# ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

**Effective from the Academic Year 2017-18 onwards**

# M. Tech. Two Year Degree Programme

**(MR17 Regulations)**

**in**

# Electrical Power Systems (EPS)

## Department of Electrical and Electronics Engineering


# MALLA REDDY ENGINEERING COLLEGE (Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH Hyderabad,
Recognized under section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II Cycle)
Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad-500 100
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**MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)**

**MR17 ACADEMIC REGULATIONS (CBCS)**
**For M. Tech. (REGULAR) DEGREE PROGRAMME**

Applicable for the students of M. Tech. (Regular) programme admitted from the Academic Year ***2017-18*** onwards.

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

## INSTITUTION VISION

A Culture of excellence , the hallmark of MREC as world class education center to impart Technical Knowledge in an ambience of humanity, wisdom, intellect, creativity with ground breaking discovery, in order to nurture the students to become Globally competent committed professionals with high discipline, compassion and ethical values.

## INSTITUTION MISSION

Commitment to progress in mining new knowledge by adopting cutting edge technology to promote academic growth by offering state of art Under graduate and Post graduate programmes based on well-versed perceptions of Global areas of specialization to serve the Nation with Advanced Technical knowledge.

## DEPARTMENT VISION

To strive and develop a learning centre in the field of electrical engineering and prepare the students to become talented and committed professionals with discipline and sincerity in serving the society.

## DEPARTMENT MISSION

To impart quality education with dedication to achieve academic excellence and offer state-of-the-art technology in the field of electrical engineering to enhance the knowledge and employability of the students.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

| | |
|---|---|
| **PEO 1: Core Competence** | Graduates are competent enough to meet the industrial requirements, have a better career and pursue higher studies in electrical power systems. |
| **PEO 2: Research** | Graduates are kindled to foresee the technical challenges in power system and optimal ways to handle them through research for the benefit of the society. |
| **PEO 3: Lateral Thinking** | Graduates are able to explore their skills to invent, design and realize new technology. |
| **PEO 4: Leadership** | Graduates are capable of working in a team to accomplish the professional and organizational goals with ethical and moral values. |
| **PEO 5: Lifelong Learning** | Graduates keep themselves abreast of emerging technologies; continually learn new skills to nourish ever-developing careers. |

## PROGRAM OUTCOMES (POs):

**PO1:** Ability to apply the knowledge of engineering fundaments and engineering specialization to the solution of electrical power system problems.

**PO2:** Ability to apply intellectual and creative knowledge for conducting research and solve complex electrical power system problems.

**PO3:** Ability to design solutions for complex electrical power systems problems to meet the specified needs in consideration with safety, societal and environmental factors.

**PO4:** Ability to apply research based knowledge, research methods and synthesis to provide valid conclusions.

**PO5:** Ability to create and apply modern IT tools techniques to solve complex electrical Power system problems.

**PO6:** Ability to apply contextual knowledge to access societal, safety and legal issues relevant to the professional engineering practice.

**PO7:** Ability to understand the impact of the professional engineering solutions for sustainable development.

**PO8:** Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9:** Ability to function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10:** Ability to communicate effectively on complex engineering activities and able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11:** Ability to apply management principles in workplace as a member and leader in a team to manage projects and in multidisciplinary environments.

**PO12:** Ability to engage in life-long learning independently, with a high level of passion and Proficiency.

## PROGRAM SPECIFIC OUTCOMES (PSOs):

**PSO1:** To offer optimum solution for electrical power system problems through advanced technologies like embedded system based technology and programmable logic controllers.

**PSO2:** To develop new technologies to generate electrical energy through renewable sources for better future.

**PSO3:** To enhance the technical solutions through MATLAB and LabVIEW to comply with industrial requirements.

**1.0 Eligibility for Admissions:**

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

**2.0 Award of M.Tech. Degree:**

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

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

**2.3** M.Tech is of 2 academic years (4 Semesters), with the academic year being divided into two semesters of 22 weeks ( $\geq$ 90 teaching days, out of which number of contact days for teaching / practical $\geq$ 75 and conducting examinations and preparation days = 15 ) each.

