ACADEMIC REGULATIONS,

COURSE STRUCTURE

and

DETAILED SYLLABUS

CHOICE BASED CREDIT SYSTEM

R21

M.Tech - Electrical Power Systems

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

SGPA = $\{\sum_{i=1}^{N} C_i\, G_i\} / \{\sum_{i=1}^{N} C_i\}$ …. 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

CGPA = $\{ \sum_{j=1}^{M} C_j\, G_j \} / \{ \sum_{j=1}^{M} C_j \}$ … 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 =** $\frac{18 \times 7.72 + 18 \times 7.8 + 12 \times 5.6 + 20 \times 6.0}{68} = 6.86$

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

M.Tech – Electrical Power Systems

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
B1PS101PC	Power System Analysis	PC	3	-	-	3	30	70	100
B1PS102PC	Economic Operation of Power Systems	PC	3	-	-	3	30	70	100
B1PS103PC	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
B1PS104PC	Power Systems Computation Lab-I	PC	-	-	3	1.5	30	70	100
B1PS105PC	Advanced Power Systems Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Mandatory Course (Non-Credit)									
B1PS101AC	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
B1PS206PC	Digital Protection of Power System	PC	3	-	-	3	30	70	100
B1PS207PC	Power System Dynamics	PC	3	-	-	3	30	70	100
B1PS208PC	Electrical Power Distribution System	PC	3	-	-	3	30	70	100
	Professional Elective – III	PE	3	-	-	3	30	70	100
	Professional Elective – IV	PE	3	-	-	3	30	70	100
B1PS209PC	Power Systems Computation Lab-II	PC	-	-	3	1.5	30	70	100
B1PS210PC	Power System Protection Lab	PC	-	-	3	1.5	30	70	100
TOTAL			**15**	**-**	**6**	**18**	**210**	**490**	**700**
Mandatory Course (Non-Credit)									
B1PS202AC	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
B1PS301PC	Technical Seminar	PC	2	-	-	2	100	-	100
B1PS301PW	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
B1PS402PW	Dissertation Phase - II	PWC	-	-	32	16	50	150	200
TOTAL			**-**	**-**	**32**	**16**	**50**	**150**	**200**

Total Credits = 68

PROFESSIONAL ELECTIVES			
PE- I		**PE – II**	
B1PS101PE	HVDC Transmission	B1PS104PE	Reactive Power Compensation and Management
B1PS102PE	Smart Grid Technologies	B1PS105PE	Mathematical Methods for Power Engineering
B1PS103PE	Modern Control Theory	B1PS106PE	Hybrid Electric Vehicles
PE - III		**PE – IV**	
B1PS207PE	Restructured Power Systems	B1PS210PE	Power Quality
B1PS208PE	EHV AC Transmission	B1PS211PE	Power Apparatus Design
B1PS209PE	Industrial Load Modelling and Control	B1PS212PE	Power System Reliability and Planning
PE – V			
B1PS313PE	Power System Transients		
B1PS314PE	Flexible AC Transmission Systems		
B1PS315PE	SCADA System and Applications		

OPEN ELECTIVES	
B1PS301OE	Industrial Safety
B1PS302OE	Operations Research
B1PS303OE	Cost Management of Engineering Projects
B1PS304OE	Energy from Waste

AUDIT COURSE I		AUDIT COURSE II	
B1PS101AC	English for Research Paper Writing	B1PS203AC	Disaster Management
B1PS102AC	Research Methodology and IPR	B1PS204AC	Personality Development Through Life Enlightment Skills

DETAILED SYLLABUS

I-YEAR (I-SEMESTER)

POWER SYSTEM ANALYSIS

I M.Tech-I Semester **L T P C**
Course Code: B1PS101PC **3 - - 3**

COURSE OBJECTIVES:

Course Objectives: to prepare the students to

1. Build the Nodal admittance and Nodal impedance matrices of a practical network.
2. Study various methods of load flow.
3. Analyse various types of faults in power system.
4. Understand power system security concepts
5. Understand state estimation and study simple algorithms for state estimation.

COURSE OUTCOMES:

Students will be able to:
To build/construct YBUS and ZBUS of any practical network.

1. Calculate voltage phasors at all buses, given the data using various methods of load flow.
2. Calculate fault currents in each phase.
3. Rank various contingencies according to their severity.
4. Estimate the bus voltage phasors given various quantities viz. power flow, voltages, taps , CB status etc.

UNIT I NETWORK MATRICES

Introduction, per unit system, Bus Admittance Matrix, Network Solution, Network Reduction(Kron Reduction), YBUS structure and manipulation Bus Impedance matrix, Methods to determine columns of ZBUS.

UNIT II LOAD FLOW STUDIES

Overview of Gauss-Siedel, Newton-Raphson load flow methods, fast decoupled method, convergence properties, sparsity techniques, handling Qmax violations in constant matrix, inclusion in frequency effects, AVR in load flow, handling of discrete variable in load flow.

UNIT III FAULT CALCULATIONS

Symmetrical faults-Fault calculations using ZBUS - Fault calculations using ZBUS equivalent circuits, Selection of circuit breakers, symmetrical components, unsymmetrical faults - Problems on various types of faults.

UNIT IV CONTINGENCY ANALYSIS

Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, overload index ranking

UNIT V STATE ESTIMATION

Sources of errors in measurements, Virtual and Pseudo measurements, Observability concepts, Tracking state Estimation, Weighted Least Square method, Bad Data detection and estimation.

TEXT BOOKS:

1. J.J. Grainger &W.D. Stevenson, “Power system analysis”, McGraw Hill, 2003.
2. R. Bergen & Vijay Vittal , “Power System Analysis” ,Pearson ,2000

REFERENCE BOOKS:

1. L.P. Singh , “Advanced Power System Analysis and Dynamics”, New Age International,2006.
2. G.L. Kusic, “Computer aided power system analysis”, Prentice Hall India,1986.
3. A.J. Wood, “Power generation, operation and control” , John Wiley,1994.
4. P.M. Anderson, “Faulted power system analysis”, IEEE Press, 1995.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119546924.refs
2. http://onlinelibrary.wiley.com/doi/10.1002/9780470411377.refs/pdf
3. https://onlinecourses.nptel.ac.in/noc19_ee62/preview

E-TEXT BOOKS:

1. https://www.amazon.in/Analysis-McGraw-Hill-Electrical-Computer-Engineering/dp/0070612935
2. https://www.amazon.in/Power-System-Analysis-N-Ramana-ebook/dp/B00LOBI8G2
3. https://onlinelibrary.wiley.com/doi/book/10.1002/0471722901

MOOCS COURSES:

1. https://www.openlearning.com/courses/power-system-analysis
2. https://www.coursera.org/learn/electric-power-systems
3. https://www.classcentral.com/course/swayam-power-system-analysis-14243

ECONOMIC OPERATION OF POWER SYSTEMS

I M.Tech-I Semester **L T P C**
Course Code: B1PS102PC **3 - - 3**

COURSE OBJECTIVES:

Students will be able to:

1. Understand economic load scheduling problem and unit commitment problem.
2. Understand hydro-thermal scheduling problem.
3. Understand load frequency control (LFC)
4. Understand the optimal power flow (OPF) problem.

COURSE OUTCOMES:

The student will be able to

1. Distinguish between economic load dispatch and unit commitment problem
2. Solve economic load scheduling (with and without network losses) and unit commitment problem
3. Solve hydro-thermal scheduling problem
4. Analyze the single area and two area systems for frequency deviation
5. Solve the OPF problem using ac and dc load flow methods

UNIT I ECONOMIC LOAD SCHEDULING

Characteristics of Steam Turbine, Variations in steam unit characteristics, Economic dispatch with piecewise linear cost functions, Lambda Iterative method, LP method, Economic dispatch under composite generation production cost function, Base point and Participation factors, Thermal system Dispatching with Network losses.

UNIT II UNIT COMMITMENT

Unit Commitment–Definition–Constraints in Unit Commitment–Unit Commitment solution methods– Priority–List Methods – Dynamic Programming Solution.

UNIT III HYDRO THERMAL SCHEDULING

Characteristics of Hydroelectric units, Introduction to Hydrothermal coordination, Long-Range and Short-Range Hydro-Scheduling, Hydroelectric plant models, Hydrothermal scheduling with storage limitations, Dynamic programming solution to hydrothermal scheduling.

UNIT IV LOAD FREQUENCY CONTROL

Control of generation – models of power system elements – single area and two area block diagrams–generation control with PID controllers – implementation of Automatic Generation control (AGC) – AGC features.

UNIT V OPTIMAL POWER FLOW

Introduction to Optimal power flow problem, OPF calculations combining economic dispatch and power flow, OPF using DC power flow, Algorithms for solution of the ACOPF, Optimal Reactive Power Dispatch.

