ACADEMIC REGULATIONS,
COURSE STRUCTURE
and
DETAILED SYLLABUS

CHOICE BASED CREDIT SYSTEM

R21

M.Tech – Power Electronics

M.Tech - Regular Two Year Degree Programme
(For batches admitted from the academic year 2021 - 2022)

Holy Mary Institute of Technology & Science
Bogaram (V), Keesara (M), Medchal (Dist) - 501 301

FOREWORD

The autonomy is conferred on Holy Mary Institute of Technology & Science by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

Holy Mary Institute of Technology & Science is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a two decades in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college to order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

M. Tech. - Regular Two Year Degree Programme
(For batches admitted from the academic year 2021 - 22)

For pursuing two year post graduate Masters Degree Programme of study in Engineering (M.Tech) offered by Holy Mary Institute of Technology & Science under Autonomous status and herein referred to as HITS (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2021-22 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Holy Mary Institute of Technology & Science (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Holy Mary Institute of Technology & Science shall be the Chairman, Academic Council.

1. ADMISSION

Admission into first year of two year M. Tech. degree Program of study in Engineering:
Eligibility:

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

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

The medium of instructions for the entire post graduate programme in Engineering & technology will be English only.

2. AWARD OF M. Tech. DEGREE

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 two academic years of course work, failing which he shall forfeit his seat in M. Tech. programme.

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

The minimum instruction days in each semester are 90.

3. BRANCH OF STUDY

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

1. Highway Engineering
2. CSE
3. Computer Networks & Information Security
4. Embedded Systems
5. VLSI Design
6. Electrical Power Systems
7. Power Electronics
8. CAD / CAM
9. Machine Design

4. COURSE REGISTRATION

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice / Option for 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, ensuring 'DATE and TIME Stamping'. The 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 Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

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

4.5 Course Registrations are final and CANNOT be changed, nor can they be 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. ATTENDANCE

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

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

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below75%) in each semester shall be granted by the College Academic Committee.

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end semester examination of that subject and their registration shall stand cancelled.

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

5.6 A Candidate shall put in a minimum required attendance at least three (3) theory courses in I Year I semester for promoting to I Year II Semester. 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.

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

6. EVALUATION

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

- For the theory courses 70 marks shall be awarded for the performance in the Semester End Examination and 30 marks shall be awarded for Continuous Internal Evaluation (CIE). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other, immediately after the completion of Semester instructions. Each mid-term examination shall be conducted for a total duration of 120 minutes.

Continuous Internal Examination (CIE)

- Subjective Paper shall contain three questions. Question 1 & 2 with internal choice from unit-I, question 3 & 4 with internal choice from unit-II and question no 5 & 6 may be having a, b sub questions with internal choice from first half part of unit-III for CIE-I. For CIE-II 1 & 2 questions from unit-4, questions 3 & 4 from unit-5 and question no 5 & 6 from remaining half part of unit-3. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. Question no. 1 to 6 carries 10 Marks.

Semester End Examination (SEE)

- The Semester End Examination will be conducted for 70 marks examination shall be conducted for a total duration of 180 minutes. Question paper consists of Part–A and Part-B with the following.
- Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 4 marks each.
- Part-B to be answered 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.

6.1 For practical courses, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded for day-to-day performance as Internal Marks.

6.2 For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Chief Controller of Examination in one week before for commencement of the lab end examinations.

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

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

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

6.6 A candidate shall be given one chance to re-register for the courses if the internal marks secured by a candidate is less than 50% and failed in that course for maximum of two courses and should register within four weeks of commencement of the class work. In such a case, the candidate must re-register for the courses 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 Semester End Examination in those courses. In the event of the student taking another chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stands cancelled.

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

6.8 Offering one open elective courses in III-Semester along with core and specialized courses as a part of inculcating knowledge to the student.

7. 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/Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item6above, and a corresponding Letter Grade shall be given.

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

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

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

7.4 A student not appeared for examination then 'AB' Grade will be allocated in any 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 Subject / Course.

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

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

7.9 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course.

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

7.10 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP)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

$$\textbf{SGPA} = \{\sum_{i=1}^{N} C_i\, G_i\} / \{\sum_{i=1}^{N} C_i\} \text{ …. For each Semester,}$$

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), C_i is the no. of Credits allotted to that ix Course, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that its Course.

Illustration of Computation of SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	3	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x10= 30
Course5	3	C	5	3 x 5 = 15
Course6	3	B	6	4 x 6 = 24

Thus, **SGPA =139/18 =7.72**

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

$$\text{CGPA} = \{\sum_{j=1}^{M} C_j\, G_j\} / \{\sum_{j=1}^{M} C_j\} \ldots \text{ for all S Semesters registered}$$

(i.e., up to and inclusive of S Semesters, S ≥ 2)

where 'M' is the TOTAL no. of Courses (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Course indicator index (takes into account all Courses from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Course, and G_j

represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Course. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4
Credits : 18 SGPA : 7.72	Credits : 18 SGPA : 7.8	Credits : 12 SGPA : 5.6	Credits : 20 SGPA : 6.0

Thus, **CGPA =** $\dfrac{18 \times 7.72 + 18 \times 7.8 + 12 \times 5.6 + 20 \times 6.0}{68} = 6.86$

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

7.13 No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given semester.

7.14 Conversion formula for the conversion of GPA into indicative percentage is

% of marks scored = (final CGPA -0.50) x 10

8. EVALUATION OF PROJECT/DISSERTATION WORK

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

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

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

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

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

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

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

8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 30%, 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 Dissertation Phase-I in II Year I Sem. there is an internal marks of 100, the evaluation should be done by the PRC for 50 marks and Supervisor will evaluate for 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Phase-I. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.

8.10 For Dissertation Phase-II (Viva Voce) in II Year II Sem. There is an internal marks of 50, the evaluation should be done by the PRC for 25 marks and Supervisor will evaluate for 25 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. There is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations and he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

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

8.12 The thesis shall be adjudicated by one examiner selected by the Chief Controller of Examinations. For this, the HOD of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned and Head of the Department.

8.13 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

8.14 If the report of the examiner is favorable, Project dissertation shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.

8.15 The Head of the Department shall coordinate and make arrangements for the conduct of Project dissertation.

8.16 For Audit Course (Non-Credit Courses) offered in a Semester, after securing ≥ 65% attendance and has secured not less than 40% marks in the SEE, and a minimum of 50% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for these courses/activities. However, for non-credit courses '**SATISFACTORY'** or "**UNSATISFACTORY'** shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9. AWARD OF DEGREE AND CLASS

9.1 A Student who registers for all the specified Courses/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of 68 Credits (with CGPA ≥ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 **Award of Class**

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

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 7.00 to < 8.00 CGPA
Second Class	≥ 6.00 to < 7.00 CGPA

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. WITHOLDING OF RESULTS

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

11. TRANSITORY REGULATIONS

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

11.2 The candidate who fails in any course will be given two chances to pass the same course; otherwise, he has to identify an equivalent course as per HITS21 Academic Regulations.

12 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd semester shall be conducted with the regular examinations of even semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write more than one examination.

13. REVALUATION

Students shall be permitted for revaluation after the declaration of end semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

14. AMENDMENTS TO REGULATIONS

The Academic Council of Holy Mary Institute of Technology & Science reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

15. GENERAL

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

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

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

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

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

MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER CONDUCT IN EXAMINATIONS

S. No	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 course 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course 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 course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course 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 and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practical's 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 examinations. The continuation of the course by the candidate is course 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 in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course 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 examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations 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 addl. Controller of examinations, 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 course 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 also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
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 course 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 examinations. The continuation of the course by the candidate is course 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 course 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.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course 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. 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 course 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.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

COURSE STRUCTURE

Dept. of M.Tech – Power Electronics

I M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1PE101PC	Power Electronic Converters	PC	3	-	-	3	30	70	100
B1PE102PC	Machine Modeling and Analysis	PC	3	-	-	3	30	70	100
B1PE103PC	Power Electronics for Renewable Energy Systems	PC	3	-	-	3	30	70	100
	Professional Elective - I	PE	3	-	-	3	30	70	100
	Professional Elective - II	PE	3	-	-	3	30	70	100
B1PE104PC	Machine Modelling and Analysis Lab	PC	-	-	3	1.5	30	70	100
B1PE105PC	Power Electronic Converters Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Mandatory Course (Non-Credit)									
B1PE101AC	Audit Course - I	AC	2	-	-	-	100	-	100

I M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1PE206PC	Advanced Power Electronic Converters	PC	3	-	-	3	30	70	100
B1PE207PC	Electrical Drives	PC	3	-	-	3	30	70	100
B1PE208PC	Reactive Power Compensation and Management	PC	3	-	-	3	30	70	100
	Professional Elective – III	PE	3	-	-	3	30	70	100
	Professional Elective – IV	PE	3	-	-	3	30	70	100
B1PE209PC	Advanced Power Electronic Converters Lab	PC	-	-	3	1.5	30	70	100
B1PE210PC	Electrical Drives Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Mandatory Course (Non-Credit)									
B1PE202AC	Audit Course - II	AC	2	-	-	-	100	-	100

II M.Tech I Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
	Professional Elective - V	PE	3	-	-	3	30	70	100
	Open Elective	OE	3	-	-	3	30	70	100
B1PE301PC	Technical Seminar	PC	2	-	-	2	100	-	100
B1PE301PW	Dissertation Phase - I	PWC	-	-	16	8	100	-	100
TOTAL			**8**	**-**	**16**	**16**	**260**	**140**	**400**

II M.Tech II Semester									
Course Code	Course Title	Category	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
B1PE402PW	Dissertation Phase - II	PWC	-	-	32	16	50	150	200
TOTAL			**-**	**-**	**32**	**16**	**50**	**150**	**200**

Total Credits = 68

PROFESSIONAL ELECTIVES			
PE- I		**PE- II**	
B1PE101PE	Smart Grid Technologies	B1PE104PE	Power Semiconductor Devices and Modelling
B1PE102PE	Dynamics of Electrical Machines	B1PE105PE	High Frequency Magnetic Components
B1PE103PE	Modern Control Theory	B1PE106PE	Hybrid Electric Vehicles
PE- III		**PE- IV**	
B1PE207PE	Industrial Load Modelling and Control	B1PE210PE	Distributed Generation
B1PE208PE	SCADA Systems and Applications	B1PE211PE	Power Quality
B1PE209PE	PWM Converters and Applications	B1PE212PE	Integration of Energy Sources
PE- V			
B1PE313PE	Reliability Engineering		
B1PE314PE	Flexible AC Transmission Systems		
B1PE315PE	HVDC Transmission		

OPEN ELECTIVES	
B1PE301OE	Industrial Safety
B1PE302OE	Operations Research
B1PE303OE	Cost Management of Engineering Projects
B1PE304OE	Energy from Waste

