

(B30306)MODERN CONTROL THEORY

(PROFESSIONAL ELECTIVE II)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT–I: Mathematical Preliminaries: Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-II: State Variable Analysis: Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III: Non Linear Systems: Introduction – Non Linear Systems – Types of Non-Linearities – Saturation – Dead-Zone – Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-IV: Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems – Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V: Optimal Control: Introduction to optimal control – Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained

minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

TEXT BOOKS:

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

REFERENCES:

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

Course Outcomes: By the end of the course students will be able to

1. Analyze and draw the state diagrams for continuous time state models.
2. Observe the controllability and observability of state models
3. Illustrate the stability analysis of Non-linear systems
4. Determine the stability of Linear Continuous time invariant systems
5. Formulate optimal control problems

(B30307) ELECTRICAL ENERGY AUDIT & MANAGEMENT
(PROFESSIONAL ELECTIVE II)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I : ENERGY AUDIT

Introduction, Need for Energy Audit, Types of Energy Audit, Energy Audit Methodology, Process Flow Diagram, Energy Audit Reporting Format, Bench marking & Energy performance, Matching Energy usage to requirement, Energy Audit Instruments, Energy Efficiency, Energy Audit Case Studies. Standards and labeling

Energy Conservation Act 2001 and related policies: Salient features of Energy conservation Act 2001 and Electricity Act 2003, Integrated energy policy, National action plan on climate change.

UNIT II : ENERGY COST AND LOAD MANAGEMENT

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation.

Load management: Demand control techniques- Utility monitoring and control system-HVAC and energy management-DSM-Benefits and Implementation

UNIT III : ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT

Systems and equipment-Electric motors-Transformers and reactors-Capacitors and synchronous machines. Electrical devices for improving energy efficiency.

UNIT IV: METERING FOR ENERGY MANAGEMENT

Relationships between parameters-Units of measure-Typical cost factors-Utility meters – Timing of meter disc for kilowatt measurement - Demand meters –Time of day Metering - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples

UNIT V: LIGHTING SYSTEMS & COGENERATION

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1stedition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
5. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.
6. K.V.Sharma, P.Venkataseshaiah: Energy Management and Conservation IK International
Publishing House Pvt. Ltd.
7. Turner W.C.: Energy Management Handbook.
8. Energy Management Hand Book / W.C. Turner (Ed)
9. Energy Management / W.R. Murthy and G. Mc. Kay / BS Publication
10. Energy Engineering & Management – Amlan Chakrabarti - PHI

Course Outcomes: By the end of the course students will be able to

1. Elucidate concepts behind economic analysis and Load management.
2. Emphasize the energy management on various electrical equipments and metering.
3. Illustrate the concept of lighting systems and cogeneration.

(B30308) CAD OF ELECTRICAL APPARATUS
(PROFESSIONAL ELECTIVE II)

M. Tech – I Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION

Outline of Electromagnetic Fields – Electromagnetic Field Equations – Laplace and Poisson's Equations - Conventional design procedures – Limitations – Need for field analysis based design.

UNIT II PHILOSOPHY OF FEM

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method - 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT III CAD PACKAGES

Elements of a CAD System –Preprocessing – Modelling – Meshing – Material properties – Boundary Conditions – Setting up solution – Post processing.

UNIT IV DESIGN OF ROTATING MACHINES

Analytical study of Magnetic device – Finite element analysis – Synchronous Generators – Computation of the No load Characteristic – Computation of the Direct Axis Inductance and quadrature Axis Inductance - Cylindrical Magnetic Devices.

UNIT V DESIGN OF TRANSFORMERS

Single phase transformer – Computation of the No load Inductances – Estimation of Iron Loses – and leakage inductances.

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, Yes DEE publishers, Indian reprint, 2007.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element
Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. Matthew N. O. Sadiku, 'Principles of Electromagnetics", (English) 4th Edition, Oxford University
Press, New Delhi, 2010

Course Outcomes: By the end of the course students will be able to

1. Compare the conventional and field analysis based design.
2. Interpret the basic concepts of finite element method understand and Perceive the procedures of CAD packages.
3. Devise the design of rotating machines.
4. Analyze the design of transformers.

(B30212) RESEARCH METHODOLOGY AND IPR

M. Tech (PE) – I Semester

L	T	P	C
2	0	0	2

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II

Effective literature studies approach, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Outcomes:

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

1. Analyze research related information & formulate research problem.
2. Follow research ethics.
3. Explain the importance of IPR and the need of information about Intellectual Property Right to be promoted among students in general & engineering.

Illustrate how IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

(B30310)Power Converter Lab

M. Tech – I Sem. PE **L T P C**
0 0 4 2

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 phase chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for DC motor with closed loop control.
5. 3-Phase input, thyristorised drive, DC motor with closed loop.
6. 3-Phase input IGBT, 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 controlled converter with inductive load.