TEXT BOOKS:

1. Olle l. Elgerd, “Electric Energy Systems Theory an Introduction”, TMH, 2nd Edition,1983
2. J.J. Grainger &W.D.Stevenson, “Power system analysis ”, McGraw Hill,2003

REFERENCE BOOKS:

1. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé-Power Generation, Operation and Control-Wiley-Interscience(2013)
2. NPTEL Course, Prof.S.N. Singh, Power System Operation and Control,https://www.youtube.com/playlist?list=PL4BFB13CCDB954BCF

WEB REFERENCES:

1. https://link.springer.com/chapter/10.1007/978-1-4615-1465-7_2
2. https://www.researchgate.net/publication/282901269_economic_dispatch_in_power_systems
3. https://www.researchgate.net/publication/322256055_economic_operation_of_power_system_in_India

E-TEXT BOOKS:

1. https://www.routledge.com/Power-System-Economic-and-Market-Operations/Zhong/p/book/9781482299045
2. https://www.amazon.in/Economic-Operations-System-Nagendra-Swarnkar/dp/9382247041
3. https://www.amazon.in/Power-System-Operation-Robert-Miller/dp/0070671125

MOOCS COURSES:

1. https://www.mooc-list.com/course/electric-power-systems-coursera
2. https://www.classcentral.com/course/electric-power-systems-12053
3. https://www.coursera.org/learn/electric-power-systems

RENEWABLE ENERGY SYSTEMS

I M.Tech-I Semester **L T P C**
Course Code: B1PS103PC **3 - - 3**

COURSE OBJECTIVES:

Students will be able to:

1. Learn various renewable energy sources
2. Gain understanding of integrated operation of renewable energy sources
3. Understand power electronics interface with the grid

COURSE OUTCOMES:

Students will be able to:

1. Gain Knowledge about renewable energy
2. Understand the working of distributed generation system in autonomous/grid connected modes

UNIT I SOLAR ENERGY SYSTEMS

Introduction – solar radiation - solar thermal energy conversion - Flat plate collector - concentric collectors- solar pond - central receiver system- solar pumping - Solar photovoltaic systems - characteristics of PV cell- Photo voltaic modules - Types of Photo voltaic systems.

UNIT II WIND ENERGY AND BIO GAS

Basics of wind energy - classification of turbines - wind characteristics - energy extraction - Betz limit - Modes of wind power genera tion- Bio Mass energy conversion - Anaerobic Digestion - Aerobic Digestion - Gasification-Bio Gas Plants.

UNIT III OCEAN ENERGY CONVERSION

Tidal Energy generation - characteristics of Tides - Power generation schemes - Components in Tidal power plant- Wave Energy - Principle of wave energy plant - Wave energy conversion machines - Ocean Thermal Energy conversion - Principle - cycles of operation - Types of OTEC plants - Applications

UNIT IV GEO-THERMAL ENERGY AND FUEL CELLS

Hybrid Energy Systems: Geothermal Energy - Structure of Earth's interior - Geothermal fields, gradient, resources - Geothermal power generation - Fuel cells – Introduction - Principle of operation - Types of FUEL CELLS - State of art fuel cells-energy output of a fuel cell - operating characteristics of fuel cells - thermal efficiency - Need for Hybrid systems - Types of Hybrid systems.

UNIT V ENERGY SYSTEMS AND GRIDS

Introduction, Energy systems, Distribution technologies, Energy storage for grid electricity, Social and environmental aspects of energy supply and storage.
Electricity grids (networks), DC grids, Special challenges and opportunities for renewable electricity, Power Electronic Interface with the Grid

TEXT BOOKS:

1. D.P.Kothari, K.C.Singal, R.Ranjan," Renewable Energy Resources and emerging technologies"- PHI 2/e 2011.
2. John Twidell and Tony Weir, "Renewable Energy Resources" - 2nd edition, CRC Press.
3. Rakosh Das Begamudre, "Energy conversion systems"- New Age International Publishers, New Delhi - 2000.
4. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd Edition, Fspon & Co.

REFERENCE BOOKS:

1. Understanding Renewable Energy Systems, by Volker Quaschning, 2005, UK.
2. Renewable Energy Systems-Advanced Conversion, Technologies & Applications by Faner Lin Luo Honer Ye, CRC press, Taylor & Francis group.
3. NPTEL Course on Non-Conventional Energy Sources, https://www.youtube.com/playlist?list=PL3QMEfkolRFbGhXveCE7RFDBgY0_gRxkh

WEB REFERENCES:

1. https://www.nrdc.org/stories/renewable-energy-clean-facts
2. https://www.eia.gov/energyexplained/renewable-sources/
3. https://www.tandfonline.com/doi/full/10.1080/23311916.2016.1167990

E-TEXT BOOKS:

1. https://www.amazon.in/Textbook-Renewable-Energy-Bhatia-Gupta/dp/8193644603
2. https://www.amazon.in/Renewable-Energy-Resources-John-Twidell/dp/0415584388

MOOCS COURSES:

1. https://www.coursera.org/courses?query=renewable%20energyV
2. https://www.edx.org/learn/renewable-energy
3. https://www.classcentral.com/subject/renewable-energy

HVDC TRANSMISSION
(Professional Elective - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PS101PE **3 - - 3**

COURSE OBJECTIVES:
1. To prepare the students to understand the state-of-the-art of HVDC technology.
2. To enable the students to model and analyse HVDC systems

COURSE OUTCOMES:
Students will be able to:
1. Understand the state-of-the-art of HVDC technology.
2. Model and analye the HVDC system for inter-area power flow regulation.
3. Analyze the converter and dc grid faults and adopt methods to mitigate them.
4. Analyse the HVDC converter reactive power requirements and address the issues.

UNIT I GENERAL ASPECTS OF DC TRANSMISSION
Evolution of HVDC transmission, Comparison of HVDC and HVAC systems, Types of DC links, Components of a HVDC system, Valve characteristics, Properties of converter circuits, assumptions, single phase and Three-phase Converters, Pulse number, choice of best circuit for HVDC converters.

UNIT II ANALYSIS OF BRIDGE CONVERTER
Analysis of simple rectifier circuits, required features of rectification circuits for HVDC transmission. Analysis of HVDC converter: Different modes of converter operation, Output voltage waveforms and DC voltage in rectification, Output voltage waveforms and DC in inverter operation, Thyristor/Valve voltages. Equivalent electrical circuit.

UNIT III DC LINK CONTROL
Grid control, basic means of control, power reversal, limitations of manual control, Constant current versus Constant Voltage, Desired features of control.
Actual Control Characteristics: Constant-minimum-ignition-angle control, Constant-current control, Constant-extinction-angle control. Stability of control, tap-changer control, Power control and current limits, frequency control.

UNIT IV CONVERTER FAULTS & PROTECTION
Converter mal-operations, Commutation failure, Starting and shutting down the converter bridge, Converter protection.

UNIT V REACTIVE POWER MANAGEMENT
Smoothing reactor and DC Lines, Reactive power requirements, Harmonic analysis, Filter design

TEXT BOOKS:
1. J. Arrillaga, “High Voltage Direct Transmission”, Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, “HVDC Power Transmission Systems”, New Age International Publishers, 3rd Edition, 2015.

REFERENCE BOOKS:
1. High Voltage Direct Current Transmission, NPTEL Lectures by Prof. S. N. Singh, https://www.youtube.com/playlist?list=PL4B78E9972172086A
2. E. W. Kimbark, “Direct Current Transmission”, Vol. I, Wiley Interscience, 1971.
3. Erich Uhlmann, “Power Transmission by Direct Current”, B.S. Publications, 2004.
4. SN Singh, “Electric Power Generation, Transmission and Distribution, PHI, New Delhi 2nd edition, 2008.
5. V. Kamaraju,”HVDC Transmission” Tata McGraw-Hill Education Pvt Ltd,New delhi,2011.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108/104/108104013/
2. http://large.stanford.edu/courses/2010/ph240/hamerly1/docs/energyweek00.pdf
3. https://en.wikipedia.org/wiki/High-voltage_direct_current

E-TEXT BOOKS:

1. https://easyengineering.net/hvdc-power-transmission-systems-by-padiyar/
2. https://www.amazon.in/HVDC-Transmission-S-Kamakshaiah/dp/0071072535
3. https://www.amazon.in/HVDC-Power-Transmission-Systems-Padiyar/dp/1781831076

MOOCS COURSES:

1. https://www.coursebuffet.com/sub/electrical-engineering/488/high-voltage-dc-transmission
2. https://www.edx.org/course/multilevel-converters-for-mediumhigh-power-applica
3. https://www.flipkart.com/hvdc-transmission-b-tech-iv-year-ii-sem-eee-r15-mooc-3-jntu-anantapur-latest-2020/p/itma99e194323a61

SMART GRID TECHNOLOGIES
(Professional Elective - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PS102PE **3 - - 3**

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

COURSE OUTCOMES:
Students will be able to
1. Distinguish between conventional grid and smart 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. Develop smart grid solutions using modern communication technologies

UNIT I 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

UNIT II SMART METERS
Introduction to Smart Meters, Real Time Pricing, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Smart Appliances, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation, Wide Area Measurement System (WAMS), Phasor Measurement Unit (PMU)

UNIT III INFORMATION AND STORAGE SYSTEMS
Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, Pumped Hydro, Compressed Air Energy Storage, fuel-cells

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

UNIT V POWER QUALITY
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. and communication protocols in grid.