AUDIT COURSE I		AUDIT COURSE II	
B1PE101AC	English for Research Paper Writing	B1PE203AC	Disaster Management
B1PE102AC	Research Methodology and IPR	B1PE204AC	Personality Development Through Life Enlightment Skills

DETAILED SYLLABUS

I-YEAR (I-SEMESTER)

POWER ELECTRONIC CONVERTERS

I M.Tech-I Semester **L T P C**
Course Code: B1PE101PC **3 - - 3**

COURSE OBJECTIVES:

To learn

1. Understand the principle of operation of modern power semiconductor devices.
2. Comprehend the concepts of different power converters and their applications
3. Analyze and design switched mode regulators for various industrial applications

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Choose appropriate device for a particular converter topology.
2. Use power electronic simulation packages for analyzing and designing power converters

UNIT I AC VOLTAGE CONTROLLERS

Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive-inductive- induce e.m.f. loads – ac voltage controllers with PWM Control – Effects of source and load inductances -Synchronous tap changers. Three phase AC voltage controllers –Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – Applications & Problems

UNIT II CYCLO-CONVERTERS

Single phase to single phase cyclo-converters – analysis of midpoint and bridge Configurations – Three phase to three phase cyclo-converters –analysis of Midpoint and bridge configurations – Limitations –Advantages – Applications & Problems - Matrix Converter

UNIT III SINGLE PHASE & THREE PHASE CONVERTERS

Single phase converters – Half controlled and Fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – single phase dual converters– power factor Improvements Techniques– Extinction angle control – symmetrical angle control, PWM– single phase sinusoidal PWM – single phase series converters – overlap analysis – Applications& Problems. Three phase converters – Half controlled and fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – three phase dual converters– power factor Improvements Techniques– three phase PWM - twelve pulse converters – Applications– Problems – Design of converters.

UNIT IV DC TO DC CONVERTERS

Analysis of step-down and step-up dc to dc converters with Resistive and Resistive-inductive loads – Switched mode regulators – Analysis of Buck Regulators - Boost regulators – buck and boost regulators– Cuk regulators – Condition for continuous inductor current and capacitor voltage – comparison of regulators –Multi output boost converters – advantages – Applications – Problems.

UNIT V PULSE WIDTH MODULATED INVERTERS

Principle of operation – performance parameters – single phase bridge inverter- evaluation of output voltage and current with resistive, inductive and Capacitive loads– Voltage control of single phase inverters – single PWM – Multiple PWM – sinusoidal PWM – modified PWM – phase displacement Control – Advanced modulation techniques for improved performance – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – Advantages – Applications & Problems. Three phase inverters – analysis of 180 degree conduction for output voltage And current with resistive, inductive loads – analysis of 120 degree Conduction – voltage control of three phase inverters –sinusoidal PWM – Third Harmonic PWM – 60 degree PWM – space vector modulation – Comparison of PWM techniques – harmonic reductions – Problems

TEXT BOOKS:

1. Mohammed H. Rashid "Power Electronics" Pearson Education Third Edition – First Indian reprint 2004.
2. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics" - John Wiley & Sons – Second Edition

REFERENCE BOOKS:

1. Milliman Shepherd and Lizang – "Power converters circuits" – Chapter 14 (Matrix converter) PP- 415-444.
2. M.H.Rashid - Power electronics hand book
3. Marian P. Kaźmierkowski, Ramu Krishnan, Frede Blabjerg Edition:" Control in power
4. electronics" illustrated Published by Academic Press, 2002
5. NPTEL online course, Power Electronics, by Prof. B. G. Fernandez.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9783527698523
2. https://ieeexplore.ieee.org/document/7497622
3. https://www.wiley.com/enar/Power+Electronic+Converters:+Dynamics+and+Control+in+Conventional+and+Renewable+Energy+Applications-p-9783527340224

E -TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9783527698523
2. https://www.mdpi.com/2079-9292/9/4/654/htm

MOOCS COURSE:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

MACHINE MODELING AND ANALYSIS

I M.Tech-I Semester **L T P C**
Course Code: B1PE102PC **3 - - 3**

COURSE OBJECTIVES:

To prepare the students to

1. Identify the methods and assumptions in modeling of machines.
2. Recognize the different frames for modeling of AC machines.
3. Write voltage and torque equations in state space form for different machines

COURSE OUTCOMES:

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

1. Develop the mathematical models of various AC and DC machines
2. Analyze the developed models in various reference frames

UNIT I BASIC TWO-POLE DC MACHINE

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

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

UNIT III VOLTAGE AND CURRENT EQUATIONS

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

UNIT IV CIRCUITS MODEL OF A 3PHASE SYNCHRONOUS MOTOR

Circuits model of a 3ph Synchronous motor – Two axis representation of Synchronous Motor. Voltage and current Equations in state – space variable form – Torque equation - dq model based short circuit fault analysis- emphasis on voltage, frequency and recovery time.

UNIT V MODELING

Modelling of Permanent Magnet Synchronous motor – Modelling of Brushless DC Motor.

TEXT BOOKS:

1. Generalized Machine theory - P.S. Bimbhra, Khanna Publishers
2. Analysis of electric machinery and Drives systems - Paul C. Krause, Oleg wasynezuk, Scott D.Sudhoff

REFERENCE BOOKS:

1. Thyristor control of Electric Drives - Vedam Subranmanyam.
2. Power System Stability and Control – Prabha Kundur, EPRI.
3. Performance optimization of induction motors during Voltage-controlled soft starting, Article in IEEE Transactions on Energy Conversion, July 2004.

WEB REFERENCES:

1. https://www.sanfoundry.com/best-reference-books-modeling-analysis-electrical-machines/
2. https://books.google.com/books/about/ELECTRICAL_MACHINES_MODELLING_AND_ANALYS.html?id=u3SADAAAQBAJ

E -TEXT BOOKS:

1. https://books.google.com/books/about/ELECTRICAL_MACHINES_MODELLING_AND_ANALYS.html?id=u3SADAAAQBAJ
2. https://www.ikbooks.com/books/book/engineering-computer-science/electrical-engineering/modeling-analysis-electrical-machine/9789384588267/

MOOCS COURSE:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

I M.Tech-I Semester **L T P C**
Course Code: B1PE103PC **3 - - 3**

COURSE OBJECTIVES

To prepare the students to

1. Provide knowledge about the stand alone and grid connected renewable energy systems.
2. Equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
3. Analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
4. Design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems. To develop maximum power point tracking algorithms

COURSE OUTCOMES

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

1. Ability to understand and analyze power system operation, stability, control and protection.
2. Ability to handle the engineering aspects of electrical energy generation and utilization.

UNIT I INTRODUCTION

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG

UNIT III POWER CONVERTERS

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS

Standalone operation of fixed and variable speed wind energy conversion systems and solar system. Grid connection Issues -Grid integrated PMSG, SCIG based WECS, grid Integrated solar system.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TEXT BOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 2009.

REFERENCE BOOKS:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non-conventional energy sources”, Khanna publishes, 1993.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118755525
2. https://www.mdpi.com/1996-1073/12/10/1852/pdf

E -TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118755525
2. https://www.springer.com/gp/book/9788132221180

MOOCS COURSE:

1. https://www.coursera.org/specializations/power-electronics

SMART GRID TECHNOLOGIES

(Professional Elective- I)

I M.Tech-I Semester **L T P C**
Course Code: B1PE101PE **3 - - 3**

COURSE OBJECTIVES

To learn

1. Understand concept of smart grid and its advantages over conventional grid.
2. Know smart metering techniques
3. Learn wide area measurement techniques
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid

COURSE OUTCOMES

At the end of the course, student will be able to:

1. Appreciate the difference between smart grid & conventional grid.
2. Apply smart metering concepts to industrial and commercial installations
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements
4. Come up with smart grid solutions using modern communication technologies

UNIT I INTRODUCTION TO SMART GRID

Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self-Healing Grid Present development & International policies in Smart Grid. Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation.

UNIT II GEOGRAPHIC INFORMATION SYSTEM

Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit(PMU)

UNIT III MICRO-GRID

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid, Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

UNIT IV POWER QUALITY ISSUES

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 APPLICATIONS

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area, Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols.

TEXT BOOKS:

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2011.
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press , 2009

REFERENCE BOOKS:

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, “Smart Grid: Technology and Applications” Wiley 2012.
2. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions “ CRC Press
3. A.G.Phadke, “Synchronized Phasor Measurement and their Applications”, Springer

WEB REFERENCES:

1. http://www.ecerg.com/iesres/data/Presentation_08_04_2016_r1.pdf
2. https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/DOE_SG_Book_Single_Pages%281%29.pdf
3. https://intra.ece.ucr.edu/~hamed/Smart_Grid_Topic_2_Smart_Grid.pdf
4. http://e4uhu.com/down/smart%20grid%20technology/JanakaGrid.pdf

E -TEXT BOOKS:

1. https://www.engineeringbookspdf.com/smart-grid-fundamentals-of-design-and-analysis-by-james-momoh/
2. https://www.springer.com/gp/book/9783662609293
3. https://www.ieee-pes.org/images/files/pdf/2012-pe-smart-grid-compendium.pdf

MOOCS COURSES:

1. https://www.coursera.org/lecture/electric-utilities/5-2-smart-grid-YUPgW
2. https://www.mooc-list.com/tags/smart-grids
3. https://online.stanford.edu/courses/xeiet137-smart-grid-sensing-data-analytics-and-control
4. https://onlinecourses.nptel.ac.in/noc19_ee64/preview

DYNAMICS OF ELECTRICAL MACHINES

(Professional Elective- I)

I M.Tech-I Semester **L T P C**
Course Code: B1PE102PE **3 - - 3**

COURSE OBJECTIVES

To prepare the students to

1. Understand generalized modeling of electrical machines
2. Analyze different electrical machines with dynamic modeling

COURSE OUTCOMES

After taking this course, the student will be able to:

1. Understand the basic mathematical analysis of electrical machines and its characteristics.
2. Understand behavior of electrical machines under steady state and transient state.
3. Understand dynamic modeling of electrical machines.

UNIT I BASIC MACHINE THEORY

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

UNIT II ELECTRO DYNAMICAL EQUATION & THEIR SOLUTIONS

Spring and Plunger system - Rotational motion – mutually coupled coils – Lagrange's equation – Application of Lagrange's equation solution of Electro dynamical equations.

UNIT III DYNAMICS OF DC MACHINES

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

UNIT IV INDUCTION MACHINE DYNAMICS

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

UNIT V SYNCHRONOUS MACHINE DYNAMICS

Electromechanical equation – motor operation – generator operation – small oscillations – general equations for small oscillations – representation of the oscillation equations in state variable form.

TEXT BOOKS:

1. Sen Gupta D.P. and J.W "Electrical Machine Dynamics "Macmillan Press Ltd 1980.
2. Bimbhra P.S. "Generalized Theory of Electrical Machines "Khanna Publishers 2002.