(B30309) Electrical Systems Simulation-I Laboratory

M. Tech – I Sem. PE **L T P C**
0 0 4 2

1. PSPICE Simulation of Single phase full converter using RL and E loads.
2. PSPICE Simulation of Three phase full converter using RL and E loads.
3. PSPICE Simulation of Single phase AC Voltage controller using RL load.
4. PSPICE Simulation of Three phase inverter with PWM controller.
5. PSPICE Simulation of resonant pulse commutation circuit.
6. PSPICE Simulation of impulse commutation circuit.
7. MATLAB Simulation of DC- DC chopper.
8. MATLAB Simulation of Buck- Boost chopper
9. Determine stability of a given dynamical system using following methods.
    a. Root locus
    b. Bode plot
    c. Nyquist plot
10. Transform a given dynamical system from I/O model to state variable model and vice versa.

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(C30001)ENGLISH FOR RESEARCH PAPER WRITING

M. Tech – I Sem. PE

L	T	P	C
2	0	0	0

Unit I

1. Planning and Preparation, Word Order, Breaking up long sentences.
2. Structuring Paragraphs and Sentences, Being Concise and Removing, Redundancy.
3. Avoiding Ambiguity and Vagueness

Unit II

4. Clarifying Who Did What. Highlighting Your Findings.
5. Hedging and Introduction

Unit III

6. Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit IV

7. Key skills are needed when writing a Title
8. Key skills are needed when writing an Abstract
9. Key skills are needed when writing an Introduction
10. Skills needed when writing a Review of the Literature

Unit V

11. Skills are needed when writing the Methods
12. Skills needed when writing the Results
13. Skills are needed when writing the Discussion
14. Skills are needed when writing the Conclusions useful phrases
15. How to ensure paper is as good as it could possibly be the first-time submission

COURSE OUTCOMES

On completion of the course students will be able to

1. Identify the required word order in sentences.
2. Illustrate meaningful sentence structures.
3. Clarify the findings of his research.
4. Argue and defend his research methods.
5. Predict the outcome of his research and will write meaningful conclusions.

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
Model Curriculum of Engineering & Technology PG Courses [Volume-I][41]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht
Heidelberg London, 2011

(B30311) SOLID STATE AC DRIVES

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO INDUCTION MOTORS

Steady state performance equations – Rotating magnetic field – torque production, Equivalent
circuit– Variable voltage, constant frequency operation – Variable frequency operation, constant
Volt/Hz operation. Drive operating regions, variable stator current operation, different braking
methods.

UNIT II VSI AND CSI FED INDUCTION MOTOR CONTROL

AC voltage controller circuit – six step inverter voltage control-closed loop variable frequency
PWM inverter with dynamic braking-CSI fed IM variable frequency drives comparison

UNIT III ROTOR CONTROLLED INDUCTION MOTOR DRIVES

Static rotor resistance control - injection of voltage in the rotor circuit – static scherbius drives -
power factor considerations – modified Kramer drives

UNIT IV FIELD ORIENTED CONTROL

Field oriented control of induction machines – Theory – DC drive analogy – Direct and Indirect
methods – Flux vector estimation - Direct torque control of Induction Machines – Torque
expression with stator and rotor fluxes, DTC control strategy.

UNIT V SYNCHRONOUS MOTOR DRIVES

Wound field cylindrical rotor motor – Equivalent circuits – performance equations of operation
from a voltage source – Power factor control and V curves – starting and braking, self control –
Load commutated Synchronous motor drives - Brush and Brushless excitation .

REFERENCES

1. Bimal K Bose, “Modern Power Electronics and AC Drives”, Pearson Education Asia 2002.
2. Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw Hill,
1994.
3. Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Yersy,
1989.
4. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India
Pvt. Ltd., New Delhi, 2003.
5. W.Leonhard, “Control of Electrical Drives”, Narosa Publishing House, 1992.
6. Murphy J.M.D and Turnbull, “Thyristor Control of AC Motors”, Pergamon Press, Oxford,
1988.

Course Outcomes:

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

1. Comprehend various operating regions of the induction motor drives.
2. Analyze the operation of VSI & CSI fed induction motor control.
3. Demonstrate the speed control of induction motor drive from the rotor side.
4. Illustrate the field oriented control of induction machine.
5. Understand the control of synchronous motor drives.

(B30312) SOLID STATE DC DRIVES

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT I DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS

DC motor- Types, induced emf, speed-torque relations; Speed control – Armature and field speed control; Ward Leonard control – Constant torque and constant horse power operation - Introduction to high speed drives and modern drives. Characteristics of mechanical system – dynamic equations, components of torque, types of load; Requirements of drives characteristics - stability of drives – multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.