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”,
2. Wiley 2012
3. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions “ CRC Press
4. A.G.Phadke, “Synchronized Phasor Measurement and their Applications”, Springer
5. S. Chowdhury, S. P. Chowdhury, and P. Crossley, “Microgrids and active distribution networks”, IET, 2009, http://uni-site.ir/khuelec/wp-content/uploads/Microgrids-and-Active- Distribution-Networks.pdf

WEB REFERENCES:

1. https://policyreview.info/concepts/smart-technologies
2. https://dl.acm.org/doi/10.1145/2078316.2078321
3. https://www.igi-global.com/dictionary/smart-interactive-game-based-system-for-preschools-in-tanzania/38186

E-TEXT BOOKS:

1. https://www.springer.com/gp/book/9789811371387
2. https://www.worldscientific.com/worldscibooks/10.1142/4832
3. https://www.collins.in/product/collins-smart-tech/

MOOCS COURSES:

1. https://www.mooc-list.com/tags/smart-technologies
2. https://www.my-mooc.com/en/mooc/smart-device-mobile-emerging-technologies/
3. http://www.scitepress.org/Papers/2018/68097/68097.pdf

MODERN CONTROL THEORY
(Professional Elective - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PS103PE **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. 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.
6. Formulate and solve deterministic optimal control problems in terms of performance indices.
7. Apply knowledge of control theory for practical implementations in engineering and network analysis.

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.

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

UNIT III 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 IV STABILITY ANALYSIS:
Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

UNIT V STATE FEEDBACK CONTROLLERS AND OBSERVERS:
State feedback controller design through Pole Assignment, using Ackkermans formula– State observers: Full order and Reduced order observers

TEXT BOOKS:

1. M.Gopal, Modern Control System Theory, New Age International - 1984
2. Ogata. K, Modern Control Engineering, Prentice Hall - 1997

REFERENCE BOOKS:

1. N K Sinha, Control Systems, New Age International – 3rd edition.
2. Donald E.Kirk, Optimal Control Theory an Introduction, Prentice - Hall Network series - First edition.

WEB REFERENCES:

1. https://www.sciencedirect.com/topics/engineering/modern-control-theory
2. https://en.wikipedia.org/wiki/Control_theory
3. https://link.springer.com/chapter/10.1007/978-1-4615-0553-2_2

E-TEXT BOOKS:

1. https://www.amazon.in/Modern-Control-Theory-William-Brogan/dp/8131761673
2. https://www.amazon.in/Modern-Control-Theory-K-R-Verma-ebook/dp/B07FCBZ1NV
3. https://www.quora.com/Which-is-the-best-book-for-modern-control-theory

MOOCS COURSES:

1. https://www.quora.com/What-course-do-you-take-to-learn-control-theory
2. https://www.ou.edu/dreamcourse/past-courses/spring-2017/control-theory-and-apps
3. https://www.mooc-list.com/tags/modern-control

REACTIVE POWER COMPENSATION AND MANAGEMENT
(Professional Elective - II)

I M.Tech-I Semester **L T P C**
Course Code: B1PS104PE **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
4. Distinguish demand side reactive power management & user side reactive power management

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

UNIT II STEADY STATE AND TRANSIENT 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 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, economics planning, capacitor placement, retrofitting of capacitor banks

UNIT V USER SIDE REACTIVE POWER MANAGEMENT
KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations
Reactive power management in electric traction systems and arc 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 BOOK:
1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just “Reactive Power Compensation: A Practical Guide, April, 2012, Wiley publication.

WEB REFERENCES:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119967286
2. https://www.slideshare.net/NaveenKssvs/reactive-power-compensation-33009860
3. https://www.accessscience.com/content/reactive-power-compensation-technologies/YB084380

E-TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119967286
2. https://www.amazon.in/Reactive-Compensation-Hidaia-Mahmood-Alassouli-ebook/dp/B0798H9Y6J
3. https://www.amazon.in/Reactive-Power-Compensation-Practical-Guide/dp/0470977183

MOOCS COURSES:

1. https://www.iare.ac.in/?q=courses/mtech-electrical-power-systems/reactive-power-compensation-and-management
2. https://www.iare.ac.in/?q=pages/mtech-course-descriptions-r18-0
3. https://www.inspirenignite.com/jntuh/jntuh-m-tech-2017-2018-r17-detailed-syllabus-reactive-power-compensation-and-management-2/

MATHEMATICAL METHODS FOR POWER ENGINEERING
(Professional Elective - II)

I M.Tech-I Semester **L T P C**
Course Code: B1PS105PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Understand the relevance of mathematical methods to solve engineering problems.
2. Understand how to apply these Methods for a given engineering Problem.

COURSE OUTCOMES:
Students will be able to
1. Understand vector spaces, Linear transformation, eigenvalues and eigenvectors of linear Operators
2. Learn About Linear Programming Problems And Understand The Simplex Method For Solving linear Programming Problems in various fields of science And Technology
3. Acquire Knowledge About Nonlinear Programming And Various Techniques Used For Solving constrained and Unconstrained Nonlinear programming problems
4. Understand The Concept Of Random Variables, Functions Of Random Variable And Their probability Distribution
5. Understand stochastic processes and their classification

UNIT I
Vector spaces, Linear transformations, Matrix representation of linear transformation, Eigen values and Eigen vectors of linear operator

UNIT II
Linear Programming Problems, Simplex Method, Duality, Non Linear Programming problems

UNIT III
Unconstrained Problems, Search methods, Constrained Problems

UNIT IV
Lagrange method, Kuhn-Tucker conditions, Random Variables, Marginal and Conditional distributions, Elements of stochastic processes

UNIT V
Mathematical methods applied to Power Engineering, examples – economic load dispatch, optimal power flow, unit commitment

TEXT BOOKS:
1. Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd Edition, PHI, 1992
2. Erwin Kreyszig, “Introductory Functional Analysis with Applications”, John Wiley & Sons, 2004

REFERENCE BOOKS:
1. Irwin Miller and Marylees Miller, John E. Freund’s “Mathematical Statistics”, 6th Edn, PHI, 2002
2. J. Medhi, “Stochastic Processes”, New Age International, New Delhi., 1994
3. A Papoulis, “Probability, Random Variables and Stochastic Processes”, 3rd Edition, McGraw Hill, 2002
4. John B Thomas, “An Introduction to Applied Probability and Random Processes”, John Wiley, 2000
5. Hillier F S and Liebermann G J, “Introduction to Operations Research”, 7th Edition, McGraw Hill, 2001
6. Simmons D M, “Non Linear Programming for Operations Research”, PHI, 1975
7. MIT online course, Prof. Gilbert Strang, Linear Algebra, https://www.youtube.com/playlist?list=PL49CF3715CB9EF31D
8. Matpower, Free open-source tools for electric power system simulation and optimization, https://matpower.org/

WEB REFERENCES:

1. https://www.cambridge.org/core/books/mathematical-methods-in-electrical-engineering/439FCA0C1EE9EDD12780A01159394BDDB
2. http://www.astrosen.unam.mx/~aceves/Metodos/ebooks/riley_hobson_bence.pdf
3. https://www.hindawi.com/journals/mpe/

E-TEXT BOOKS:

1. https://www.amazon.in/Mathematical-Methods-Electrical-Engineering-Thomas/dp/0521306612
2. https://www.cambridge.org/core/books/mathematical-methods-in-electrical-engineering/439FCA0C1EE9EDD12780A01159394BDD
3. https://www.routledge.com/Mathematical-Methods-for-Physics-and-Engineering/Blennow/p/book/9781138056886

MOOCS COURSES:

1. https://www.mooc-list.com/tags/mathematical-methods
2. https://nptel.ac.in/courses/108/108/108108109/
3. https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering

HYBRID ELECTRIC VEHICLES
(Professional Elective - II)

I M.Tech-I Semester **L T P C**
Course Code: B1PS106PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Understand upcoming technology of hybrid system
2. Understand different aspects of drives application
3. Learn the electric traction

COURSE OUTCOMES:
Students will be able to
1. Acquire fundamental concepts and principles of hybrid electric vehicles (HEV)
2. Design and analyse HEVs
3. Apply electric drives in vehicles / traction
4. Understand energy management in HEVs

UNIT I INTRODUCTION TO HYBRID ELECTRIC VEHICLES (HEV)
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 HYBRID TRACTION
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 CONTROL OF MOTORS FOR HEV
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 DESIGN OF HEV
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 IN HEV
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. NPTEL Course on Electric Vehicles, https://www.youtube.com/playlistlist=PLlYm0-AHZdZRLYSylFinxkspWmcgNvbtl
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

WEB REFERENCES:

1. https://www.nap.edu/read/12826/chapter/8
2. https://www.hindawi.com/journals/ijvt/2011/571683/
3. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118970553

E-TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118970553
2. https://www.intechopen.com/books/hybrid-electric-vehicles
3. https://www.amazon.in/Electric-Hybrid-Vehicles-Tom-Denton/dp/1138842370

MOOCS COURSES:

1. https://onlinecourses.nptel.ac.in/noc20_ee18/preview
2. https://www.classcentral.com/tag/electric-cars

POWER SYSTEMS COMPUTATION LAB – I

I M.Tech-I Semester **L T P C**
Course Code: B1PS104PC **- - 3 1.5**

COURSE OBJECTIVES:

Students will be able to:

1. Construction of Y-bus, z-bus for a n-bus system.
2. Analyse various Load flow studies.
3. Steady state, transient stability analysis.
4. Economic load dispatch problem.
5. Unit commitment problem.
6. State estimation of power system.