REFERENCE BOOKS:

1. Thyristor control of Electric Drives – Vedam Subranmanyam.
2. Performance optimization of induction motors during Voltage-controlled soft starting, Article in IEEE Transactions on Energy Conversion, July 2004.

WEB REFERENCES:

1. https://link.springer.com/content/pdf/bfm%3A978-1-349-01615-0%2F1.pdf
2. https://www.intechopen.com/books/matlab-a-fundamental-tool-for-scientific-computing-and-engineering applications-volume-1/dynamic-simulation-of-electrical-machines-and-drive-systems-using-matlab-gui

E -TEXT BOOKS:

1. https://www.scribd.com/document/350510697/D-P-Sen-Gupta-J-W-Lynn-Auth-Electrical-Machine-Dynamics-Macmillan-Education-UK-1980
2. https://link.springer.com/book/10.1007/978-1-349-01615-0

MOOCS COURSE:

1. https://nptel.ac.in/courses/108/106/108106023/
2. https://www.engineeringonline.ncsu.edu/course/ece-732-dynamics-and-control-of-electric-machines/

MODERN CONTROL THEORY

(Professional Elective- I)

I M.Tech-I Semester **L T P C**
Course Code: B1PE103PE **3 - - 3**

COURSE OBJECTIVES

1. To explain the concepts of basics and modern control system for the real time analysis and design of control systems.
2. To explain the concepts of state variables analysis.
3. To study and analyze nonlinear systems.
4. To analyze the concept of stability for nonlinear systems and their categorization.
5. To apply the comprehensive knowledge of optimal theory for Control Systems.

COURSE OUTCOMES

Upon completion of this course, students should be able to

1. Various terms of basic and modern control system for the real time analysis and design of control systems.
2. To perform state variables analysis for any real time system.
3. Apply the concept of optimal control to any system.
4. Able to examine a system for its stability, controllability and observability.
5. Implement basic principles and techniques in designing linear control systems.

UNIT I MATHEMATICAL PRELIMINARIES AND STATE VARIABLE ANALYSIS

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 systems – The concept of state – State space model of Dynamic systems – Time invariance and Linearity – Non uniqueness of state model – State diagrams for Continuous-Time State models - Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and it's properties. Complete solution of state space model due to zero input and due to zero state.

UNIT II CONTROLLABILITY AND OBSERVABILITY

General concept of controllability – Controllability tests, different state transformations such as diagonalization, Jordon canonical forms and Controllability canonical forms for Continuous-Time Invariant Systems – General concept of Observability – Observability tests for Continuous-Time Invariant Systems – Observability of different State transformation forms.

UNIT III STATE FEEDBACK CONTROLLERS AND OBSERVERS

State feedback controller design through Pole Assignment, using Ackkermans formula– State observers: Full Order and Reduced order observers.

UNIT IV NON-LINEAR SYSTEMS

Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash –Jump Phenomenon etc; Linearization of nonlinear systems, Singular Points and its types– Describing function– describing function of different types of nonlinear elements, – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Stability analysis of nonlinear systems based on phase-plane method.

UNIT V 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.

TEXT BOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009

REFERENCE BOOKS:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non-conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.

WEB REFERENCES:

1. https://civildatas.com/download/modern-control-theory-by-bakshi
2. https://www.engineeringbookspdf.com/modern-control-theory/
3. https://www.technicalbookspdf.com/modern-control-theory-pdf/

E -TEXT BOOKS:

1. http://docs.znu.ac.ir/members/pirmohamadi_ali/Control/Brogan(BookZZ.org).pdf

MOOCS COURSE:

1. https://www.coursera.org/lecture/bioengineering/introduction-to-the-control-theory-ni2VN
2. https://www.coursera.org/courses?query=control%20systems&page=1
3. https://nptel.ac.in/courses/107/106/107106081/
4. https://onlinecourses.nptel.ac.in/noc20_ee90/preview

POWER SEMICONDUCTOR DEVICES AND MODELLING

(Professional Elective- II)

I M.Tech-I Semester **L T P C**
Course Code: B1PE104PE **3 - - 3**

COURSE OBJECTIVES

To prepare the students to

1. Improve power semiconductor device structures for adjustable speed motor control applications.
2. Understand the static and dynamic characteristics of current controlled power semiconductor devices
3. Understand the static and dynamic characteristics of voltage controlled power semiconductor devices
4. Enable the students for the selection of devices for different power electronics applications
5. Understand the control and firing circuit for different devices.

COURSE OUTCOMES

Upon completion of this course, students should be able to:

1. Know the operating charactertics of various basic semiconductor devices and switches
2. Understand the advanced power semiconductor devices operation.
3. Know the modeling of basic and advanced semiconductor devices and switches through simulation
4. Analyze the applications of various power semiconductor switches

UNIT I POWER DIODES

Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristics-turn-on transient, turn off transient and reverse recovery transient, Schottky diodes, snubber requirements for diodes, diode snubber, modeling and simulation of Power diodes. 5 Hrs. Power BJT'S: Basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and it's control- FBSOA and RBSOA curves - on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turn-on transient, turn-off transient, storage time, base drive requirements, switching losses

UNIT II POWER BJT'S, SCR, TRIACS

Device protection- snubber requirements for BJT'S and snubber design switching aids, modeling and simulation of power BJT'S Basic structure, V-I characteristics, turn-on process, on-state operation, turn -off process, switching characteristics, turn-on transient and di/dt limitations, turn-off transient, turnoff time and reapplied dv/dt limitations, gate drive requirements, ratings of thyristors, snubber requirements and snubber design, modelling and simulation of thyristor Basic structure and operation-I characteristics, ratings, snubber requirements, modeling and simulation of triacs.

UNIT III GATE TURNOFF THYRISTOR & POWER MOSFET

Basic structure and operation, GTO switching characteristics, TO turn-on transient, GTO turn -off transient, minimum on and off state times, gate drive requirements, maximum controllable anode current, over current protection of GTO'S, modeling and simulation of GTO'S.

Basic structure, V-I characteristics, turn-on process, on state operation, turnoff process, switching Characteristics, resistive switching specifications, clamped inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses - dv/dt limitations, gating requirements, gate charge - ratings of MOSFET'S, FBSOA and RBSOA curves, device protection - snubber requirements, modeling and simulation of Power MOSFET'S.

UNIT IV INSULATED GATE BIPOLAR TRANSISTORS (IGBT'S)

Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specification –IGBT turn-on transient, IGBT turn off transient- current tailing - gating requirements ,ratings of IGBT'S,FBSOA and RBSOA curves, switching losses – minimum on and off state times, switching frequency capability – overcurrent protection of IGBT'S, short circuit protection, snubber requirements and snubber design.

UNIT V ADVANCED POWER SEMICONDUCTOR DEVICES

MOS gated thyristors, MOS controlled thyristors or MOS GTO'S, base resistance controlled thyristors, emitter switched thyristor, thermal design of power electronic equipment, modelling and simulation, heat transfer by conduction, transient thermal impedance, heat sinks, heat transfer by radiation and convection - heat sinks election for power semiconductor devices.

TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rd Edition. Wiley India Pvt Ltd, 2011.
2. G. Massobrio, P. Antognetti, "Semiconductor Device Modeling with Spice", McGrawHill, 2nd Edition, 2010.

REFERENCE BOOKS:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rd Edition. Wiley India Pvt Ltd, 2011.
2. G. Massobrio, P. Antognetti, "Semiconductor Device Modeling with Spice", McGrawHill, 2nd Edition, 2010.

WEB REFERENCES:

1. http://www.cluster2.hostgator.co.in/files/writeable/uploads/hostgator58966/file/powerelectronicssemoconductordevices.pdf
2. http://www.ime.cas.cn/icac/learning/learning_3/201907/P020190717354934353602.pdf
3. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470611494.fmatter

E -TEXT BOOKS:

1. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1043&context=elecengtheses

MOOCS COURSE:

1. https://www.coursera.org/lecture/converter-circuits/sect-4-2-0-introduction-to-power-semiconductors-b5VYY
2. https://www.coursera.org/specializations/power-electronics
3. https://nptel.ac.in/courses/108/102/108102145/
4. https://online.stanford.edu/courses/ee216-principles-and-models-semiconductor-devices

HIGH FREQUENCY MAGNETIC COMPONENTS

(Professional Elective- II)

I M.Tech-I Semester **L T P C**
Course Code: B1PE105PE **3 - - 3**

COURSE OBJECTIVES

To prepare the students to

1. Know about magnetic circuits
2. Know about high frequency magnetic components.

COURSE OUTCOMES

Upon completion of this course, students should be able to:

1. Design of magnetic components (i.e., inductor and transformer) in a converter.
2. Perform steady-state analysis of switched mode power supply.
3. Understand core loss in an electromagnetic device, recognize & describe its effect.
4. Describe the engineering uses of electromagnetic waves, by frequency band, and the respective hazards associated with them

UNIT I FUNDAMENTALS OF MAGNETIC DEVICES & MAGNETIC CORES

Introduction, Magnetic Relationships, Magnetic Circuits, Magnetic Laws, Eddy Currents, Core Saturation, Volt-Second Balance, Inductance, Inductance Factor, Magnetic Energy, Self-Resonant Frequency, Classification of Power Losses in Magnetic Components, Non-inductive Coils.

Introduction, Properties of Core Materials, Magnetic Dipoles, Magnetic Domains, Curie Temperature, Magnetization, Magnetic Materials, Hysteresis, Core Permeability, Core Geometries, Iron Alloy Cores, Amorphous Alloy Cores, Nickel–Iron and Cobalt–Iron Cores, Ferrite Cores, Powder Cores, Nano-crystalline Cores, Superconductors, Hysteresis Core Loss, Eddy-Current Core Loss, Total Core Loss, Complex Permeability

UNIT II SKIN EFFECT & PROXIMITY EFFECT AND WINDING RESISTANCE AT HIGH FREQUENCIES

Introduction, Magnet Wire, Wire Insulation, Skin Depth, Ratio of AC-to-DC Winding Resistance, Skin Effect in Long Single Round Conductor, Current Density in Single Round Conductor, Impedance of Round Conductor, Magnetic Field Intensity for Round Wire, Other Methods of Determining the Round Wire Inductance, Power Density in Round Conductor, Skin Effect on Single Rectangular Plate. Proximity and Skin Effects in Two Parallel Plates, Anti-proximity and Skin Effects in Two Parallel Plates, Proximity Effect in Multiple-Layer Inductor, Appendix: Derivation of Proximity Power Loss.