UNIT II CONVERTER CONTROL

Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms, performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

UNIT III CHOPPER CONTROL

Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper
controlled DC motor – performance analysis, multi-quadrant control - Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

UNIT IV CLOSED LOOP CONTROL

Modeling of drive elements – Equivalent circuit, transfer function of self, separately excited DC
motors; Linear Transfer function model of power converters; Sensing and feeds back elements -
Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed d.c drive.

UNIT V DIGITAL CONTROL OF D.C DRIVE

Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant
horse power and load disturbed operations; Speed detection and current sensing circuits.

REFERENCES

1. Gopal K Dubey, "Power Semiconductor controlled Drives", Prentice Hall Inc., New Yersy, 1989.
2. R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2010.
3. Gobal K.Dubey, "Fundamentals of Electrical Drives", Narosal Publishing House, New Delhi, Second Edition ,2009
4. Vedam Subramanyam, "Electric Drives – Concepts and Applications", Tata McGraw-Hill publishing company Ltd., New Delhi, 2002.
5. P.C Sen "Thyristor DC Drives", John wiely and sons, New York, 1981

Course Outcomes:

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

1. Understand steady state operation and transient dynamics of a motor load system
2. Analyze the operation of the converter / chopper fed DC drive, both
   qualitatively and quantitatively.
3. Analyze and design the current and speed controllers for a closed loop solid state DC
   motor drive.
4. Implement the control algorithms using microcontrollers and phase locked loop.

(B30313)SMART GRID
(PROFESSIONAL ELECTIVE III)

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO SMART GRID

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers,
functions, opportunities, challenges and benefits, Difference between conventional & Smart
Grid, Concept of Resilient & Self Healing Grid, Present development & International policies in
Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives.

UNIT II SMART GRID TECHNOLOGIES

Technology Drivers, Smart energy resources,Smart substations, Substation Automation, Feeder
Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection
and control, Distribution systems: DMS, Volt/VAr control,Fault Detection, Isolation and service
restoration, Outage management,High-Efficiency Distribution Transformers, Phase Shifting
Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits,AMI
protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement
Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable
Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality

monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

REFERENCES*:*

1. Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati,
   and Gerhard P. Hancke, Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and
   Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids,
3. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions",CRC Press 2012.
4. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama,
5. "Smart Grid: Technology and Applications", Wiley.

Course Outcomes:

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

1. Elucidate about Smart Grid technologies, different smart meters and advanced metering infrastructure.
2. Manage power quality issues in Smart Grid.
3. Disseminate the high performance computing for Smart Grid applications

(B30314) FLEXIBLE AC TRANSMISSION SYSTEMS
(PROFESSIONAL ELECTIVE III)

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT-I: FACTS CONCEPTS

Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNIT-II: VOLTAGE SOURCE CONVERTERS

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT-III: STATIC SHUNT COMPENSATION

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-IV: SVC AND STATCOM

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT-V: STATIC SERIES COMPENSATORS

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series

capacitor (TSSC), and thyristor controlled series capacitor (TCSC) Control schemes for GSC TSSC and TCSC.

TEXT BOOKS

1. "Understanding FACTS Devices" N.G. Hingorani and L. Guygi. IEEE Press Publications 2000.

Course Outcomes:

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

- Explain the characteristics, applications and modelling of series and shunt FACTS
- Emphasis the need for FACTS controllers
- Analyze the interaction of different FACTS controller and perform control coordination.
- Solve the power quality issues by using FACTS devices

(B30315) SOFT COMPUTING TECHNIQUES
(PROFESSIONAL ELECTIVE III)

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS

Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- McCulloch Pitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient - back propagation algorithm- factors affecting back propagation training applications.

UNIT II ARTIFICIAL NEURAL NETWORKS

Counter propagation network- architecture- functioning & characteristics of counter- Propagation network-Hopfield/ Recurrent network- configuration- stability constraints-associative memoryand characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory.

UNIT III FUZZY LOGIC SYSTEM

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning.
Introduction to fuzzy logic modeling and control- Fuzzification- inferencingand defuzzification-
Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems.Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

UNIT V APPLICATIONS

GA application to power system optimization problem- Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural Network interconnection systems- Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox-Stability analysis of fuzzy control systems.

REFERENCES

1. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education,
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning",
   Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, "Neural Networks for Control", MIT Press, 1996.