COURSE OUTCOMES:

Students will be able to:

1. Construct Y-bus and Z-bus
2. Compare the different load flow methods
3. Analize the different stability analysis of variety of power systems
4. Understood Economic load dispatch and Unit commitment problems.
5. Understood State estimation of power system.

LIST OF EXPERIMENTS

1. Develop Program for YBUS formation by direct inspection method.
2. Develop Program for YBUS formation by Singular Transformation method.
3. Develop Program for G-S Load Flow Algorithm.
4. Develop Program for N-R Load Flow Algorithm in Polar Coordinates.
5. Develop Program for FDLF Algorithm.
6. Develop Program for DC load Flow Algorithm.
7. Develop Program for ZBUS Building Algorithm.
8. Develop Program for Short Circuit Analysis using ZBUS Algorithm.
9. Develop Program for Transient Stability Analysis for Single Machine connected to Infinite Bus
10. Develop Program for Economic Load Dispatch Problem using Lambda Iterative Method.
11. Develop Program for Unit Commitment Problem using Forward Dynamic Programming Method.
12. Develop Program for State Estimation of Power System.

Note: From the above list minimum 10 experiments are to be conducted using suitable software.

TEXT BOOK:

1. https://jntuhcej.ac.in/web/syllabus/30_R19M.Tech_ELECTRICALPOWERSYSTEMSSyllabus.pdf
2. https://www.silicon.ac.in/M.%20Tech_EEE-Syllabus-Autonomy.pdf
3. https://www.bitswgl.ac.in/ece/B.Tech%20Lab%20manuals/Electrical-Power-systems-Lab-manual-3-2.pdf
4. http://www.gvpce.ac.in/7%20M.TECH-PSCA-19-10-2011-FINAL.pdf

REFERENCE BOOKS:

1. https://www.researchgate.net/publication/306094450_power_system_lab_manual
2. http://www.eee.griet.ac.in/document/labmanuals/IV-I%20PSS%20Lab%20Manual.pdf
3. https://www.bitswgl.ac.in/ece/B.Tech%20Lab%20manuals/Electrical-Power-systems-Lab-manual-3-2.pdf
4. https://jntuhcej.ac.in/web/syllabus/30_R19M.Tech_ELECTRICALPOWERSYSTEMSSyllabus.pdf

ADVANCED POWER SYSTEMS - LAB

I M.Tech-I Semester **L T P C**
Course Code: B1PS105PC **- - 3 1.5**

COURSE OBJECTIVES:

Students will be able to:

1. Determine transmission line parameters
2. Determine transmission line regulation and efficiency
3. Determine various fault calculations
4. Perform load and line compensation

COURSE OUTCOMES:

Students will be able to:

1. Calculate transmission line parameters
2. Calculate transmission line regulation and efficiency
3. Calculate various fault parameters
4. Compare system parameters with and without compensation

LIST OF EXPERIMENTS

1. Determination of Line Parameters R, L and C.
2. Determination of T/L efficiency and Regulation for a given load.
3. Analysis of Ferranti effect on Transmission Lines under light loadings.
4. Determination of ABDC parameters of a given Transmission Line Network.
5. Fault Analysis:
   I. Single Line to Ground fault (L-G).
   II. Line to Line fault (L-L).
   III. Double Line to Ground fault (L-L-G).
   IV. Triple Line to Ground fault (L-L-L-G).
6. Analysis of Uncompensated lines and their voltage profiles.
7. Shunt compensation of Transmission lines (Capacitor/Reactors)
8. Load Compensation analysis
9. Line Compensation using FACTS devices.
10. Analysis of Transmission lines under Surge Impedance Loading.
11. Determination of Sequence impedance of Transmission Line and SIL analysis.

TEXT BOOKS:

1. https://www.silicon.ac.in/M.%20Tech_EEE-Syllabus-Autonomy.pdf
2. https://makautwb.ac.in/syllabus/MTech_EE_Power_Common_Syllabus_10.04.14_2.pdf
3. http://www.gvpce.ac.in/7%20M.TECH-PSCA-19-10-2011-FINAL.pdf
4. https://avanthienggcollege.ac.in/syllabus/PS.pdf

REFERENCE BOOKS:

1. https://www.researchgate.net/publication/271461897_Advanced_power_system_laboratory
2. https://www.mtu.edu/research/about/centers-institutes/apsrc/
3. https://www.mtu.edu/mechanical/research/thrusts/aps/
4. https://www.mtu.edu/research/about/centers-institutes/apsrc/

ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course - I)

I M.Tech-I Semester **L T P C**
Course Code: B1PS101AC **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
Introduction - 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 needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT V
Skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills 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: B1PS102AC **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

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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)

DIGITAL PROTECTION OF POWER SYSTEM

I M.Tech-II Semester **L T P C**
Course Code: B1PS206PC **3 - - 3**

COURSE OBJECTIVES:

To prepare the students to:

1. Study numerical relays.
2. Develop mathematical approach towards protection.
3. Study algorithms for numerical protection.

COURSE OUTCOMES:

Students will be able to:

1. Understand the importance of Digital Relays.
2. Apply mathematical approach towards protection.
3. Develop various protection algorithms.

UNIT I MATHEMATICAL BACKGROUND TO DIGITAL PROTECTION

Overview of static relays, Transmission line protection, Transformer protection, Need for Digital protection. Performance and operational characteristics of Digital protection, Basic structure of Digital relays, Finite difference techniques, Interpolation formulas, Numerical differentiation, Curve fitting and smoothing, Fourier analysis, Walsh function analysis, Relationship between Fourier and Walsh coefficients.

UNIT II BASIC ELEMENTS OF DIGITAL PROTECTION

Basic components of a digital relay, Signal conditioning subsystems, Conversion subsystem, Digital relay subsystem, The digital relay as a unit.

UNIT III DIGITAL RELAYING ALGORITHMS-I

Sinusoidal-Wave-Based algorithms: Sample and first-derivative methods, First and second-derivative methods, Two-sample technique, Three-sample technique, An early relaying scheme.
Fourier analysis based algorithms: Full cycle window algorithm, Fractional-cycle window algorithms, Fourier-transform based algorithm. Walsh-function-based algorithms.

UNIT IV DIGITAL RELAYING ALGORITHMS-II

Least squares based methods: Integral LSQ fit, Power series LSQ fit, Multi-variable series LSQ technique, Determination of measured impedance estimates. Differential equation based techniques: Representation of transmission lines with capacitance neglected, Differential equation protection with selected limits, Simultaneous differential equation techniques.
Travelling-wave based protection: Fundamentals of Travelling-wave based protection, Bergeron's- equation based protection scheme, Ultra-high-speed polarity comparison scheme, Ultra-high-speed wave differential scheme, Discrimination function-based scheme, Superimposed component trajectory-based scheme.

UNIT V DIGITAL PROTECTION OF TRANSFORMERS AND TRANSMISSION LINES

Principles of transformer protection, Digital protection of Transformer using: FIR filter-based algorithm, Least squares curve fitting based algorithms, Fourier-based algorithm, Flux-restrained current differential relay. Digital Line differential protection: Current-based differential schemes, Composite voltage- and current- based scheme.

TEXT BOOKS:

1. A.G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press, 2009.
2. A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press, 1999.

REFERENCE BOOKS:

1. Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006.
2. S.R.Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014.