Introduction, Winding Resistance, Square and Round Conductors, Winding Resistance of Rectangular Conductor, Winding Resistance of Square Wire, Winding Resistance of Round Wire, Leakage Inductance, Solution for Round Conductor Winding in Cylindrical Coordinates, Litz Wire, Winding Power Loss for Inductor Current with Harmonics, Effective Winding Resistance for Non-sinusoidal Inductor Current, Thermal Model of Inductors

UNIT III DESIGN OF TRANSFORMERS

Introduction, Neumann's Formula for Mutual Inductance, Mutual Inductance, Energy Stored in Coupled Inductors, Magnetizing Inductance, Leakage Inductance, Measurement of Transformer Inductances, Stray Capacitance, High-Frequency Transformer Model, Non-interleaved Windings, Interleaved Windings, AC Current Transformers, Winding Power Losses with Harmonics, Thermal Model of Transformers.

Area Product Method, Optimum Flux Density, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM.

UNIT IV INTEGRATED AND DESIGN OF INDUCTORS

Introduction, Resistance of Rectangular Trace, Inductance of Straight Rectangular Trace, Construction of Integrated Inductors, Meander Inductors, Inductance of Straight Round Conductor, Inductance of Circular Round Wire Loop, Inductance of Two-Parallel Wire Loop, Inductance of Rectangle of Round Wire, Inductance of Polygon Round Wire Loop, Bond-wire Inductors, Single-Turn Planar Inductor, Inductance of Planar Square Loop, Planar Spiral Inductors, Multi-metal Spiral Inductors, Planar Transformers, MEMS Inductors, Inductance of Coaxial Cable, Inductance of Two-Wire Transmission Line, Eddy Currents in Integrated Inductors, Model of RF Integrated Inductors, PCB Inductors.

Restrictions on Inductors, Window Utilization Factor, Temperature Rise of Inductors, Mean Turn Length of Inductors, Area Product Method, AC Inductor Design, Inductor Design for Buck Converter in CCM, Inductor Design for Buck Converter in DCM method.

UNIT V SELF-CAPACITANCE

Introduction, High-Frequency Inductor Model, Self-Capacitance Components, Capacitance of Parallel-Plate Capacitor, Self-Capacitance of Foil Winding Inductors, Capacitance of Two Parallel Round Conductors, Capacitance of Round Conductor and Conducting Plane, Self- Capacitance of Single-Layer Inductors, Self-Capacitance of Multi-layer Inductors, Capacitance of Coaxial Cable.

TEXT BOOKS:

1. Design of Magnetic Components for Switched Mode Power Converters, Umanand L.hat, S.R., ISBN: 978-81- 224-0339-8, Wiley Eastern Publication, 1992.
2. High-Frequency Magnetic Components, Marian K. Kazimierczuk, ISBN: 978-0-470- 71453-9 John Wiley & Sons, Inc.

REFERENCE BOOKS:

1. G.C. Chryssis, High frequency switching power supplies, McGraw Hill, 1989 (2nd Edn.)
2. Eric Lowdon, Practical Transformer Design Handbook, Howard W. Sams & Co., Inc., 1980
3. “Thompson --- Electrodynamic Magnetic Suspension.pdf”
4. Witulski --- “Introduction to modeling of transformers and coupled inductors” Beattie ---“Inductance 101.pdf”
5. P. L. Dowell, "Effects of eddy currents in transformer windings.pdf"

WEB REFERENCES:

1. https://www.buecher.de/shop/leistungselektronik/high-frequency-magnetic-components-ebook-pdf/kazimierczuk-marian-k- /products_products/detail/prod_id/39935460/
2. http://convocation.smu.edu.in/7lun/05-deshaun-huel/OtRAUnxK.pdf

E -TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118717806
2. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781118717806.fmatter
3. https://sites.google.com/a/sturgisrapid.web.app/328ro4/high-frequency-magnetic-components-by-marian-k-kazimierczuk-b00gyxpbkq

MOOCS COURSE:

1. https://www.coursera.org/learn/magnetics-for-power-electronic-converters-v2

HYBRID ELECTRIC VEHICLES

(Professional Elective- II)

I M.Tech-I Semester **L T P C**
Course Code: B1PE106PE **3 - - 3**

COURSE OBJECTIVES

1. To understand upcoming technology of hybrid system
2. To understand different aspects of drives application
3. To Learning the electric Traction

COURSE OUTCOMES

Upon completion of this course, students should be able to:

1. Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. To learn electric drive in vehicles / traction.

UNIT I INTRODUCTION

History of hybrid and electric vehicles, Social and environmental importance of hybrid and electric vehicles, Impact of modern drive-trains on energy supplies, Basics of vehicle performance, vehicle power source characterization Transmission characteristics, Mathematical models to describe vehicle performance.

UNIT II INTRODUCTION TO VARIOUS HYBRID DRIVE

Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

UNIT III ELECTRIC COMPONENTS IN HYBRID AND ELECTRIC VEHICLES

Introduction to electric components used in hybrid and electric Vehicles, Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives configuration and control of Permanent Magnet Motor drives Configuration and control of Switch Reluctance, Motor drives, drive system efficiency.

UNIT IV POWER ELECTRONICS IN ENERGY STORAGE TECHNOLOGY

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics selecting the energy storage technology, Communications, supporting subsystems.

UNIT V ENERGY MANAGEMENT

Introduction to energy management and their strategies used in hybrid and electric vehicle, Classification of different energy management strategies Comparison of different energy management strategies Implementation issues of energy strategies.

TEXT BOOKS:

1. Sira -Ramirez, R. Silva Ortigoza, “Control Design Techniques in Power Electronics Devices” Springer.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, “Sliding mode control of switching Power Converters”

REFERENCE BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
4. Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

WEB REFERENCES:

1. https://core.ac.uk/download/pdf/41785444.pdf
2. http://www.ieahev.org/assets/1/7/2009_annual_report.pdf
3. http://www.ieahev.org/assets/1/7/Report2015_WEB.pdf

E -TEXT BOOKS:

1. http://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.routledge.com/rsc/downloads/CRC_Hybrid_Vehicles_Freebook.pdf

MOOCS COURSE:

1. https://nptel.ac.in/courses/108/103/108103009/

MACHINE MODELING AND ANALYSIS LAB

I M.Tech-I Semester **L T P C**
Course Code: B1PE104PC **- - 3 1.5**

COURSE OBJECTIVES

To prepare the students to

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

COURSE OUTCOMES

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

1. Develop the mathematical models of various machines like, induction motor and Synchronous
2. Machines, permanent magnet synchronous motor, brushless DC motor using modelling equations.
3. Analyze the developed models in various reference frames

LIST OF EXPERIMENTS

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

TEXT BOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 2009

REFERENCE BOOKS:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non-conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. Andrzej M. Trzynnadlowski, ‘Introduction to Modern Power Electronics’, 2nd edition, wiley India Pvt. Ltd, 2012.

WEB REFERENCES:

1. http://www.msec.ac.in/files/mech/lab/6_2.pdf
2. http://www.darshan.ac.in/DIET/EE/SubjectDetail/2720715

E -TEXT BOOKS:

1. https://www.vlab.co.in/broad-area-electrical-engineering

MOOCS COURSE:

1. https://www.coursera.org/lecture/modeling-simulation-natural-processes/modeling-and-simulation-F7vas

POWER ELECTRONIC CONVERTERS LAB

I M.Tech-I Semester **L T P C**
Course Code: B1PE105PC **- - 3 1.5**

COURSE OBJECTIVES:

To prepare the students to

1. Simulation of various AC-AC, AC-DC, DC-DC, DC-AC converter topologies Recognize the different frames for modelling of AC machines

COURSE OUTCOMES:

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

1. Simulate AC-AC Converters
2. Simulate AC-DC Converters
3. Simulate DC-DC Converters
4. Simulate DC-AC Converters
5. Analysis of various converter topologies developed

LIST OF EXPERIMENTS

Experiment 1 Single phase full converter using RL and E loads.
Experiment 2 Single phase semi converter using RL and E loads.
Experiment 3 Three phase full converter using RL and E loads.
Experiment 4 Three phase semi converter using RL and E loads.
Experiment 5 Single phase AC Voltage controller using RL load.
Experiment 6 Single phase Cyclo-converter using RL load.
Experiment 7 Three phase six stepped inverter
Experiment 8 Three-phase inverter with PWM controller.
Experiment 9 BUCK, BOOST and CUCK regulators
Experiment 10 Space vector PWM converter

TEXT BOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009

REFERENCE BOOKS:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non-conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. Andrzej M. Trzynnadlowski, ‘Introduction to Modern Power Electronics’, Second edition, wiley India Pvt. Ltd, 2012.

WEB REFERENCES:

1. https://www.scribd.com/document/284782110/Power-Converters-Lab-Manual
2. http://publish.illinois.edu/powerandenergy/files/2016/09/ECE469V32_Aug2016f.pdf

E -TEXT BOOKS:

1. https://www.springer.com/gp/book/9781447154778
2. https://www.freebookcentre.net/Electronics/Power-Electronics-Books.html

MOOCS COURSE:

1. https://www.coursera.org/specializations/power-electronics
2. https://engineering.purdue.edu/online/courses/power-electronic-converters-systems

ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PE101AC **2 - - -**

COURSE OBJECTIVES:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

COURSE OUTCOMES:
1. Students should be familiar with representative literary and cultural texts within a significant number of historical, geographical, and cultural contexts.
2. Students should be able to apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

UNIT I
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

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

UNIT IV
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT V
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS:
1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

REFERENCES BOOKS:
1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelber London, 2011

RESEARCH METHODOLOGY AND IPR
(Audit Course - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PE102AC **2 - - -**

COURSE OBJECTIVES:
1. To understand the research problem
2. To know the literature studies, plagiarism and ethics
3. To get the knowledge about technical writing
4. To analyze the nature of intellectual property rights and new developments
5. To know the patent rights

COURSE OUTCOMES:
At the end of this course, students will be able to
1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics

.

UNIT I
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II
Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT III
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

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

UNIT V
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:
1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”.

REFERENCE BOOKS:
1. Ranjit Kumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall , “Industrial Design”, McGraw Hill, 1992.
4. Niebel , “Product Design”, McGraw Hill, 1974.
5. Asimov , “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

I-YEAR (II-SEMESTER)

ADVANCED POWER ELECTRONIC CONVERTERS

I M.Tech-II Semester **L T P C**
Course Code: B1PE206PC **3 - - 3**

COURSE OBJECTIVES

Understand various advanced power electronics devices.

1. Describe the operation of multi-level inverters with switching strategies for high power applications.
2. Comprehend the design of resonant converters and switched mode power supplies.