Course Outcomes:

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

1. Interpret the concepts of feed forward neural networks.
2. Acquire knowledge about feedback neural networks.
3. Explain the concept of fuzziness involved in various systems.
4. Expose the ideas about genetic algorithm
5. Acquire knowledge about of FLC and NN toolbox

(B30316)POWER QUALITY
(PROFESSIONAL ELECTIVE IV)

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT I INTRODUCTION

Introduction – Characterisation of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

UNIT II ANALYSIS OF SINGLE PHASE AND THREE PHASE SYSTEM

Single phase linear and non linear loads – single phase sinusoidal, non sinusoidal source – supplying linear and nonlinear load – three phase Balance system – three phase unbalanced system – three phase unbalanced and distorted source supplying non linear loads – concept of pf – three phase three wire – three phase four wire system.

UNIT III CONVENTIONAL LOAD COMPENSATION METHODS

Principle of load compensation and voltage regulation – classical load balancing problem open loop balancing – closed loop balancing, current balancing – harmonic reduction and voltage sag reduction – analysis of unbalance – instantaneous of real and reactive powers – Extraction of fundamental sequence component from measured.

UNIT IV LOAD COMPENSATION USING DSTATCOM

Compensating single – phase loads – Ideal three phase shunt compensator structure – generating reference currents using instantaneous PQ theory – Instantaneous symmetrical components theory – Generating reference currents when the souce is unbalanced – Realization and control of DSTATCOM – DSTATCOM in Voltage control mode

UNIT V SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM

Rectifier supported DVR – Dc Capacitor supported DVR – DVR Structure – voltage Restoration
– Series Active Filter – Unified power quality conditioner.

REFERENCES

1. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer
Academic Publishers, 2002
2. G.T.Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1994(2nd edition)
3. Power Quality - R.C. Duggan
4. Power System Harmonics –A.J. Arrillga
5. Power Electronic Converter Harmonics –Derek A. Paice

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

1. Illustrate various power quality issues.
2. Comprehend the concept of power and power factor in single phase and three phase
systems
3. Apprehend the conventional compensation techniques used for power factor correction and load voltage regulation.
4. Identify the active compensation techniques used for power factor correction and load voltage regulation

(B30317)DIGITAL CONTROL SYSTEMS

(PROFESSIONAL ELECTIVE IV)

M. Tech – II Sem. PE **L T P C**
3 0 0 3

UNIT-I INTRODUCTION

Introduction, Examples of Data control systems — Digital to Analog conversion and Analog to Digital conversion, sample and hold operations. Z — TRANSFORMS: Introduction, Linear difference equations, pulse response, Z — transforms, Theorems of Z — Transforms, the inverse Z — transforms, Modified Z- Transforms. Z-Transform method for solving difference equations; Pulse transforms function) block diagram analysis of sampled — data systems, mapping between s-plane and z-plane.

UNIT II STATE SPACE ANALYSIS

: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state — space equations. Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

UNIT III STABILITY ANALYSIS

Mapping between the S-Plane and the Z-Plane — Primary strips and Complementary Strips — Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test — Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT-IV DESIGN OF DISCRETE TIME CONTROL SYSTEM

Transient and steady — State response Analysis — Design based on the frequency response method — Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

UNIT-V STATE FEEDBACK CONTROLLERS & OBSERVERS

: Design of state feedback controller through pole placement — Necessary and sufficient conditions, Ackerman's formula. State Observers — Full order and Reduced order observers.

TEXT BOOK

1. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2 Edition.
2. Digital Control Systems , V. I. George, C. P. Kurian, Cengage Learning

REFERENCE BOOKS

1. Digital Control Systems, Kuo, Oxford University Press, 2 Edition, 2003.Digital Control and State Variable Methods by M.Gopal, TMH.
2. Digital Control Engineering Analysis and Design M. Sami Fadali Antonio Visioli, AP Academic Press.

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

1. Elucidate the fundamentals digital control systems, z-transforms, state space representation of the control systems.
2. Illustrate the concepts of controllability and observabilty, estimation of stability in different domains.
3. Design discrete time control systems, compensators, state feedback controllers, state observers through various transformations.

(B30318) SWITCHED MODE POWER CONVERSIONS

(PROFESSIONAL ELECTIVE IV)

M. Tech – II Sem. PE **L T P C**

3 0 0 3

UNIT I INTRODUCTION

Reactive elements – Design of Inductor, capacitor and transformer for Power electronics applications.

UNIT II BASIC SWITCHING CONVERTER TOPOLOGIES

Basic concepts of SMPS – DC-DC converters – Characteristics – Constituent elements – Operating principles.

UNIT III RESONANT CONVERTERS

Classification of resonant converters – Basic resonant circuit concepts – Load resonant converters – Resonant switches converters – Zero voltage switching.

UNIT IV TRANSFORMERIZED SWITCHING CONVERTERS

Forward converter – Push-pull converter – Half–bridge switching converter – Full – bridge switching converter – Flyback converter – Zero–Current– Switching Quasi–Resonant Half–Bridge converter

UNIT V POWER CONDITIONERS, UPS AND FILTERS

Power line disturbances – Power conditioners – Offline and Online UPS, Applications – Voltage filters, Series–parallel resonant filters, filter for PWM VSI, current filter, DC filters.