WEB REFERENCES:

1. https://www.ee.iitb.ac.in/web/academics/courses/EE651
2. http://www.rose.pwr.wroc.pl/PC_DER/An%20Introduction%20to%20the%20Digital%20Protection%20of%20Power%20Systems.pdf
3. https://www.researchgate.net/publication/316561483_Digital_Protection

E-TEXT BOOKS:

1. https://www.amazon.in/Digital-Power-System-Protection-Bhide/dp/8120349792
2. https://www.kopykitab.com/Digital-Power-System-Protection-by-Bhide-S-R
3. https://digital-library.theiet.org/content/books/po/pbpo015e

MOOCS COURSES:

1. https://www.classcentral.com/course/swayam-power-system-protection-19974
2. https://onlinecourses.nptel.ac.in/noc20_ee80/preview

POWER SYSTEM DYNAMICS

I M.Tech-II Semester **L T P C**
Course Code: B1PS207PC **3 - - 3**

COURSE OBJECTIVES:

To prepare students to:

1. Develop mathematical models for synchronous machine, Exciter, Governor and Prime mover.
2. Study power system dynamic phenomena and the effects of exciter and governor control.
3. Understand methods to improve dynamic stability.

COURSE OUTCOMES:

Students will be able to:

1. Understand the modeling of synchronous machine in details
2. Understand the modeling of Exciter and Governor control
3. Carry out simulation studies of power system dynamics using MATLAB-SIMULINK, MI-POWER
4. Carry out stability analysis with and without power system stabilizer (PSS)

UNIT I POWER SYSTEM STABILITY: A CLASSICAL APPROACH

Introduction, Requirements of a Reliable Electrical Power Service, Swing Equation, Power-Angle Curve, Stability analysis of SMIB system, Equal area criteria, Classical Model of a Multimachine System, Shortcomings of the Classical Model, Block Diagram of One Machine infinite bus system, System Response to Small Disturbances, Types of Problems Studied, The Unregulated Synchronous Machine, Modes of Oscillation of an Unregulated Multimachine System, Regulated Synchronous Machine.

UNIT II SYNCHRONOUS MACHINE MODELING-I

Introduction, Park's Transformation, Flux Linkage Equations, Voltage Equations, Formulation of State- Space Equations, Current Formulation, Per Unit Conversion, Normalizing the Voltage and Torque Equations, Equivalent Circuit of a Synchronous Machine, The Flux Linkage State-Space Model, Load Equations, Sub-transient and Transient Inductances and Time Constants, Simplified Models of the Synchronous Machine, Turbine Generator Dynamic Models

UNIT-III: SYNCHRONOUS MACHINE MODELING-II

Steady state equations and phasor diagrams, determining steady state conditions, Evaluation of Initial conditions, Determination of machine parameters, Digital simulation of Synchronous machines, Linearization and Simplified Linear model and state-space representation of simplified model.

UNIT IV EXCITATION AND PRIME MOVER CONTROL

Simplified view of excitation control, control configurations, typical excitation configurations, excitation control system definitions, voltage regulator, exciter build up, excitation system response, state-space description of the excitation system, computer representation of excitation systems, Typical system constants, and the effects of excitation on generator power limits, transient stability and dynamic stability of the power system, Prime mover control: Hydraulic turbines and governing systems, Steam turbines and governing systems

UNIT V SMALL SIGNAL STABILITY ANALYSIS

Fundamental concepts of stability of dynamic systems, Eigen properties of the state matrix, Small-signal stability of a single-machine infinite bus system, Effects of excitation system, Power system stabilizer, System state matrix with amortises, Characteristics of small-signal stability problems.

TEXT BOOKS:

1. P. M. Anderson & A. A. Fouad “Power System Control and Stability”, Galotti, New Delhi, 1981
2. J Machowski, J Bialek & J. R W. Bumby, “Power System Dynamics and Stability”, John Wiley & Sons, 1997

REFERENCE BOOKS:

1. P.Kundur, “Power System Stability and Control”, McGraw Hill Inc., 1994.
2. E.W. Kimbark, “Power system stability”, Vol. I & III, John Wiley & Sons, New York 2002
3. L. Leonard Grigsby (Ed.); “Power System Stability and Control”, 2nd edition, CRC Press, 2007
4. NPTEL online course, Prof. A. M. Kulkarni, Power System Dynamics and Control, https://www.youtube.com/playlist?list=PLuv3GM6-gsE2WXbxLSnqKHf5gcnedXCZH

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21_ee16/preview
2. https://ieeexplore.ieee.org/book/8006404
3. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118516072

E-TEXT BOOKS:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118516072
2. https://www.amazon.in/Power-System-Dynamics-Stability-Control-ebook/dp/B005UQLKIU
3. https://www.phindia.com/Books/BookDetail/9788120335257/power-system-dynamics-ramanujam

MOOCS COURSES:

1. https://www.classcentral.com/course/swayam-power-system-dynamics-control-and-monitoring-12955
2. https://www.classcentral.com/tag/power-systems
3. https://www.coursera.org/learn/electric-power-systems
4. https://www.mooc-list.com/tags/system-dynamics

ELECTRICAL POWER DISTRIBUTION SYSTEM

I M.Tech-II Semester **L T P C**
Course Code: B1PS208PC **3 - - 3**

COURSE OBJECTIVES:

To prepare the students to

1. Learn about load forecasting
2. Understand power distribution system reconfiguration and restoration
3. Learn control and communication systems
4. Understand distribution automation

COURSE OUTCOMES:

Students will be able to

1. Understand power distribution system
2. Explore distribution Automation And its application in practice
3. Learn control and communication systems
4. Apply optimization techniques for distribution systems
5. Carryout Distribution energy management

UNIT I LOAD FORECASTING

Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power System Loading, Technological Forecasting.

UNIT II DISTRIBUTION AUTOMATION

Advantages of Distribution Management System (DMS) Distribution Automation: Definition, Restoration / Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction

UNIT III CONTROL AND COMMUNICATION

Interconnection of Distribution, Control & Communication Systems, Remote Metering, Automatic Meter Reading and its implementation. SCADA: Introduction, Block Diagram, SCADA Applied To Distribution Automation. Common Functions of SCADA, Advantages of Distribution Automation through SCADA

UNIT IV OPTIMALITY PRINCIPLES

Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial, Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring

UNIT V ENERGY MANAGEMENT

Maintenance of Automated Distribution Systems, Difficulties in Implementing Distribution. Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI techniques applied to Distribution Automation

TEXT BOOKS:

1. A.S. Pabla, "Electric Power Distribution", Tata McGraw Hill Publishing Co. Ltd., Fourth Edition.
2. M.K. Khedkar, G.M. Dhole, "A Text Book of Electrical power Distribution Automation", University Science Press, New Delhi

REFERENCE BOOKS:

1. Turan Gonen, "Electric Power Distribution Engineering", 3rd Edition CRC Press,
2. Anthony J Panseni, "Electrical Distribution Engineering", CRC Press
3. James Momoh, "Electric Power Distribution, automation, protection & control", CRC Press
4. NPTEL course, Electricial Distribution System Analysis, https://www.youtube.com/playlist?list=PLLy_2iUCG87DxrqJr3dBhSruMiRHK0rNr

WEB REFERENCES:

1. https://www.eolss.net/sample-chapters/c05/E6-39A-06-01.pdf
2. https://en.wikipedia.org/wiki/Electric_power_distribution
3. http://onlinelibrary.wiley.com/doi/10.1002/9781118950289.refs/pdf
4. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470943854.fmatter

E-TEXT BOOKS:

1. https://www.amazon.in/ELECTRICAL-POWER-DISTRIBUTION-SYSTEM-KAMARAJU/dp/B01GYR5EMG
2. https://www.amazon.in/Electric-Power-Distribution-7th-Pabla/dp/9389538394
3. https://www.routledge.com/Electric-Power-Distribution-Engineering/Gonen/p/book/9781482207002

MOOCS COURSES:

1. https://www.classcentral.com/course/swayam-electrical-distribution-system-analysis-14029
2. https://www.mooc-list.com/course/electric-power-systems-coursera
3. https://www.coursera.org/learn/electric-power-systems

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RESTRUCTURED POWER SYSTEMS
(Professional Elective - III)

I M.Tech-II Semester **L T P C**
Course Code: B1PS207PE **3 - - 3**

COURSE OBJECTIVES:
To prepare students to
1. Understand restructuring of the electricity market
2. Understand deregulation of the electricity market
3. Understand the money, power & information flow in a deregulated power system

COURSE OUTCOMES:
Students will be able to
1. Know about various types of regulations in power systems.
2. Identify the need of regulation and deregulation.
3. Understand technical and Non-technical issues in deregulated Power Industry.
4. Identify existing electricity markets.
5. Classify different market mechanisms and summarize the role of various entities in the market.

UNIT I
Fundamentals of restructured system, Market architecture, Load elasticity, Social welfare maximization

UNIT II
Optimal power flow (OPF): Role in vertically integrated systems and in restructured markets, congestion management

UNIT III
Optimal bidding, Risk assessment, Hedging, Transmission pricing, Tracing of power

UNIT IV
Ancillary services, Standard market design, Distributed generation in restructured markets, renewable energy markets

UNIT V
Developments in India, IT applications in restructured markets, Working of restructured power systems, Pennsylvania-New Jersey-Maryland Interconnection (PJM) market, Recent trends in Restructuring

TEXT BOOKS:
1. LorrinPhilipson, H. Lee Willis, “Understanding electric utilities and de-regulation”, Marcel Dekker Pub.,1998.
2. Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley and Sons, 2002.