COURSE OUTCOMES

At the end of the course, student will be able to:

1. Develop and analyze various converter topologies.
2. Design AC or DC switched mode power supplies.

UNIT I MODERN POWER SEMICONDUCTOR DEVICES

Modern power semiconductor devices – Insulated Gate Bipolar Transistor (IGBT) –MOSFET-MOS Turn Off Thyristor (MTO) – Emitter Turn Off Thyristor (ETO) – Integrated Gate-Commutated Thyristor (IGCTs) – MOS-controlled thyristors (MCTs) – Power integrated circuits (PICs) – symbol, structure and equivalent Circuit – comparison of their features

UNIT II RESONANT PULSE INVERTERS

Resonant pulse inverters – series resonant inverters – series resonant inverters with unidirectional switches – series resonant inverters with bidirectional switches – analysis of half bridge resonant inverter –evaluation of currents and voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverters – for series loaded inverter – for parallel loaded inverter – For series and parallel loaded inverters – parallel resonant inverters – Voltage control of resonant inverters – class E resonant inverter – class E resonant rectifier – evaluation of values of C's and L's for class E inverter and Class E rectifier – numerical problems.

UNIT III RESONANT CONVERTERS

Resonant converters – zero current switching resonant converters – L type ZCS resonant converter – M type ZCS resonant converter – zero voltage switching resonant converters – comparison between ZCS and ZVS resonant converters – Two quadrant ZVS resonant converters – resonant dc-link inverters – evaluation of L and C for a zero current switching inverter – Numerical problems factor and harmonic factor – continuous and Discontinuous load current – three phase dual converters – power factor Improvements Techniques– three phase PWM - twelve pulse converters – Applications – Problems – Design of converters.

UNIT IV MULTILEVEL INVERTERS

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

UNIT V DC & AC POWER SUPPLIES

DC power supplies – classification - switched mode dc power supplies – fly back Converter – forward converter – push-pull converter – half bridge converter – Full bridge converter – Resonant d c power supplies – bidirectional power supplies – Applications.AC power supplies – classification – switched mode ac power

supplies – Resonant AC power supplies– bidirectional ac power supplies – multistage conversions – control circuits – applications. Introduction– power line disturbances – power conditioners – Uninterruptible Power supplies – application.

TEXT BOOKS:

1. Mohammed H. Rashid "Power Electronics" Pearson Education Third Edition – First Indian reprint 2004.
2. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics" - John Wiley &Sons – Second Edition

REFERENCE BOOKS:

1. Milliman Shepherd and Lizang – "Power converters circuits" – Chapter 14 (Matrix converter) PP- 415-444.
2. M.H.Rashid - Power electronics hand book
3. Marian P. Kaźmierkowski, Ramu Krishnan, FredeBlabjerg Edition:" Control in power electronics" illustrated Published by Academic Press, 2002
4. NPTEL online course, Power Electronics, by Prof. B. G. Fernandez.

WEB REFERENCES:

1. https://sites.google.com/site/eeenotes2u/courses/advanced-power-electronics
2. https://www.routledge.com/Power-Electronics-Drives-and-Advanced-Applications/Kumar-Behera-Joshi-Bansal/p/book/9781138062399

E-TEXT BOOKS:

1. https://www.wiley.com/en-in/Advanced+Power+Electronics +Converters%3A+PWM+Converters +Processing+AC+Voltages-p-9781118880944
2. https://www.electronicbo.com/2019/06/Advanced-Power-Electronics-Converters.html

MOOCS COURSE:

1. https://www.classcentral.com/course/swayam-advance-power-electronics-and-control-12956
2. https://nptel.ac.in/courses/108/107/108107128/
3. https://onlinecourses.nptel.ac.in/noc20_ee28/preview

ELECTRICAL DRIVES

I M.Tech-II Semester **L T P C**
Course Code: B1PE207PC **3 - - 3**

COURSE OBJECTIVES:

1. Understand principle of operation of scalar control of ac motor and corresponding speed-torque characteristics
2. Comprehend the vector control for ac motor drive (IM and SM)
3. Explain the static resistance control and Slip power recovery drive
4. Explain synchronous motor drive characteristics and its control strategies
5. Comprehend the brushless dc motor principle of operation.

COURSE OUTCOMES:

1. Develop induction motor for variable speed operations using scalar and vector control techniques.
2. Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
3. Develop controllers for synchronous motor and variable reluctance motor.

UNIT I RECTIFIER CONTROLLED DC MOTOR:

Rectifier Controlled DC Motor:

Separately excited DC motors and DC series motors with single phase semi converter and single phase full converter-Three-phase controlled converter, control circuit, control modeling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, Three phase converter controlled DC motor drive – DC motor and load, converter.

Closed Loop Control of Dc Drive:

Current and speed controllers - Current and speed feedback – Design of controllers – Current and speed controllers – Motor equations – filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation – Harmonics and associated problems – sixth harmonics torque

UNIT II CHOPPER CONTROLLED DC MOTOR DRIVES

Principle of operation of the chopper – Chopper with other power devices – model of the chopper –input to the chopper – steady state analysis of chopper controlled DC motor drives

Closed loop operation: Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller – modeling of current controller – design of current controller.

UNIT III CONTROL OF INDUCTION MOTOR

Characteristics with variable voltage operation Variable frequency operation constant v/t operation –Variable stator current operation – Induction motor characteristics in constant torque and field weakening regions.

Stator Side Control: Scalar control – Voltage fed inverter control – Open loop volts/Hz control – speed control slip regulation

– speed control with torque and flux control – current controlled voltage fed inverter drive – inverters – evaluation of L and C for a zero current switching inverter – Numerical problems factor and harmonic factor – continuous and Discontinuous load current – three phase dual converters – power factor Improvements Techniques– three phase PWM - twelve pulse converters – Applications – Problems – Design of converters.

UNIT IV VECTOR CONTROL OF INDUCTION MOTOR DRIVES:

Principles of Vector control – Vector control methods – Direct methods of vector control – Indirect methods of vector control – Adaptive control principles – Self tuning regulator Model referencing control – Direct torque control of AC motors

UNIT V CONTROL OF SYNCHRONOUS MOTOR DRIVES:

Synchronous motor and its characteristics – Control strategies – Constant torque angle control – Unity power factor control – Constant mutual flux linkage control – closed loop operation.

TEXT BOOKS:

1. Electric Motor Drives Pearson Modeling, Analysis and control – R. Krishnan – Publications – 1st edition 2002.
2. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1st edition

REFERENCE BOOKS:

1. Power Electronics and Control of AC Motors – MD Murthy and FG Turn Bull Pergman Press 1st edition
2. Power Electronics and AC Drives – BK Bose – Prentice Hall Eagle wood diffs New Jersey - 1st edition
3. Power Electronic circuits Deices and Applications – M H Rashid – PHI – 1995.
4. Fundamentals of Electrical Drives – G. K. Dubey – Narosa publications – 1995.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118622735
2. https://books.google.co.in/books/about/Fundamentals_of_Electrical_Drives.html?id=2NsGKpLolsQC
3. https://www.freebookcentre.net/Electrical/Electric-Drives-Books.html

E-TEXT BOOKS:

1. https://easyengineering.net/a-first-course-on-electrical-drives-by-pillai/
2. http://www.freeengineeringbooks.com/Electrical/Electric-Drives-books.php
3. https://www.sanfoundry.com/best-reference-books-electrical-drives-control/

MOOCS COURSE:

1. https://www.classcentral.com/course/swayam-fundamentals-of-electric-drives-14073
2. https://onlinecourses.nptel.ac.in/noc19_ee65/preview
3. https://freevideolectures.com/course/3114/advanced-electric-drives
4. https://ocw.tudelft.nl/courses/electrical-machines-and-drives/

REACTIVE POWER COMPENSATION AND MANAGEMENT

I M.Tech-II Semester **L T P C**
Course Code: B1PE208PC **3 - - 3**

COURSE OBJECTIVES

1. To identify the necessity of reactive power compensation
2. To describe load compensation
3. To select various types of reactive power compensation in transmission systems
4. To illustrate reactive power coordination system
5. To characterize distribution side and utility side reactive power management

COURSE OUTCOMES

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

1. Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
2. Observe various compensation methods in transmission lines
3. Construct model for reactive power coordination

UNIT I LOAD COMPENSATION

Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples

UNIT II STEADY–STATE AND TRANSIENT STATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM

Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples.

Characteristic time periods – passive shunt compensation – static compensations - series capacitor compensation – compensation using synchronous condensers – examples

UNIT III REACTIVE POWER COORDINATION

Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of Quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency–Harmonics, radio frequency and electromagnetic interferences

UNIT IV DEMAND SIDE AND DISTRIBUTION SIDE REACTIVE POWER MANAGEMENT

Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels

System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics lanning capacitor placement – retrofitting of capacitor banks.

UNIT V USER SIDE REACTIVE POWER MANAGEMENT

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations

Electric Traction Systems and Are Furnaces:

Typical layout of traction systems – reactive power control requirements – distribution transformers-Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures–power factor of an arc furnace

TEXT BOOKS:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982.
2. Reactive power Management by D.M.Tagare, Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just "Reactive Power Compensation: A Practical Guide, April, 2012, Wiely publication.

WEB REFERENCES:

1. https://www.engineeringbookspdf.com/reactive-power-compensation-practical-guide-wolfgang-hofmann-jurgen-schlabbach-wolfgang-justauth/
2. https://www.scribd.com/document/352347061/REACTIVE-POWER-COMPENSATION-MANAGEMENT-pdf

E-TEXT BOOKS:

1. https://thebookee.net/re/reactive-power-compensation-and-management-textbook-free-download

MOOCS COURSE:

1. https://onlinecourses.nptel.ac.in/noc20_ee08/preview
2. https://www.coursera.org/lecture/linear-circuits-ac-analysis/4-3-power-factor-gdKA2
3. https://www.coursera.org/specializations/modeling-and-control-of-power-electronics
4. https://nptel.ac.in/courses/108/106/108106159/

INDUSTRIAL LOAD MODELLING AND CONTROL

(Professional Elective- III)

I M.Tech-II Semester **L T P C**
Course Code: B1PE207PE **3 - - 3**

COURSE OBJECTIVES

1. To understand the energy demand scenario
2. To understand the modeling of load and its ease to study load demand industrially
3. To know Electricity pricing models
4. Study Reactive power management in Industries

COURSE OUTCOMES

1. Knowledge about load control techniques in industries and its application
2. Different types of industrial processes and optimize the process using tools like LINDO and
3. LINGO.
4. Apply load management to reduce demand of electricity during peak time.
5. Apply different energy saving opportunities in industries

UNIT I INTRODUCTION

Electric Energy Scenario-Demand Side Management-Industrial Load Management, Load Curves-Load Shaping Objectives-Methodologies, Barriers; Classification of Industrial Loads- Continuous and Batch Processes -Load Modeling

UNIT II ELECTRICITY PRICING

Electricity pricing – Dynamic and spot pricing –Models, Direct load control- Interruptible load control, Bottom up approach- scheduling- Formulation of load models- Optimization and control algorithms - Case studies

UNIT III REACTIVE POWER MANAGEMENT

Reactive power management in industries-controls-power quality impacts application of filters Energy Saving in industries. Cooling and heating loads- load profiling- Modeling, Cool storage-Types- Control Strategies, Optimal operation-Problem formulation- Case studies.