**3.0 Courses of Study:**

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

| Dept. | Specialization Code | Specialization | Intake |
|---|---|---|---|
| CE | 11 | Structural Engineering (SE) | 24 |
| EEE | 24 | Electrical Power Systems (EPS) | 24 |
| ME | 31 | Thermal Engineering (TE) | 18 |
| | 33 | Machine Design (MD) | 24 |
| CSE | 51 | Computer Science and Engineering (CSE) – Shift-I | 18 |
| | | Computer Science and Engineering (CSE) – Shift-II | 24 |

and any other programme as approved by the University from time to time.

**4 Course Registration:**

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

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

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

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

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

the commencement of Class-work for that Semester.

**5 Attendance Requirements:**

The programmes are offered on a unit basis with each subject/course being considered as 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 Semester End examination (SEE). 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 below 75%) in each semester shall be granted by the College Academic Committee (CAC).

**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 Semester End Examination of that subject and their registration shall stand cancelled.

**5.5** A stipulated fee prescribed by the CAC, shall be payable towards Condonation of shortage of attendance.

**5.6** A Candidate shall put in a minimum required attendance in at least three (3) theory subjects in I semester for promoting to II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

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

**6 Evaluation - Distribution and Weightage of Marks: :**

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for both theory and practicals, on the basis of Continuous Internal Evaluation and Semester End Examinations. For all Subjects/ Courses, the distribution shall be 40 marks for CIE, and 60 marks for the SEE

**6.1 Theory Courses :**

**6.1.1 Continuous Internal Evaluation (CIE):**

The CIE consists of two Assignments each of 05 marks and two mid-term examinations each of 35 marks. The CIE shall be finalized based on the 70% of the best performed and 30% of the other performance.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.

First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The Assignments shall be as specified by the concerned subject teacher. Each mid-term examination shall be conducted for a total duration of 120 minutes, for 35 marks.

The division of marks for CIE is as given below:

| **Mid – Term Examination** | | | | |
|---|---|---|---|---|
| **Part** | **Type of Questions** | **No. of questions** | **Marks per question** | **Total** |
| Part A | Multiple-choice questions | 10 | 0.5 | 05 |
| | Fill-in the blanks | 10 | 0.5 | 05 |
| | Sub-Total | | | 10 |
| Part B | Compulsory questions | 5 | 2 | 10 |
| Part C | Choice questions (3 out of 5) | 3 | 5 | 15 |
| | | | **Mid-Term Exam Total** | 35 |
| | | | Assignment | 05 |
| | | | **Grand Total** | 40 |

**6.1.2 Semester End Examination (SEE):**

The division of marks for SEE is as given below:

| Semester End Examination | | | | |
|---|---|---|---|---|
| **Part** | **Type of Questions** | **No. of questions to be answered** | **Marks per question** | **Total** |
| Part A | Compulsory Questions (One from each module) | 5 | 4 | 20 |
| Part B | Choice Questions: For each question there will be an 'either or choice', which means that there will be two questions from each module and the student should answer either of the two questions | 5 | 8 | 40 |
| | | | **Grand Total** | 60 |

**6.2 Practical Courses:**

**6.2.1 Continuous Internal Evaluation (CIE):**

There will be CIE for 40 marks, shall be awarded with a distribution of 20 marks for day - to - day performance and timely submission of lab records, 5 marks for viva - voce,15 marks for internal lab exam (best out of two exams).

**6.2.2 Semester End Examination (SEE):**

There will be SEE for 60 marks, shall be awarded with a distribution of 15 marks for design/procedure/schematic diagram of the given experiment, 20 marks for conduction of experiment, 15 marks for results and 10 marks for viva - voce. For conducting SEE, one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations of the college. The external examiner should be selected from outside the college among the autonomous / reputed institutions from a panel of three examiners submitted by the concerned Head of the Department/BoS Chairman.