TEXT BOOKS

1. Simon S. Ang, “Power Switching Converter”, Marcel Dekker Inc., Taylor and Francis,3rd Edition,2005.

2. Umanand L., Bhat S.R., "Design of magnetic components for switched Mode Power converters" , Wiley Eastern Ltd.,2001.

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

1. Design the reactive elements for power electronic systems.
2. Illustrate the concepts of switching converters.
3. Explain the operation of resonant converters.
4. Explain the operation of transformerized switching converters.
5. Distinguish various types of UPS and filters.

(B30319)ELECTRICAL SYSTEMS SIMULATION- II LAB

M. Tech – II Sem. PE **L T P C**
0 0 4 2

1. Generation of power quality Disturbances SAG & SWELL
2. Generation of power quality Disturbances Transient & Harmonics
3. Simulation of mitigation device for voltage sag
4. Simulation of mitigation device for overvoltage transients.
5. Simulation of harmonic producing load and mitigating filter.
6. Study of power quality analyzers
7. Design and Test the performance of TCSC in 500 kV Transmission line.
8. Design and test the performance of SVC .
9. Design the detailed model of GTO based unified power flow controller and test its performance
10. Study the performance of D-STATCOM on a three bus 500 kV distribution system

(B30320) SIMULATION OF ELECTRICAL DRIVES LABORATORY

M. Tech – II Sem. PE **L T P C**

0 0 4 2

1. Modelling and simulation of single phase full controlled bridge rectifier fed separately excited dc motor.
2. Modelling and simulation of single phase semi controlled bridge rectifier fed separately excited dc motor.
3. Modeling and simulation of dc chopper fed separately excited dc motor.
4. Speed Control Of DC motor using 3phase fully controlled bridge converter
5. Simulation of PWM techniques.
6. Simulation of 3 phase inverter fed AC Motor
7. Simulation of single phase SPWM based induction motor
8. Simulation of Three phase SPWM based induction motor
9. Simulation of Multilevel Inverter.
10. Simulation of 3 level Neutral point clamped inverter

(C30002)VALUE

EDUCATION

M. Tech – II Sem. PE **L T P C**
2 0 0 0

Unit I

1. Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
2. Moral and non- moral valuation. Standards and principles
3. Value judgements

Unit II

4. Importance of cultivation of values.
5. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
6. Honesty, Humanity. Power of faith, National Unity
7. Patriotism.Love for nature ,Discipline

Unit III

8. Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
9. Punctuality, Love and Kindness.
10. Avoid fault Thinking.
11. Free from anger, Dignity of labour.

Unit IV

12. Universal brotherhood and religious tolerance.
13. True friendship.
14. Happiness Vs suffering, love for truth.
15. Aware of self-destructive habits.
16. Association and Cooperation.
17. Doing best for saving nature

Unit V

18. Character and Competence –Holy books vs Blind faith.
19. Self-management and Good health.
20. Science of reincarnation.
21. Equality, Nonviolence ,Humility, Role of Women.
22. All religions and same message.
23. Mind your Mind, Self-control.
24. Honesty, Studying effectively

COURSE OUTCOMES

On completion of the course students will be able to

1. Identifies the social values and work ethics.
2. Classifies the moral and non moral values.
3. Demonstrates love and kindness to fellow human beings.
4. Draws inference from the Holy books about the characters and their competence.
5. Able to judge his fellow beings character through their behavior.

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

(B30321)NEURAL AND FUZZY CONTROL SYSTEM
(PROFESSIONAL ELECTIVE V)

M. Tech – III Sem. PE **L T P C**

3 0 0 3

Unit – I: Introduction to Neural Networks
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit- II: Essentials of Artificial Neural Networks
Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application Feed Forward Neural Networks Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit III: Multilayer Feed forward Neural Networks
Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. Associative Memories Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

Unit IV: Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART) 8

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition.

UNIT V:Classical and Fuzzy Sets and Fuzzy Logic System Components

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Applications Neural network applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting. Fuzzy logic applications: Fuzzy logic control and Fuzzy classific

TEXT BOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by ajasekharan and G.A.Vijayalakshmi Pai – PHI Publication.

REFERENCE BOOKS:

1. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.
2. Neural Engineering by C.Eliasmith and CH.Anderson, PHI 3. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI P

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

1. Understand concepts of artificial neural networks and their architecture.
2. Apply the knowledge of artificial neural networks to various applications.
3. Apply the of concepts of the fuzzy logic control and their real time application

(B30322)SPECIAL ELECTRICAL MACHINES
(PROFESSIONAL ELECTIVE V)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control

UNIT II PERMANENT MAGNET SYNCHROUNOUS MOTORS

Principle of operation – EMF and Torque equations - Phasor diagram - Power controllers – Torque speed characteristics – Digital controllers – Constructional features, operating principle
and characteristics of synchronous reluctance motor
.