UNIT IV CAPTIVE POWER UNITS

Captive power units- Operating and control strategies- Power Pooling- Operation models, Energy banking-Industrial Cogeneration

UNIT V SELECTION OF SCHEMES

Selection of Schemes Optimal Operating Strategies, Peak load saving-Constraints-Problem formulation- Case study, Integrated Load management for Industries

TEXT BOOKS:

1. C.O. Bjork “Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands, 1989
2. C.W. Gellings and S.N. Talukdar, “Load management concepts,” IEEE Press, New York, 1986, pp. 3-28.

REFERENCE BOOKS:

1. Y. Manichaikul and F.C. Schweppe," Physically based Industrial load", IEEE Trans. on PAS, April 1981.
2. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 1989.
3. I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi, 1995
4. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

WEB REFERENCES:

1. https://www.nerc.com/comm/PC/LoadModelingTaskForceDL/Dynamic%20Load%20Modeling%20Tech%20Ref%202016-11-14%20-%20FINAL.PDF
2. https://www.intechopen.com/books/energy-efficiency-the-innovative-ways-for-smart-energy-the-future-towards-modern-utilities/load-management-system-using-intelligent-monitoring-and-control-system-for-commercial-and-industrial
3. https://ieeexplore.ieee.org/document/9067735

E -TEXT BOOKS:

1. https://www.researchgate.net/publication/271272882_Overview_of_Existing_Load_Models_and_Their_Applications
2. https://www.scribd.com/document/413456161/Industrial-Load-Modeling

MOOCS COURSE:

1. https://www.giet.edu/wp-content/uploads/2020/02/M.Tech-Power-ElectronicsEE2018.pdf
2. https://www.aicte-india.org/downloads/MHRD%20moocs%20guidelines%20updated.pdf

SCADA SYSTEMS AND APPLICATIONS

(Professional Elective- III)

I M.Tech-II Semester **L T P C**
Course Code: B1PE208PE **3 - - 3**

COURSE OBJECTIVES

1. To understand what is meant by SCADA and its functions.
2. To know SCADA communication.
3. To get an insight into its application

COURSE OUTCOMES

1. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their Typical applications
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
3. Knowledge about single unified standard architecture IEC 61850.
4. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
5. Learn and understand about SCADA applications in transmission and distribution sector,

UNIT I INTRODUCTION

Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies. Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA.

UNIT II INDUSTRIES SCADA SYSTEM COMPONENTS

Schemes- Remote Terminal Unit (RTU), Intelligent Electronic
Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT III SCADA ARCHITECTURE

Various SCADA architectures, advantages and disadvantages of each system -single unified standard architecture –IEC 61850

UNIT IV SCADA COMMUNICATION

Various industrial communication technologies-wired and wireless methods and fiber optics. Open standard communication protocols.

UNIT V SCADA APPLICATIONS

Utility applications- Transmission and Distribution sector- operations, monitoring, analysis and improvement. Industries - oil, gas and water, Case studies, Implementation, Simulation Exercises.

TEXT BOOKS:

1. Stuart A. Boyer: “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of America Publications, USA, 2004.
2. Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes Publications, Oxford, UK, 2004.

REFERENCE BOOKS:

1. William T. Shaw, “Cybersecurity for SCADA systems”, Penn Well Books, 2006.
2. David Bailey, Edwin Wright, “Practical SCADA for industry”, Newnes, 2003.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/SCADA
2. https://www.mdpi.com/2227-7080/5/2/12/pdf
3. https://www.researchgate.net/publication/331589512_SCADA_Systems_Architecture_Based_on_OPC_and_Web_Servers_and_Integration_of_Applications_for_Industrial_Process_Control

E -TEXT BOOKS:

1. https://www.mdpi.com/2227-7080/5/2/12/pdf
2. https://www.cedengineering.com/userfiles/SCADA%20Systems.pdf

MOOCS COURSE:

1. https://www.google.com/aclk?sa=L&ai=DChcSEwjl5cyK7ZPwAhVHDCsKHW7zC9cYABADGgJzZg&ae=2&sig=AOD64_3FqgLYEwx3gOpL1Arf9V2UdLiipQ&q&adurl&ved=2ahUKEwi0-sKK7ZPwAhXZXisKHWBMAaAQ0Qx6BAgCEAE
2. https://www.google.com/aclk?sa=L&ai=DChcSEwjl5cyK7ZPwAhVHDCsKHW7zC9cYABAAGgJzZg&ae=2&sig=AOD64_3G4ZYccw_0nPDy8WNMmosc9LBf_w&q&adurl&ved=2ahUKEwi0-sKK7ZPwAhXZXisKHWBMAaAQ0Qx6BAgEEAE
3. https://sppumoodle.unipune.ac.in/course/view.php?id=220

PWM CONVERTERS AND APPLICATIONS

(Professional Elective- III)

I M.Tech-II Semester **L T P C**
Course Code: B1PE209PE **3 - - 3**

COURSE OBJECTIVES

1. Understand the concepts and basic operation of PWM converters, including basic circuit Operation and design.
2. Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality

COURSE OUTCOMES

1. Knowledge concepts and basic operation of PWM converters, including basic circuit operation and design
2. Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality
3. Able to recognize and use the following concepts and ideas: Steady-State and transient modeling and analysis of power converters with various PWM techniques.

UNIT I INTRODUCTION

AC/DC and DC/AC power conversion, Overview of applications of voltage source converters and current source converters

UNIT II PULSE WIDTH MODULATION TECHNIQUES

Pulse width modulation techniques for bridge converters, Bus clamping PWM. Space vector based PWM. Advanced PWM techniques.

UNIT III PRACTICAL DEVICES

Practical devices in converter, Calculation of switching and conduction power losses.

UNIT IV COMPENSATION

Compensation for dead time and DC voltage regulation, Dynamic model of PWM converter. Multilevel Converters, Constant V/F induction motor drives.

UNIT V ESTIMATION

Estimation of current ripple and torque ripple in inverter fed drives, Line-side converters with power Factor compensation. Active power filtering. Reactive power compensation, Harmonic current Compensation, Selective harmonic elimination PWM technique for high power electric drives.

TEXT BOOKS:

1. Mohan, Undeland and Robbins, “Power Electronics: Converters, Applications and Design”, John’s Wiley and Sons.
2. Erickson RW, “Fundamentals of Power Electronics”, Chapman and Hall

REFERENCE BOOKS:

1. Vithyathil. J, “Power Electronics: Principles and Applications”, McGraw Hill.
2. NPTEL Online Course, Pulse width Modulation for Power Electronic Converters by Dr. G.Narayanan,.

WEB REFERENCES:

1. https://www.kuk.ac.in/userfiles/file/Year2018/LeftLinks/MiscNotices/2246-3418(1).pdf
2. https://ieeexplore.ieee.org/document/658748
3. https://www.wiley.com/eus/Power+Electronic+Converters%3A+PWM+Strategies+and+Current+Control+Techniques-p-9781118622841

E -TEXT BOOKS:

1. https://books.google.com/books/about/Advanced_Power_Electronics_Converters.html?id=GO_sBQAAQBAJ
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118886953
3. https://web.iitd.ac.in/~anandarup/ell302_2017/ell302_2017.html

MOOCS COURSE:

1. https://nptel.ac.in/content/syllabus_pdf/108108035.pdf
2. https://freevideolectures.com/course/3345/pulse-width-modulation-for-power-electronic-converters

DISTRIBUTED GENERATION

(Professional Elective- IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PE210PE **3 - - 3**

COURSE OBJECTIVES

Understand renewable energy sources.

1. Gain understanding of the working of off-grid and grid-connected renewable energy generation Schemes.

COURSE OUTCOMES

1. Understand the planning and operational issues related to Distributed Generation.
2. Acquire Knowledge about Distributed Generation Learn Micro-Grids

UNIT I INTRODUCTION

Need for Distributed generation, Renewable sources in distributed generation and current scenario in Distributed Generation

UNIT II PLANNING OF DGS

Planning of DGs, Sitting and sizing of DGs optimal placement of DG sources in distribution systems, Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces, Aggregation of multiple DG units.

UNIT III TECHNICAL IMPACTS OF DGS

Technical impacts of DGs, Transmission systems Distribution Systems De-regulation Impact of DGs upon protective relaying, Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis.

UNIT IV ECONOMIC AND CONTROL ASPECTS OF DGS

Economic and control aspects of DGs Market facts, Issues and challenges Limitations of DGs, Voltage control techniques, Reactive power control, Harmonics Power quality issues, Reliability of DG based systems.

UNIT V INTRODUCTION TO MICRO-GRIDS

Introduction to micro-grids, Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids, Modeling & analysis of Micro-grids with multiple DGs, Micro-grids with power electronic interfacing units. Transients in micro-grids, Protection of micro-grids, Case studies, advanced topics.

TEXT BOOKS:

1. H. Lee Willis, Walter G. Scott, “Distributed Power Generation – Planning and Evaluation”, Marcel Decker Press.
2. M.GodoySimoes, Felix A.Farret, “Renewable Energy Systems – Design and Analysis with Induction Generators”, CRC press

REFERENCE BOOKS:

1. Stuart Borlase. “Smart Grid: Infrastructure Technology Solutions” CRC Press
2. NPTEL online course on “Power Electronics and Distributed Generation” by Dr. Vinod John, Department of Electrical Engineering, IISc Bangalore.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Distributed_generation
2. https://www.tandfonline.com/toc/ucgn21/current
3. https://www.tandfonline.com/loi/ucgn20

E -TEXT BOOKS:

1. https://www.tandfonline.com/toc/ucgn21/current
2. https://www.researchgate.net/publication/228838433_Distributed_Generation_in_Power_Systems_An_Overview_and_Key_Issues
3. https://www.sciencedirect.com/book/9780128042083/distributed-generation-systems

MOOCS COURSE:

1. https://www.aicte-india.org/downloads/MHRD%20moocs%20guidelines%20updated.pdf

POWER QUALITY

(Professional Elective- IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PE211PE **3 - - 3**

COURSE OBJECTIVES

1. To Study the basics of power quality, power quality problems and power quality standards,
2. To Study about the characteristics of non-linear loads
3. To Study Voltage, Current, Power and Energy measurements and analysis methods of
4. Laplace's, Fourier and Hartley and Wavelet Transforms
5. To Study the analysis and conventional mitigation methods
6. To Study about various devices used to enhance power quality

COURSE OUTCOMES

1. Know the different characteristics of electric power quality in power systems,
2. Learn about the applications of non-linear loads,
3. Know the applications of Hartley and Wavelet Transforms,
4. Learn how to mitigate the power quality problems
5. Learn about the application of FACTS device on DG side

UNIT I INTRODUCTION

Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT II LONG & SHORT INTERRUPTIONS

Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short Interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT III SINGLE AND THREE-PHASE VOLTAGE SAG CHARACTERIZATION

Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.

Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags

UNIT IV POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS

Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT V MITIGATION OF INTERRUPTIONS & VOLTAGE SAGS

Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards:

Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

TEXT BOOKS:

1. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.
2. "Power Quality VAR Compensation in Power Systems", R. SastryVedam Mulukutla S. Sarma,CRC Press.

REFERENCE BOOKS:

1. Power Quality, C. Sankaran, CRC Presss.
2. Electrical Power Systems Quality, Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H.
3. Wayne Beaty, Tata McGraw Hill Education Private Ltd

WEB REFERENCES:

1. https://www.pge.com/includes/docs/pdfs/mybusiness/customerservice/energystatus/powerquality/pqreferences-web-8-10-07.pdf
2. https://www.researchgate.net/publication/224365867_Development_of_Web_based_power_quality_monitoring_system_for_handling_user_custom_power_quality_query_and_auto_power_quality_monitoring_report_notification_via_email
3. http://www.gcebargur.ac.in/sites/gcebargur.ac.in/files/lectures_desk/electrical_power_systems_quality.pdf

E -TEXT BOOKS:

1. Http://Www.Gcebargur.Ac.In/Sites/Gcebargur.Ac.In/Files/Lectures_Desk/Electrical_Power_Systems_Quality.Pdf
2. Https://Www.Cet.Edu.In/Noticefiles/227_Electrical_Power_Quality-Peel5403-8th_Sem-Electrical.Pdf
3. Https://Www.Sciencedirect.Com/Book/9780128007822/Power-Quality-In-Power-Systems-And-Electrical-Machines

MOOCS COURSE:

1. https://files.eric.ed.gov/fulltext/EJ1120306.pdf
2. https://www.researchgate.net/publication/331327802_Quality_Reference_Framework_QRF_for_the_Quality_of_MOOCs

INTEGRATION OF ENERGY SOURCES

(Professional Elective- IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PE212PE **3 - - 3**

COURSE OBJECTIVES

1. Introduce the characteristics of various types of renewable energy sources and converters.
2. Explain the importance of storage and sizing of hybrid systems.
3. Introduce the control issues of isolated systems.
4. Explain the harmonics, power quality, voltage imperfections, power injection issues on the grid By integrating renewable energy sources

COURSE OUTCOMES

1. Identify the characteristics of renewable energy sources and converters.
2. Analyze the importance of storage and sizing of hybrid systems.
3. Realize the problems related to isolated systems.
4. Analyze the challenges faced by the grid by integrating renewable energy sources

UNIT I REVIEW OF CHARACTERISTICS POWER SOURCES

Basic review of power generation from wind - Solar PV - Thermal - Small hydro - Biomass power strategies in each of these energy conversion systems - Review of maximum power point tracking techniques in solar PV and wind (perturb & observe, hill climbs, incremental conductance).

UNIT II CONVERTER TOPOLOGIES

DC/DC converter (buck, boost, buck boost) - DC/AC inverters (sine, triangular, PWM techniques) - Phase locked loop for inverters. Period, voltage and current at post fault period, stochastic prediction of short Interruptions.

UNIT III HYBRID SYSTEMS

DC/DC converter (buck, boost, buck boost) - DC/AC inverters (sine, triangular, PWM techniques) - Phase locked loop for inverters.

UNIT IV ISOLATED SYSTEMS

Control issues in isolated systems for voltage and frequency - Small signal stability in isolated power systems - Importance of storage and dump load in isolated systems.

UNIT V ISSUES IN INTEGRATION OF RENEWABLE ENERGY SOURCES

Overview of challenges in integrating renewable sources to the grid - Impact of harmonics on power quality - Need to maintain voltage within a band and fluctuations in voltage because of renewable integration - Power inverter and converter technologies - Mechanism to synchronize power from renewable sources to the grid - Overview of challenges faced in designing power injection from offshore generation sources -Challenges in modeling intermittent nature of renewable power in a power system.

TEXT BOOKS:

1. Power Electronics, Converters, Applications and Design" by N. Mohan; T.M. Undeland; W.P. Robbins. 1995, John Wiley and Sons.
2. Renewable Energy Integration Challenges and Solutions Series: Green Energy and Technology Hossain, Jahangir, Mahmud, Apel (Eds.).

REFERENCE BOOKS:

1. Integration of Alternative Sources of Energy Felix A. Farret, M. Godoy Simões, December 2005, Wiley-IEEE Press.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/0471755621
2. https://www.wiley.com/en-gb/Integration+of+Alternative+Sources+of+Energy-p-x000285368
3. https://www.researchgate.net/publication/315669268_INTEGRATION_OF_RENEWABLE_ENERGY_SOURCES_IN_SMART_GRID_A_REVIEW

E -TEXT BOOKS:

1. https://www.sciencedirect.com/science/article/pii/0301421591901003
2. https://www.researchgate.net/publication/262264959_Integration_of_Renewable_Energy_Sources_in_Future_Power_Systems_The_Role_of_Storage

MOOCS COURSE:

1. https://www.mooc-list.com/tags/renewable-energy
2. https://www.aicte-india.org/downloads/MHRD%20moocs%20guidelines%20updated.pdf

ADVANCED POWER ELECTRONICS CONVERTER LAB

I M.Tech-II Semester **L T P C**
Course Code: B1PE209PC **- - 3 1.5**

COURSE OBJECTIVES

1. Speed control techniques of DC and AC drives
2. Gate drive circuit configurations for converter circuits
3. Advanced converter topologies
4. Open loop and closed loop speed control analysis of AC and DC drives

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. Know the speed control strategies of AC and DC drives
2. Design speed, current controllers for AC and DC drives
3. Get the knowledge on multi-level inverter/converter topologies
4. Perform the open loop and closed loop speed control analysis of AC and DC drives
5. Design the gate driver circuits for converter topologies
6. Know the complete study of advanced converter technologies

LIST OF EXPERIMENTS

Part-A

(Conduct any 5 hardware experiments from the above)
Experiment 1 Single phase diode clamped Multilevel inverter.
Experiment 2 Single phase flying capacitor Multilevel inverter
Experiment 3 Single phase cascaded multilevel inverter
Experiment 4 Push pull converter
Experiment 5 Fly back converter
Experiment 6 Forward converter
Experiment 7 Series resonant converter
Experiment 8 Parallel resonant converter
Experiment 9 ZVS
Experiment 10 ZCS

Part-B

(Conduct any 5 experiments using any simulation tool)
Experiment 1 Single phase diode clamped multilevel inverter.
Experiment 2 Single phase flying capacitor multilevel inverter
Experiment 3 Single phase cascaded multilevel inverter
Experiment 4 Push pull converter
Experiment 5 Fly back converter
Experiment 6 Forward converter
Experiment 7 Series resonant converter
Experiment 8 Parallel resonant converter
Experiment 9 ZVS
Experiment 10 ZCS

REFERENCE BOOKS:

1. https://www.kettering.edu/research/advanced-power-electronics-laboratory
2. https://www.gcek.ac.in/eee_advanced_powerelectronics_lab.php
3. https://ceme.ece.illinois.edu/files/2014/07/ECE469V25.pdf

WEB REFERENCES:

1. https://www.nielit.gov.in/aurangabad/content/power-electronics-lab
2. https://web.ecs.baylor.edu/faculty/grady/Grady_UT_Austin_EE462L_Fall_2010.pdf
3. https://www.bits-pilani.ac.in/hyderabad/EEE/PowerElectronicsLab

ELECTRICAL DRIVES LAB

I M.Tech-II Semester **L T P C**
Course Code: B1PE210PC **- - 3 1.5**

COURSE OBJECTIVES

1. To understand principle operation of scalar control of ac motor and corresponding speed-torque characteristics
2. To comprehend the vector control for ac motor drive (IM and SM)
3. To explain the static resistance control and Slip power recovery drive
4. To explain synchronous motor drive characteristics and its control strategies
5. To comprehend the brushless dc motor principle of operation.

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. Develop induction motor for variable speed operations using scalar and vector control techniques.
2. Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
3. Develop controllers for synchronous motor and variable reluctance motor.

LIST OF EXPERIMENTS

Experiment 1 Speed control of separately excited DC Motor Drive with 1 quadrant chopper
Experiment 2 Speed control of separately excited DC Motor Drive with 4 quadrant chopper
Experiment 3 Speed control of BLDC Motor Drive
Experiment 4 Multi-level inverter based AC Induction Motor Drive control equipment. .
Experiment 5 Speed control of 3-phase wound rotor Induction Motor Drive
Experiment 6 Speed control of 3-phase doubly fed Induction Motor Drive
Experiment 7 Speed control of 5-phase Induction Motor Drive
Experiment 8 Speed control of 3-phase Induction Motor Drive using V/F control.
Experiment 9 Speed control of 3-phase Induction Motor Drive using Vector Control technique.
Experiment 10 Speed Measurement and closed loop control using PMDC Motor Drive
Experiment 11 Speed measurement and closed loop control of PMDC Motor Drive with thyristor circuit
Experiment 12 Matrix Converter
Experiment 13 Speed measurement and closed loop control of IGBT used single 4 quadrant chopper for PMDC Motor Drive.
Experiment 14 Isolated Gate Drive circuits for MOSFET / IGBT based circuits.

REFERENCE BOOKS:

1. https://www.aryacollege.org/labmanuals/EDTC-LAB.pdf
2. https://www.jiscollege.ac.in/ee/pdf/EE%20791%20DRIVES%20LAB%20MAUAL.pdf
3. https://www.nit.ac.in/pdf/labs/electrical/drives.pdf

WEB REFERENCES:

1. https://www.dbit.ac.in/eee/syllabus/electric-drives-lab.pdf
2. https://tint.edu.in/tict-ee-department-laboratories/tint-ee-electric-drives-lab.html
3. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2018/15EE401L-electric-drives-eee.pdf

DISASTER MANAGEMENT
(Audit Course II)

I M.Tech-II Semester **L T P C**
Course Code: B1PE203AC **2 - - -**

COURSE OBJECTIVES:
Students will be able to
1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate Disaster risk reduction and humanitarian response policy and practice From multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches,

COURSE OUTCOMES:
1. Understanding Disasters, man-made Hazards and Vulnerabilities
2. Understanding disaster management mechanism
3. Understanding capacity building concepts and planning of disaster managements

UNIT I
Introduction:
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
Disaster Prone Areas in India:
Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT II
Repercussions of Disasters and Hazards:
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches,
Man-made Disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and\ Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT III
Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT IV
Risk Assessment Disaster Risk:
Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT V
Disaster Mitigation:
Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS:
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

REFERENCES BOOKS:

1. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
2. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

PERSONALITY DEVELOPMENT THROGH LIFE ENLIGHTMENT SKILLS

(Audit Course II)

I M.Tech-II Semester **L T P C**
Course Code: B1PE204AC **2 - - -**

PREREQUISITE: None

COURSE OBJECTIVES:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

COURSE OUTCOMES: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

II-YEAR (I-SEMESTER)

RELIABILITY ENGINEERING

(Professional Elective- V)

II M.Tech-I Semester **L T P C**
Course Code: B1PE313PE **3 - - 3**

COURSE OBJECTIVES

1. Comprehend the concept of Reliability and Unreliability
2. Derive the expressions for probability of failure, Expected value and standard deviation of
3. Binominal distribution, Poisson distribution, normal distribution and weibull distributions.
4. Formulate expressions for Reliability analysis of series-parallel and Non-series parallel systems
5. Derive expressions for Time dependent and Limiting State Probabilities using Markov models

COURSE OUTCOMES

1. Apply fundamental knowledge of Reliability to modelling and analysis of series parallel and Non-series parallel systems.
2. Solve some practical problems related Understand or become aware of various failures, causes of failures and remedies for failures in practical systems

UNIT I RELIABILITY AND PROBABILITY

Rules for combining probabilities of events, Definition of Reliability. Significance of the terms appearing in The definition. Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, Binominal distribution, Poisson distribution, normal distribution, exponential distribution Wei bull distribution.