REFERENCE BOOKS:
1. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
2. Mohammad Shahidehpour, MuwaffaqAlomoush, “Restructured electrical power systems: operation, trading and volatility”, Marcel Dekker.

WEB REFERENCES:
1. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470608555
2. https://nptel.ac.in/courses/108/101/108101005/

E-TEXT BOOKS:
1. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470608555
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118558300
3. https://www.amazon.in/Restructuring-Electric-Power-Systems-Gupta/dp/9386768054

MOOCS COURSES:

1. https://www.iare.ac.in/?q=pages/mtech-course-descriptions-r18-0
2. https://nptel.ac.in/courses/108/101/108101005/
3. https://nptel.ac.in/content/syllabus_pdf/108101005.pdf

EHV AC TRANSMISSION
(Professional Elective – III)

I M.Tech-II Semester **L T P C**
Course Code: B1PS208PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Identify the different aspects of extra high voltage Ac transmission design And analysis
2. Understand the importance of Modern developments of EHV and UHV transmission systems.
3. Demonstrate ehv ac transmission system components, protection and insulation level for over voltages.

COURSE OUTCOMES:
Upon the completion of this course, the student will be able to
1. Understand the importance of EHV ac transmission
2. Estimate choice of voltage for transmission, line losses and power handling capability of EHV transmission.
3. Apply statistical procedures For Line designs, scientific and engineering Principles in Power systems.

UNIT I
Extra high voltage (EHV) AC. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of EHV lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT II
Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect of high electrostatic field on biological organisms and human beings - surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT III
Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – unenergized lines. Power Frequency Voltage control and over- voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

UNIT IV
Corona in EHV lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT V
Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

TEXT BOOKS:
1. R. D. Begamudre, “EHVAC Transmission Engineering”, New Age International (p) Ltd. 3rd Edition.
2. K. R. Padiyar, “HVDC Power Transmission Systems” New Age International (p) Ltd. 2nd revised Edition, 2012.

REFERENCE BOOKS:
1. S. Rao “EHVAC and HVDC Transmission Engineering. Practice” Khanna publishers.
2. Arrillaga. J “High Voltage Direct Current Transmission” 2nd Edition (London) Peter Peregrines, IEE, 1998.
3. Padiyar. K. R, “FACTS Controllers in Power Transmission and Distribution” New Age International Publishers, 2007.
4. Hingorani H G and Gyugyi. L “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems” New York, IEEE Press, 2000.
5. Advances in UHV Transmission and Distribution, online course https://www.youtube.com/channel/UCWKPXSjLRz-TAFgFWCfMmGg/videos

WEB REFERENCES:

1. https://app.knovel.com/web/toc.v/cid:kpEHVACTE1/viewerType:toc/
2. https://www.ijert.org/a-survey-paper-on-extra-high-voltage-ac-transmission-lines
3. https://www.ijert.org/ehvac-hvdc-transmission-system-for-power-upgrading-of-transmission-2

E-TEXT BOOKS:

1. https://www.amazon.in/Extra-High-Voltage-Transmission-Engineering/dp/8122417922
2. https://www.amazon.in/Transmission-B-Tech-IV-Year-II-Sem-JNTU/dp/B079NZY6GB
3. http://files.hostgator.co.in/hostgator253199/file/extrahighvoltageactransmissionbybegamudre.pdf
4. https://www.kopykitab.com/EHV-AC-HVDC-Transmission-And-Distribution-Engineering-Third-Edition-by-S-Rao

MOOCS COURSES:

1. https://iare.ac.in/?q=electrical-and-electronics-engineering/elective-iv
2. https://3ee2108sdg.wordpress.com/course-learning-outcome/
3. https://onlinecourses.nptel.ac.in/noc20_ee67/preview

INDUSTRIAL LOAD MODELING AND CONTROL
(Professional Elective - III)

I M.Tech-II Semester **L T P C**
Course Code: B1PS209PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Understand the energy demand scenario
2. Model the industrial loads and study Load demand
3. Study Reactive Power management in industries

COURSE OUTCOMES:
Students will be able to
1. Gain knowledge about load control techniques in industries and its application.
2. Understand different types of industrial processes and optimize the process
3. Apply load management to reduce Demand of electricity during peak time
4. Apply different energy saving opportunities in industries.

UNIT I INTRODUCTION TO INDUSTRIAL LOAD MODELING
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 LOAD CONTROL METHODS
Direct load control- Interruptible load control. Bottom up approach- scheduling- Formulation of load models-Optimization and control algorithms - Case studies. Reactive power management in industries- controls-power quality impacts, application of filters, Energy saving in industries.

UNIT III COOLING AND HEATING
Load profiling- Modeling. Cool storage-Types- Control strategies. Optimal operation-Problem formulation-Case studies.

UNIT IV CAPTIVE POWER MANAGEMENT
Captive power units- Operating and control strategies- Power Pooling- Operation models. Energy banking-Industrial Cogeneration

UNIT V OPTIMAL OPERATING STRATEGIES
Selection of Schemes Optimal Operating Strategies. Peak load saving-Constraints-Problem formulation Case study. Integrated Load management for Industries

TEXT BOOKS:
1. C.O. Bjork “Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands, 1989.
2. C.W. Gellings and S.N. Talukdar, “Load management concepts, ”IEEE Press, New York, 1986, pp.328.

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.osti.gov/pages/servlets/purl/1435710
2. https://www.nerc.com/comm/PC/LoadModelingTaskForceDL/Dynamic%20Load%20Modeling%20Tech%20Ref%202016-11-14%20-%20FINAL.PDF
3. https://ieeexplore.ieee.org/document/7981072

E-TEXT BOOKS:

1. https://www.osti.gov/pages/servlets/purl/1435710
2. https://www.amazon.in/Industrial-Load-Management-Practice-Simulations/dp/0444873651
3. https://www.elsevier.com/books/industrial-load-management/bjork/978-0-444-87365-1
4. https://www.springer.com/gp/book/9783642178740

MOOCS COURSES:

1. https://www.iare.ac.in/?q=pages/mtech-course-descriptions-r18-0
2. https://www.gitam.edu/departments_cms/assets/uploads/syllabus/1564571382_M__Tech__(PS_A)_w__e__f__2019-20_admitted_batch_.pdf
3. http://www.gcekarad.ac.in/uploaded_files/M_Tech_EPS_Structure_&_Curriculum.pdf

POWER QUALITY
(Professional Elective - IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PS210PE **3 - - 3**

COURSE OBJECTIVES:
To prepare students to
1. Know different terms of power Quality.
2. Illustrate power Quality issues for Short and long interruptions.
3. Construct study of characterization of voltage sag magnitude and three phase unbalanced voltage sag.
4. Know the behavior of power electronics loads, induction motors, synchronous motor etc. By the power Quality issues
5. Know mitigation of power quality problems by using vsi converters.

COURSE OUTCOMES:
Upon the completion of this course, the student will be able to
1. Know the severity of power quality problems in distribution system;
2. Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage)
3. Compute the power quality improvement by using various mitigating custom power devices.

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-PHASE & 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. Math H J Bollen "Understanding Power Quality Problems", IEEE Press.
2. R.C. Dugan, M.F. McGranaghan and H.W. Beaty, "Electric Power Systems Quality." New York: McGraw-Hill.1996

REFERENCE BOOKS:

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994).
2. Power Quality VAR Compensation in Power Systems, R. Sastry Vedam Mulukutla S.Sarma,CRC Press.
3. A Ghosh, G. Ledwich, Power Quality Enhancement Using Custom Power Devices. Kluwer Academic, 2002

WEB REFERENCES:

1. 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
2. https://www.pge.com/includes/docs/pdfs/mybusiness/customerservice/energystatus/powerquality/pqreferences-web-8-10-07.pdf
3. http://rericjournal.ait.ac.th/index.php/reric/article/download/107/80
4. https://openpowerquality.org/docs/intro-bibliography.html

E-TEXT BOOKS:

1. https://www.accessengineeringlibrary.com/content/book/9780071470759
2. https://www.amazon.in/Power-Quality-Electric-Engineering/dp/0849310407
3. https://www.amazon.in/Power-Quality-Electric-Engineering-ebook/dp/B00UV99Q5K

MOOCS COURSES:

1. http://www.gcebargur.ac.in/sites/gcebargur.ac.in/files/lectures_desk/electrical_power_systems_quality.pdf
2. https://easyengineering.net/ee6005powerquality/

POWER APPARATUS DESIGN
(Professional Elective - IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PS211PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Design and model ac and dc rotating machines
2. Learn electromagnetic energy conversion
3. Know about rating of machines

COURSE OUTCOMES:
Students will be able to
1. Give a systematic approach for design, modeling and Analysis of rotating machines
2. Design and model special machines.