UNIT III SWITCHED RELUCTANCE MOTORS

Constructional features –Principle of operation- Torque prediction– Characteristics Power controllers – Control of SRM drive- Sensorless operation of SRM – Applications.

UNIT IV STEPPER MOTORS

Constructional features –Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications.

UNIT V OTHER SPECIAL MACHINES

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Applications.

REFERENCES:

1. T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Claredon press, London, 1989.
   R.Krishnan, ' Switched Reluctance motor drives' , CRC press, 2001.
2. T.Kenjo, ' Stepping motors and their microprocessor controls', Oxford University press, New Delhi, 2000.

3. T.Kenjo and S.Nagamori, 'Permanent magnet and Brushless DC motors', Clarendon press, London, 1988.
4. R.Krishnan, ' Electric motor drives' , Prentice hall of India,2002.
5. D.P.Kothari and I.J.Nagrath, ' Electric machines', Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.
6. Irving L.Kosow, "Electric Machinery and Transformers" Pearson Education, Second Edition,
2007

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

1. Analysis the fundamental concepts of permanent magnets and the operation of permanent magnet brushless DC motors.
2. Explain the concepts of permanent magnet brushless synchronous motors and synchronous reluctance motors.
3. Develop the control methods and operating principles of switched reluctance motors.
4. Introduce the concepts of stepper motors and its applications.
5. Comprehend the basic concepts of other special machines.
6. Choose Special machines for particular industry applications

(B30323)PLC AND DISTRIBUTED CONTROL SYSTEM
(PROFESSIONAL ELECTIVE V)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

UNIT I PROGRAMMABLE LOGIC CONTROLLER

Evolution of PLC,,s – Components of PLC – Advantages over relay logic – Architecture of PLC – Programming devices - Discrete and Analog I/O modules – Programming languages
Ladder diagram – Programming timers and counters – Design of PLC.

UNIT II APPLICATIONS OF PLC

Instructions in PLC – Program control instructions, math instructions, sequencer instructions
- Use of PC as PLC – Application of PLC – Case study of bottle filling system.

UNIT III COMPUTER CONTROLLED SYSTEMS

Basic building blocks of Computer controlled systems – SCADA – data Acquisition System
- Supervisory Control – Direct digital Control.

UNIT IV DISTRIBUTED CONTROL SYSTEM

DCS – Architectures – Comparison – Local control unit – Process interfacing issues
- Communication facilities.

UNIT V INTERFACES IN DCS

Operator interfaces - Low level and high level operator interfaces – Operator displays Engineering interfaces – Low level and high level engineering interfaces – General purpose computers in DCS.

TEXT BOOKS

1. Petruzella,Industrial Electronics,,, McGraw Hill, 1996.

2. Michael P. Lukas,Distributed Control System,, Van Nostrand Reinhold Co.,Canada,1986.

REFERENCES

1. Hughes, T., A., Programmable Controllers - 4th Edition ǁ, ISA Press, 2005

2. John W Webb and Ronald A Reis ,Programmable Logic Controllers-Principles and pplications Prentice Hall Inc., New Jersey, Third edition, 2003.

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

1. Gain adequate knowledge about various application of PLC
2. Analyze the parameters of distributed control systems
3. Design various interfaces to the digital control systems
4. Understand the concept of Supervisory control

(B30230) APPLICATION SPECIFIC INTEGRATED CIRCUITS DESIGN
(OPEN ELECTIVE)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

UNIT-I: Types of ASICs
Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

UNIT-II : ASIC Library design:
Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC.

UNIT-III: Low level design entry
Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog.

UNIT-IV: Logic synthesis
Logic synthesis in Verilog & VHDL simulation.

UNIT-V: ASIC Construction
Floor Planning & Placement Algorithms -Routing

Text Books:

1. Application specific Integrated Circuits", J.S. Smith, Addison Wesley.
2. Principles of CMOS VLSI Design: A System Perspective, N. Westle & K. Eshraghian, Addison – Wesley Pub.Co.1985. Technological Age", 2016.

References:

1. Basic VLSI Design :Systems and Circuits, Douglas A. Pucknell & Kamran Eshraghian, Prentice Hall of India Private Ltd. , New Delhi , 1989.
2. Introduction to VLSI System,C. Mead & L. Canway, Addison Wesley Pub

3. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall,
4. Digital Integrated Circuits: A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt Ltd

Course Outcomes:

After completion of the course the student will be able to

1. Analyze different types of ASICs and their libraries.
2. Design programmable ASICs, Low level design ASICs using Verilog & VHDL.
3. Gets complete knowledge regarding different methods of software ASIC design their simulation, testing and construction of ASICs.