UNIT II HAZARD RATE

Derivation of the reliability function in terms of the hazard rate. Failures: Causes of failures, types of failures (Early failures, chance failures and wear-out failures). Bath tub curve. Preventive and corrective maintenance. Modes of failure. Measures of reliability: mean time to failure and mean time between failures.

UNIT III CLASSIFICATION OF ENGINEERING SYSTEMS

Series, parallel and series-parallel systems- Expressions for the reliability of the basic configurations. Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cut sets from Event tree.

UNIT IV DISCRETE MARKOV CHAINS

General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model. Absorbing states. Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating time dependent and limiting state Probabilities of one component repairable model. Evaluation of limiting state probabilities of two component repairable model.

UNIT V FREQUENCY AND DURATION TECHNIQUES

Frequency and duration concepts, application to multi state problems, Frequency balance approach. Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. “Reliability evaluation of Engineering systems”, Roy Billinton and Ronald N Allan, BS Publications.
2. “Reliability Engineering”, Elsayed A. Elsayed, Prentice Hall Publications.

REFERENCE BOOKS:

1. "Reliability Engineering: Theory and Practice", By Alessandro Birolini, Springer Publications.
2. "An Introduction to Reliability and Maintainability Engineering", Charles Ebeling, TMH Publications.
3. "Reliability Engineering", E. Balaguruswamy, TMH Publications.

WEB REFERENCES:

1. https://dl.acm.org/citation.cfm?id=3006357
2. https://en.wikipedia.org/wiki/Site_reliability_engineering
3. https://www.linkedin.com/pulse/understanding-site-reliability-engineering-through-movies-laughlin

E -TEXT BOOKS:

1. https://reliabilityanalyticstoolkit.appspot.com/static/books.htm
2. https://www.springer.com/gp/book/9783642395345
3. https://www.weibull.com/knowledge/books.htm

MOOCS COURSE:

1. https://www.google.com/aclk?sa=L&ai=DChcSEwiOrZnz5pPwAhWCBXIKHcShDwUYABAAGgJzZg&ae=2&sig=AOD64_08QIytdxSq4RY0AWfPXFUCcODr8Q&q&adurl&ved=2ahUKEwjTtpLz5pPwAhWhW3wKHRPUCaoQ0Qx6BAgDEAE
2. https://www.coursera.org/learn/site-reliability-engineering-slos
3. https://dl.acm.org/doi/10.1145/3286606.3286834

FLEXIBLE AC TRANSMISSION SYSTEMS

(Professional Elective- V)

II M.Tech-I Semester **L T P C**
Course Code: B1PE314PE **3 - - 3**

COURSE OBJECTIVES

1. To develop the understanding of uncompensated lines and their behavior under heavy loading Conditions.
2. To understand the concept and importance controllable parameters of FACTS controllers.
3. To emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.
4. To analyse the functioning of series controllers like GCSC, TSSC and TCSC

COURSE OUTCOMES

1. Choose proper controller for the specific application based on system requirements
2. Understand various systems thoroughly and their requirements
3. Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz.
4. Transient stability Enhancement, voltage instability prevention and power oscillation damping
5. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

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. Hingorani H G and Gyugyi. L “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems” New York, IEEE Press, 2000.
2. Padiyar.K.R, “ FACTS Controllers in Power Transmission and Distribution” New Age Int. Publishers, 2007

REFERENCE BOOKS:

1. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modelling and Control", Springer, 2012.
2. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1999.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Flexible_AC_transmission_system
2. https://www.siemens-energy.com/global/en/offerings/power-transmission/portfolio/flexible-ac-transmission-systems.html
3. https://link.springer.com/referencework/10.1007/978-3-319-71926-9

E -TEXT BOOKS:

1. https://books.google.co.in/books/about/Flexible_Ac_Transmission_Systems_FACTS.html?id=AqPr4JyDWg0C
2. https://digital-library.theiet.org/content/books/po/pbpo030e
3. https://www.researchgate.net/publication/236623112_Flexible_AC_Transmission_System_Modelling_and_Control

MOOCS COURSE:

1. https://en.wikipedia.org/wiki/Flexible_AC_transmission_system
2. https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1208&context=ecetr
3. https://www.hindustanuniv.ac.in/assets/pdf/pg/Power-system-engineering-2018.pdf

HVDC TRANSMISSION

(Professional Elective- V)

II M.Tech-I Semester **L T P C**
Course Code: B1PE315PE **3 - - 3**

COURSE OBJECTIVES

1. Understand state of the art HVDC technology.
2. Learn the Methods to carry out modeling and analysis of HVDC system frontier-area power flow Regulation.

COURSE OUTCOMES

1. Expose the students to the state of the art HVDC technology.
2. Knowledge of modelling and analysis of HVDC system for inter-area power flow regulation.
3. Study of Neetishatakam will help in developing.

UNIT I DEVELOPMENT OF HVDC

Development of HVDC Technology, DC versus AC Transmission, Selection of converter configuration. Rectifier and Inverter operation, Digital Simulation of converters, Control of HVDC converters and Systems.

UNIT II INDIVIDUAL PHASE CONTROL

Individual phase control, Equidistant firing controls, higher level controls .Characteristics and non-characteristics harmonics filter design. Fault development and protection.

UNIT III INTERACTION BETWEEN AC-DC POWER SYSTEMS

Interaction between AC-DC power systems. Over voltages on AC/DC side, multi-terminal HVDC systems, control of MTDC systems.

UNIT IV MODELLING OF HVDC

Modelling of HVDC systems, per unit system, Representation for power flow solution, representation for stability studies

UNIT V STANDARDS

Introduction to relevant national and international standards, safe clearances for HV, Study regulation for HV tests, Digital techniques in HV measurements.

TEXT BOOKS:

1. J. Arrillaga, “High Voltage Direct Transmission”, Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, “HVDC Power Transmission Systems”, Wiley Eastern Ltd., 1990.

REFERENCE BOOKS:

1. E. W. Kimbark, “Direct Current Transmission”, Vol. I, Wiley Interscience, 1971.
2. Erich Uhlmann, “Power Transmission by Direct Current”, B.S. Publications, 2004

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/High-voltage_direct_current
2. https://ieeexplore.ieee.org/document/8740460

E -TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119566632
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470822975

MOOCS COURSE:

1. https://nptel.ac.in/courses/108/104/108104013/

INDUSTRIAL SAFETY

(Open Elective)

II M.Tech-I Semester **L T P C**
Course Code: B1PE301OE **3 - - 3**

COURSE OBJECTIVES:

1. To provide information regarding different elements of industrial water pollution and Methods of treatment.
2. To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Know how to take safety measures in executing works
2. Identify the need for maintenance (or) replacement of equipment
3. Understand the need for periodic and preventive maintenance

UNIT- I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, 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, Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication Side feed lubrication ,Ring lubrication ,Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion preventionmethods.

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 ,Any one machine tool, Pump Air compressor Internal combustion engine ,Boiler, 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 Machine tools, Pumps Air compressors ,Diesel generating (DG) sets,Program and schedule of preventive maintenance of mechanical and electrical equipment,Advantages of preventive maintenance. Repair cycle concept and importance

TEXT BOOKS

1. http://cms.sinhgad.edu/media/357263/book%20by%20dr.%20kale.pdf
2. http://kalasalingam.ac.in/site/wp-content/uploads/2015/10/M.Tech-Industrial-Safety-Engineering.pdf

REFERENCE BOOKS:

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

OPERATIONS RESEARCH

(Open Elective)

II M.Tech-I Semester **L T P C**
Course Code: B1PE302OE **3 - - 3**

COURSE OBJECTIVES:

1. To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems

COURSE OUTCOMES:

At the end of the course, the student should be able to

1. Apply the dynamic programming to solve problems of discreet andcontinuous variables.
2. Apply the concept of non-linear programming
3. Carry out sensitivity analysis
4. Able to model the real-world problem and simulate it.

UNIT I

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

UNIT II

Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method sensitivity analysis - parametric programming

UNIT III

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

UNIT IV

Scheduling and sequencing - single server and multiple server models – deterministic inventory models Probabilistic inventory control models - Geometric Programming.

UNIT V

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

TEXT BOOKS

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

REFERENCE BOOKS:

1. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
2. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
3. Pannerselvam, Operations Research: Prentice Hall of India 2010
4. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

II M.Tech-I Semester **L T P C**
Course Code: B1PE303OE **3 - - 3**

COURSE OBJECTIVES:

1. To make them understand the concepts of Project Management for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting

COURSE OUTCOMES:

1. .Understand project characteristics and various stages of a project.
2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic

UNIT I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision- making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre-project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT- III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing,Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT- IV

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

UNIT- V

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

TEXT BOOKS

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting

REFERENCE BOOKS:

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
3. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

ENERGY FROM WASTE

(Open Elective)

II M.Tech-I Semester **L T P C**

Course Code: B1PE304OE **3 - - 3**

COURSE OBJECTIVES:

1. To enable students to understand of the concept of Waste to Energy.
2. To link legal, technical and management principles for production of energy form waste.
3. To learn about the best available technologies for waste to energy

COURSE OUTCOMES:

1. Analyze of case studies for understanding success and failures.
2. Facilitate the students in developing skills in the decision making process.

UNIT- I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial aste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT- II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT- III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT- IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT- V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energyconversion - Biomass energy programme in India.

TEXT BOOKS

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II,Tata McGraw Hill Publishing Co. Ltd., 1983.

REFERENCE BOOKS:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley &Sons, 1996.