UNIT I
Principles of Design of Machines -Specific loadings, choice of magnetic and electric loadings, Real and apparent flux densities, temperature rise calculation, Separation of main dimension for DC machines, Induction machines and synchronous machines, Design of Transformers-General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling.

UNIT II
Specific loadings, choice of magnetic and electric loadings Real and apparent flux -densities, temperature rise calculation, Separation of main dimension for DC machines, Induction machines and synchronous machines, Heating and cooling of machines, types of ventilation, continuous and intermittent rating.

UNIT III
General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling tubes, Calculation of losses, efficiency and regulation, Forces winding during short circuit.

UNIT IV
General considerations, output equation, Choice of specific electric and magnetic loadings, efficiency, power factor, Number of slots in stator and rotor, Elimination of harmonic torques.

UNIT V
Design of stator and rotor winding, slot leakage flux, Leakage reactance, equivalent resistance of squirrel cage rotor, Magnetizing current, efficiency from design data. Types of alternators, comparison, specific loadings, output co-efficient, design of main dimensions Introduction to Computer Aided Electrical Machine Design Energy efficient machines.

TEXT BOOKS:
1. Clayton A.E, “The Performance and Design of D.C. Machines”, Sir I. Pitman & sons, Ltd.
2. M.G. Say, “The Performance and Design of A.C. Machines “, Pitman

REFERENCE BOOKS:
1. Sawhney A.K, “A course in Electrical Machine Design”, Dhanpat Rai & Sons, 5th Edition

WEB REFERENCES:
1. https://www.ti.com/reference-designs/index.html
2. https://www.ti.com/power-management/power-over-ethernet-poe/sourcing-equipment/reference-designs.html
3. https://www.power.com/

E-TEXT BOKKS:

1. https://www.accessengineeringlibrary.com/content/book/9780071377515
2. https://easyengineering.net/ee6604-design-of-electrical-machines-nw/
3. https://easyengineering.net/power-systems-books/

MOOCS COURSRS:

1. https://www.coursera.org/specializations/power-electronics
2. http://makautexam.net/aicte_details/MOOCS/EE.pdf
3. https://www.aicte-india.org/downloads/MHRD%20moocs%20guidelines%20updated.pdf
4. https://nptel.ac.in/course.html

POWER SYSTEM RELIABILITY AND PLANNING
(Professional Elective - IV)

I M.Tech-II Semester **L T P C**
Course Code: B1PS212PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to:
1. Describe the Generation system model and Recursive relation for capacitive model Building
2. Explain the equivalent transitional rates, cumulative probability and cumulative frequency
3. Develop the understanding of risk, System and load point reliability indices
4. Explain the basic and Performance reliability indices

COURSE OUTCOMES:
The student will be able to:
1. Understand the importance of maintaining reliability of power system components.
2. Apply the probabilistic methods for evaluating the reliability of generation and transmission systems.
3. Assess the different models of system components in reliability studies.
4. Assess the reliability of single area and multi area systems.

UNIT I BASIC RELIABILITY CONCEPTS:
The general reliability function, exponential distribution – Mean time to failures – series and parallel systems. Markov process – continuous Markov process – Recursive techniques – Simple series and parallel system models.

UNIT II GENERATING CAPACITY – BASIC PROBABILITY METHODS:
The generation system model – Loss of load indices – Capacity expansion analysis – scheduled outages. Load forecast uncertainty Loss of energy indices. The frequency and duration method.

UNIT III TRANSMISSION SYSTEMS RELIABILITY EVALUATION:
Radial configuration – Conditional probability approach – Network configurations – State selection.

UNIT IV GENERATION PLANNING:
Comparative economic assessment of individual generation projects – Investigation and simulation models – Heuristic and linear programming models – Probabilistic generator and load models.

UNIT V TRANSMISSION AND DISTRIBUTION PLANNING:
Deterministic contingency analysis – Probabilistic transmission system – reliability analysis. Reliability calculations for single area and multi–area power systems. Network configuration design–consisting of schemes – security criteria configuration synthesis.

TEXT BOOKS:
1. Roy Billinton and Ronald Allan Pitam: Reliability Evaluation of Power Systems,1996.
2. R.L. Sullivan: Power System Planning, McGraw Hill International, 1977.

REFERENCE BOOKS:
1. Wheel Wright and Makridakis: Forecasting methods and Applications, John Wiley, 1992.
2. J. Endremyl: Reliability Modelling in Electric Power Systems, John Wiley, 2005.
3. International Renewable Energy Agency , Bonn Lecture Series: Planning for the Transformation of Power Systems https://www.youtube.com/watch?v=sbZ2sY_E4QU

WEB REFERENCES:
1. https://www.intechopen.com/books/system-reliability/power-system-reliability-mathematical-models-and-applications
2. https://www.researchgate.net/publication/37881951_The_economics_of_power_system_reliability_and_planning_theory_and_case_study
3. https://www.researchgate.net/publication/223412624_Power_system_planning_-_a_reliability_perspective

E-TEXT BOOKS:

1. https://www.researchgate.net/publication/37881951_The_economics_of_power_system_reliability_and_planning_theory_and_case_study
2. https://www.osti.gov/biblio/5024455-power-system-planning
3. https://stupidsid.com/popular-books/power-system-planning-and-reliability-337

MOOCS COURSES:

1. https://www.coursera.org/learn/electric-power-systems
2. https://www.dnv.sg/training/training-course-power-system-reliability-9331
3. https://www.iare.ac.in/?q=pages/mtech-course-descriptions-r18-0
4. https://zoetalentsolutions.com/course/electric-power-system-planning-and-reliability-calculation/

POWER SYSTEMS COMPUTATION LAB – II

I M.Tech-II Semester **L T P C**
Course Code: B1PS209PC **- - 3 1.5**

COURSE OBJECTIVES:

Students will be able to:

1. Known Neural network tool box
2. Know the various Evolutionary Algorithms
3. Apply various Evolutionary Algorithms to power system problems

COURSE OUTCOMES:

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

1. Understood Neural network and fuzzy logic tool box
2. Understood various Evolutionary Algorithms
3. Solved power system problems by applying various Evolutionary Algorithms

LIST OF EXPERIMENTS

1. Load Flow analysis using Neural Network
2. State Estimations using Neural Network
3. Contingency Analysis using Neural Network
4. Power system Security using Neural Network
5. Fuzzy Logic based AGC – Single area system – Two area system
6. Fuzzy Logic based small signal stability analysis
7. Economic Dispatch of Thermal Units using ANN
8. Economic Dispatch of Thermal Units using GA
9. Unit commitment problem by using GA
10. Unit commitment problem by using PSO
11. Optimal location and sizing of capacitor in distribution system using PSO
12. Security constrained optimal power dispatch using GA
13. Optimal Reactive power dispatch using PSO

TEXT BOOKS:

1. https://jntuhcej.ac.in/web/syllabus/30_R19M.Tech_ELECTRICALPOWERSYSTEMSSyllabus.pdf
2. https://makautwb.ac.in/syllabus/MTech_EE_Power_Common_Syllabus_10.04.14_2.pdf
3. https://www.silicon.ac.in/M.%20Tech_EEE-Syllabus-Autonomy.pdf
4. https://www.nitw.ac.in/media/uploads/2019/03/15/mtech-pse-revised-syllabus-02-08-2016-0535pm.pdf

REFERENCE BOOKS:

1. https://www.researchgate.net/publication/306094450_power_system_lab_manual
2. https://www.bitswgl.ac.in/ece/B.Tech%20Lab%20manuals/Electrical-Power-systems-Lab-manual-3-2.pdf
3. https://www.slideshare.net/mathupuji/power-system-simulation-lab-electrical-engineering-power-systems
4. http://www.eee.griet.ac.in/document/labmanuals/IV-I%20PSS%20Lab%20Manual.pdf

POWER SYSTEM PROTECTION LAB

I M.Tech-II Semester **L T P C**
Course Code: B1PS210PC **- - 3 1.5**

COURSE OBJECTIVES:

Upon successful completion of the lab students will be familiar with:

1. Different types of Faults occurring in power systems
2. Characteristics of different types of relays
3. Protection schemes

COURSE OUTCOMES:

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

1. Calculate various faults
2. Analize the various time-current characteristics of protective relays
3. Know the Performance and Testing of various electrical models and systems

LIST OF EXPERIMENTS

1. Characteristics of Electromechanical Non-Directional over current relay
2. Characteristics of Electromechanical Directional Over Current Relay
3. Characteristics of Electromechanical differential protection relay
4. Characteristics of Numerical Distance relay
5. Characteristics of Integrated Numerical under Voltage Relay
6. Characteristics of Numerical over current Relay
7. Zones protection characteristics of distance Relay
8. Differential protection on Single Phase Transformer
9. Performance and Testing of Feeder Protection System
10. Performance and Testing of Generator Protection System.