(B30231) EMBEDDED SYSTEMS
(OPEN ELECTIVE)

M. Tech – III Sem. PE

L	T	P	C
3	0	0	3

UNIT-I: Embedded Computing & CPU fundamentals
Embedded Computing: Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC;
CPU fundamentals: programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, super scalar execution, caching, CPU power consumption.

UNIT-II: Embedded computing platform & Program design and analysis
Embedded Computing platform: CPU bus, memory devices, I/O devices, interfacing, designing with microprocessors, debugging techniques.
Program design and analysis: models of program, assembly and linking, compilation techniques, analysis and optimization of execution time, energy, power and size.

UNIT-III: Processes and operating systems
Multiple tasks and multiple processes, context switching, scheduling policies, inter-process communication mechanisms.
UNIT-IV: Hardware accelerators & Networks
Hardware accelerators: CPUs and accelerators, accelerator system design.
Networks: Distributed embedded architectures, networks for embedded systems, network-based design and Internet-enabled systems.

UNIT-V: System design techniques
Design methodologies, requirements analysis, system analysis and architecture design, quality assurance.

Text Books:

1. Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)

Reference Books

1. Manuel Jiménez Rogelio,PalomeraIsidoroCouvertier "Introduction to Embedded SystemsUsing Microcontrollers and the MSP430" Springer Publications, 2014.
2. Frank Vahid, Tony D. Givargis, "Embedded system Design: A Unified Hardware/Software Introduction", John Wily & Sons Inc.2002.
3. Peter Marwedel, "Embedded System Design", Science Publishers, 2007.

Course Outcomes:

1. Expected to understand the selection procedure of Processors in the Embedded domain.
2. Design Procedure for Embedded System.
3. Expected to visualize the role of Real time Operating Systems in Embedded Systems
4. Expected to evaluate the architectures & networks for Embedded system.

(B30331) RENEWABLE ENERGY SOURCES (OPEN ELECTIVE)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

Unit – I: Solar Energy

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar energy collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. **Storage and applications**: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications-solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Unit-II: Wind energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Unit-III: Bio-mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

Unit-IV: Geothermal energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Unit-V: Direct energy conversion: Need for DEC, Carnot cycle, limitations, principles of DEC.

Text Books

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

Reference Books

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

Course Outcomes On completion of the course, students will be able to

1. Interpret the principles of solar radiation, collection and application.
2. Explain the concepts of Wind energy generation
3. Demonstrate the concepts of Bio-mass energy and operation of IC engines
4. Illustrate the perception of Geo-thermal energy and production in India
5. Elucidate the ideology of direct energy conversion

(B30332) Industrial Safety
(OPEN ELECTIVE)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

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 948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction
methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity
lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's
like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing,
cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and

preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

Course outcomes: Up on the completion of the course students will be able to

1. Demonstrate the concepts of industrial safety, accidents and preventive measures.
2. Explain the Fundamentals of maintenance engineering.
3. Explain Wear and Corrosion and their prevention
4. Interpret the Fault tracing and draw decision tree for problems in machine tools.
5. Explain the concepts of Periodic and preventive maintenance

(B30431) GREEN BUILDINGS
(OPEN ELECTIVE)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

Unit-I
Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management -
Macro aspect of energy use in dwellings and its implications.

Unit-II
Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

Unit-III
Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

Unit-IV
End-use, energy utilization and requirements - Lighting and day lighting - End -use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope -Evaluation of the overall thermal transfer.

Unit-V
Energy management options - Energy audit and energy targeting - Technological options for energy management.

Reference Books
1. J. Krieder and A. Rabl, Heating and Cooling of Buildings - Design for Efficiency, McGraw Hill, 1994.
2. S.M. Guinnes and Reynolds, Mechanical and Electrical Equipment for Buildings, Wiley, 1989.
3. Shaw, Energy Design for Architects, AEE Energy Books, 1991.
4. ASHRAE, Handbook of Fundamentals, Atlanta, 1997.
5. Donald W. Abrams, Low Energy Cooling – A Guide to the Practical Application of Passive Cooling and Cooling Energy

Conservation Measures, Van Nostrand Reinhold Co., New York, 1986

Course Learning Outcomes

After completing this course, students will be able to:

1. Describe and use the basic terms and concepts used in green buildings.
2. Recognize and analyze green buildings.
3. Identify and define green building systems and materials.
4. Analyze and solve design problems utilizing principles of green building.
5. Assimilate knowledge gained in this course to evaluate green buildings.