TEXT BOOKS:

1. http://eie.sliet.ac.in/files/2021/03/Power-System-Lab-Manual.pdf
2. https://jcboseust.ac.in/electrical/images/lab/ps_lab_manual.pdf
3. https://www.scribd.com/doc/59926214/Power-System-Protection-Lab-Manual

REFERENCE BOOKS:

1. https://www.academia.edu/44789446/Lab_Manual_Electrical_Power_System_Protection_PTUK
2. https://baixardoc.com/documents/59926214-power-system-protection-lab-manual-5c7d8ae6eb1c4
3. https://www.textroad.com/pdf/JAEBS/J.%20Appl.%20Environ.%20Biol.%20Sci.,%207(3)252-257,%202017.pdf

DISASTER MANAGEMENT
(Audit Course II)

I M.Tech-II Semester **L T P C**
Course Code: B1PS203AC **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: B1PS204AC **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)

POWER SYSTEM TRANSIENTS
(Professional Elective - V)

II M.Tech-I Semester **L T P C**
Course Code: B1PS313PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to:
1. Learn the reasons for Occurrence of transients in a power system.
2. Understand the Change in Parameters like voltage & Frequency During Transients.
3. Know about the lightning Phenomenon and Its effect on power System.

COURSE OUTCOMES:
Students will be able to:
1. Know various transients in Power System and their mathematical Formulation.
2. Design various protective devices in power system for Protecting equipment and personnel.
3. Coordinate the insulation of various equipment's in power System.
4. Model the power system for transient Analysis.

UNIT I
Fundamental circuit analysis of electrical transients, Laplace Transform method of solving simple Switching transients, Damping circuits -Abnormal switching transients, Three-phase circuits and transients, Computation of power system transients

UNIT II
Principle of digital computation – Matrix method of solution, Model analysis- Z transform- Computation using EMTP, Lightning, switching and temporary over voltages, Lightning, Physical phenomena of lightning.

UNIT III
Interaction between lightning and power system, Influence of tower footing resistance and Earth Resistance, Switching: Short line or kilometric fault, Energizing transients - closing and re-closing of lines, line dropping, load rejection – over voltages induced by faults

UNIT IV
Switching HVDC line, Travelling waves on transmission line, Circuits with distributed Parameters, Wave Equation, Reflection, Refraction, Behaviour of Travelling waves at the line Terminations, Lattice Diagrams, Attenuation and Distortion factors, Multi-conductor system and Velocity wave.

UNIT V
Insulation co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS) Coordination between insulation and protection level, Statistical approach. Protective devices, Protection of system against over voltages, lightning arresters, substation earthing

TEXT BOOKS:
1. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991
2. Harold A Peterson: Transient in Power Systems, McGraw Hill, 1966.

REFERENCE BOOKS:
1. Kuffel and Abdullah: High Voltage Engineering, PHI, 2000.
2. Rakesh D. Begamudre: EHV AC Transmission Engineering, PHI, 2006.

WEB REFERENCES:
1. http://ieeexplore.ieee.org/document/1458910/
2. https://www.mdpi.com/journal/energies/special_issues/PST_P
3. http://www.powerqualityworld.com/2011/10/emtp-rv-power-system-transients.html

E-TEXT BOOKS:

1. https://www.amazon.in/Power-System-Transients-Theory-Applications-ebook/dp/B00I60MF68
2. https://www.amazon.in/Power-System-Transients-Dr-J-Bhaskaran/dp/B071KXHS1G
3. https://www.routledge.com/Power-System-Transients-Theory-and-Applications-Second-Edition/Ametani-Nagaoka-Baba-Ohno-Yamabuki/p/book/9780367736675

MOOCS COURSES:

1. https://www.iare.ac.in/?q=courseslist/75
2. https://www.classcentral.com/course/swayam-power-system-engineering-10052
3. https://www.ntnu.edu/studies/courses/TET4130

FLEXIBLE AC TRANSMISSION SYSTEMS
(Professional Elective - V)

II M.Tech-I Semester **L T P C**
Course Code: B1PS314PE **3 - - 3**

COURSE OBJECTIVES:
To prepare the students to
1. Identify the limitations of uncompensated lines under various loading conditions.
2. Understand the concept And importance of Compensation through facts devices
3. Explore shunt Compensation, and basic operation of SVC, Statcom and UPFC.
4. Analyze The functioning of series controllers like GCSC, TSSC, TCSC and SSSC

COURSE OUTCOMES:
Upon the completion of this course, the student will be able to
1. Apply proper controller for a specific system requirement
2. Understand various systems thoroughly And their requirements
3. Interpret The Control circuits Of shunt controllers SVC & STATCOM For Various Functions Viz. Transient Stability enhancement, voltage instability prevention and power oscillation damping
4. Detect the power And control circuits of series controllers gcsc, tssc, tcsc and sssc

UNIT I CONCEPT OF FACTS
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 & CURRENT 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 STATIC SERIES COMPENSATION
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), static synchronous series compensator (SSSC), control schemes for GSC, TSSC, TCSC and SSSC.

UNIT V SVC & UPFC
The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control, basic concept of unified power flow controller (UPFC).

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. Prof. Avik Bhattacharya , IIT Roorkee, NPTEL Course on Flexible AC Transmission Systems (FACTS), July 2018, https://www.youtube.com/playlist?list=PLLy_2iUCG87AVyRAN4QwVQrC8vSg1vWa6
2. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 2012
3. 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.sciencedirect.com/topics/engineering/flexible-ac-transmission-systems
3. https://www.siemens-energy.com/global/en/offerings/power-transmission/portfolio/flexible-ac-transmission-systems.html

E-TEXT BOOKS:

1. https://www.flipkart.com/flexible-ac-transmission-systems-facts/p/itmewhz5ewqzk3hh
2. https://www.springer.com/gp/book/9783030353858
3. https://www.amazon.in/Flexible-AC-Transmission-Systems-Modelling/dp/3642282407

MOOCS COURSES:

1. https://npti.gov.in/flexible-ac-transmission-system
2. https://www.veltech.edu.in/syllabi/SoEC/EEE/PROGRAMMEELECTIVE/1152EE112FLEXIBLEACTRANSMISSIONSYSTEMS.pdf
3. https://www.tandfonline.com/doi/abs/10.1080/01587919.2014.919710

SCADA SYSTEM AND APPLICATIONS
(Professional Elective - V)

II M.Tech-I Semester **L T P C**
Course Code: B1PS315PE **3 - - 3**

COURSE OBJECTIVES:
To prepare students to:
1. Understand about Supervisory Control and Data Acquisition system (SCADA)
2. Know scada communication and its functions
3. Get an Insight into its application

COURSE OUTCOMES:
Students will be able to:
1. Describe the basic Tasks of scada
2. Acquire Knowledge about SCADA Architecture, Various Advantages And Disadvantages Of Each system.
3. Understand about single unified standard architecture IEE 61850.
4. Learn about SCADA System Components: Remote Terminal Units, Plcs, Intelligent electronic Devices, hmi systems, scada server.
5. Apply Scada systems in transmission and distribution sectors

UNIT I INTRODUCTION TO SCADA,
Data acquisition systems, Evolution of SCADA, Communication technologies. Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA.

UNIT II SCADA COMPONENTS
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”, PennWell Books, 2006.
2. David Bailey, Edwin Wright, “Practical SCADA for industry”, Newnes, 2003.
3. Michael Wiebe, “A guide to utility automation: AMR, SCADA, and IT systems for electric power”, PennWell 1999.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/SCADA
2. https://www.researchgate.net/publication/269984924_Efficient_Web-Based_SCADA_System
3. https://www.researchgate.net/publication/274738731_Using_WEB_Services_in_SCADA_Applications

E-TEXT BOOKS:

1. https://www.amazon.in/Designing-SCADA-Application-Software-Practical-ebook/dp/B00EDL4VV6
2. https://www.amazon.in/Power-System-SCADA-Smart-Grids/dp/148222674X
3. https://www.elsevier.com/books/designing-scada-application-software/mccrady/978-0-12-417000-1

MOOCS COURSES:

1. https://sppumoodle.unipune.ac.in/course/view.php?id=220
2. https://instrumentationtools.com/applications-of-scada/
3. https://en.wikipedia.org/wiki/SCADA

INDUSTRIAL SAFETY
(Open Elective)

II M.Tech-I Semester **L T P C**
Course Code: B1PS301OE **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: B1PS302OE **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. Students should able to apply the dynamic programming to solve problems of discreet andcontinuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should 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: B1PS303OE **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 CostingSystem; 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: B1PS304OE **3 - - 3**

COURSE OBJECTIVES:

1. To enable students to understand 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 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 biogasPlants – 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.