(B30432) CONSTRUCTION PROJECT MANAGEMENT

(OPEN ELECTIVE)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

Unit-I Management process- Roles, management theories, Social responsibilities, planning and strategic management, strategic implementation, Decision making tools and techniques-Organizational structure, Human resource management- motivation performance-leadership.

Unit-II Classification of construction projects, Construction Stages, Resources-Functions of Construction Management and its Applications, Preliminary planning –Collection of Data-Contract planning –Scientific Methods of Management; Network Techniques in construction management- Bar Chart-Grant Chart, CPM- PERT-Cost & Time optimization.

Unit-III Resource planning – planning for manpower, materials, Cost, equipment, Labour, Scheduling, Forms of, Scheduling-Resource allocation, budget and budgetary control methods.

Unit-IV Contract-types of contract, contract document, specification, important conditions of contract- tender and tender document- Deposits by contractor –Arbitration, negotiation – M- Book –Muster rolls- stores.

Unit-V

Management information systems- Labour Regulations: Social security-welfare Legislation-laws relating to wages , Bonus and industrial disputes, Labour administration – insurance and safety Regulations- Workmen‘s compensation Act – other labour laws- safety in construction : legal and financial aspects of accidents in construction , occupational and safety hazard assessment , human factors in safety , legal and financial aspects of accidents , occupational and safety hazard assessment.

Text Books

1) Ghalot, P.S., Dhir, D.M., Construction planning and Management, Wiley Eastern limited,1992
2) Chikara, K.K., Construction Project Management, Tata McGraw Hill publishing Co, Ltd New Delhi,1998
3) Punima, B.C., Project planning and Control with PERT and CPM, Laxmi Publications New Delhi 1987

Reference:

1. Construction Management and Planning by Sengupta, B. Guha, H., Tata McGraw Hill Publications

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

1. Explain the importance of construction planning and functioning of various earth moving equipment.
2. Explain of production of aggregate products and concreting.
3. Apply the gained knowledge to project management and construction techniques.

(B30532) BIG DATA AND ANALYTICS
(Open Elective)

M. Tech – III Sem. PE

L	T	P	C
3	0	0	3

Unit-I

Types of Digital Data-Classification of Digital Data; Introduction to Big Data- Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?, Why Big Data?, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment.

Unit-II

Big Data Analytics-What is Big Data Analytics?, What Big Data Analytics Isn't?. Classification of Analytics; Data Science, Terminologies Used in Big Data Environments, Top Analytics Tools; The Big Data Technology Landscape-NoSQL (Not Only SQL), Hadoop.

Unit-III

Introducing Hadoop, Why Hadoop?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview-Use Case of Hadoop, Hadoop Distributors-HDFS (Hadoop Distributed File System)- Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator)- Interacting with Hadoop Ecosystem.

Unit- IV

Introduction to MongoDB-What is MongoDB?, Why MongoDB?, Terms Used in RDBMS and MongoDB-Data Types in MongoDB, MongoDB Query Language Introduction to MAPREDUCE Programming-Introduction-Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

Introduction to Hive-What is Hive? Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL).

Unit-V

Introduction to Pig-What is Pig?, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig.

Introduction to Machine Learning-Introduction to Machine Learning, Machine Learning Algorithms.

Textbooks:

1. Big Data and Analytics by by Seema Acharya (Author), Subhashini Chellappan, Wiley Publisher.

References:

1. Big Data, Black Book, by DT Editorial Services, Dreamtech Press (2016).

Course Outcomes:

Students shall be able to

1. Define Big Data.
2. Classify Analytics.
3. Create Big Data Applications using Hadoop frame work.
4. Analyse Machine Learning Algorithms.
5. Write Pig Scripts.

(B30533) PROGRAMMING IN PYTHON
(Open Elective)

M. Tech – III Sem. PE **L T P C**
3 0 0 3

Unit-I

Introduction to Python Programming: How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations (Operators. Type conversions, Expressions), More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops

Unit-2

Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Storing Functions in Modules. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions

Unit-3

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples. Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms

Unit-4

Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, Working with Instances, Techniques for Designing Classes, Inheritance, Polymorphism.

Unit-5

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

TEXTBOOKS:

1. Starting Out with Python by Tony Gaddis, Pearson, 3 edition;

References:

1. Python Programming: Using Problem Solving Approach by Reema Thareja,
   Oxford University Press, First edition;
2. Fundamentals of Python, Kenneth A. Lambert, Cengage Learning,1 edition;
3. Foundations for Analytics with Python by Clinton W. Brownley, O'Reilly
   Media; 1 edition

Course Outcomes:

Students shall be able to

1. Develop simple applications using Python.
2. Write modular programs in python.
3. Work with python instances.
4. Develop GUI applications using python.