**6.3 Seminar:**

There shall be two seminar presentations during I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Department PG Coordinator, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks with a distribution of 30 marks for the report, 50 marks for presentation and 20 marks for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

**6.4 Comprehensive Viva-Voce:**

There shall be a Comprehensive Viva-Voce in III Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects studied during the M. Tech. course of study. The Head of the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consists of the Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Chief Controller of Examinations from a panel of three examiners submitted by the concerned Head of the Department. There are no internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

**6.5. General:** A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum

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

**7 Examinations and Assessment - The Grading System :**

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

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

| % of Marks Secured (Class Intervals) | Grade Points | Letter Grade (UGC Guidelines) |
|---|---|---|
| ≥ 90%, | 10 | O (Outstanding) |
| (≥ 80%, <90%) | 9 | A+ (Excellent) |
| (≥ 70%, < 80%) | 8 | A (Very Good) |
| (≥ 60%, < 70%) | 7 | B+ (Good) |
| (≥ 55%, < 60%) | 6 | B ( Average) |
| (≥ 50%, < 55%) | 5 | C (Pass) |
| (< 50%) | 0 | F (Fail) |
| Absent | 0 | Ab |

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

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

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

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

**7.7** A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that particular Subject/ Course.
Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

**7.8** The Student passes the Subject/ Course only when he gets GP ≥ 5(C Grade or above).

**7.9** The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:
$SGPA = \{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$… For each Semester
where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), $C_i$ is the no. of Credits allotted to the $i^{th}$ Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that $i^{th}$ Subject.

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

$\text{CGPA} = \{\sum_{j=1}^{M} C_j G_j\} / \{\sum_{j=1}^{M} C_j\}$ … for all S semesters registered

(i.e., up to and inclusive of S semesters, $S \geq 2$)

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

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

**8. Evaluation of Project/Dissertation Work :**

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

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

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

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

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

**8.5** A candidate shall submit his project status report in two stages at least with a gap of 2 months between them.

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

**Note:** *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper related to the thesis in a National/International Conference/Journal.*

**8.7** For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the similarity information is less than 24%, then only thesis will be accepted for submission.

**8.8** Three copies of the Project Thesis certified by the supervisor, HOD shall be submitted to the Chief Controller of Examinations / Principal for project evaluation (Viva Voce).

**8.9** For Project work part-I in III Semester there is an internal marks of 100, the evaluation should be done by the PRC for 60 marks and Supervisor will evaluate for 40 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 work part-I. If the student fails to fulfill minimum marks, the

student has to reappear after one month with modifications suggested by PRC.

**8.10** For Project work part-II in IV Semester there is an internal marks of 100, the evaluation should be done by the PRC for 60 marks and Supervisor will evaluate for 40 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-II. If the student fails to fulfill minimum marks, the student has to reappear after one month with modifications suggested by PRC.

**8.11** For Project Evaluation (Viva Voce) in IV Semester there is an external marks of 100 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The distribution of 100 marks followed by Quality of the work (Plagiarism), Paper publication, nature of the work (Tools & software used and Innovative ideas), presentation and viva-Voce - each for 20 marks. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

**8.12** If the student fails to fulfill as specified in 8.11, based on the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.

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

## 9. Award of Degree and Class :

**9.1** A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **88** Credits (with CGPA $\geq$ 5.0), 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 | CGPA |
|---|---|
| First Class with Distinction | $\geq$ 8.00 |
| First Class | $\geq$ 6.50 and < 8.00 |
| Second Class | $\geq$ 5.00 and < 6.50 |

**9.3** A student with final CGPA (at the end of the PGP) < 5.00 will not be eligible for the Award of Degree.

## 10. Withholding of Results:

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

## 11. Transitory Regulations:

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

**11.2** The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per MR17 Academic Regulations.

## 12. Student Transfers:

**12.1** There shall be no Branch/Specialization transfers after the completion of Admission Process.

**12.2** The students seeking transfer to MALLA REDDY ENGINEERING COLLEGE (Autonomous) - MREC(A) from various other Universities/institutions have to pass the failed subjects which

are equivalent to the subjects of MREC(A), and also pass the subjects of MREC(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of MREC(A), the students have to study those subjects in MREC(A) inspite of the fact that those subjects are repeated.

**12.3** The transfer students from other Universities / Institutions to MREC (A) who are on rolls will be provided one chance to write internal examinations in the failed subjects and/or subjects not studied as per the clearance letter issued by the JNTUH.

**13. General:**

**13.1** **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.

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

**13.3** Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her".

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

**13.5** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee headed by the Principal is final.

**MALPRACTICES RULES**

**DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS**

| S. No. | Nature of Malpractices / Improper conduct | Punishment |
|---|---|---|
| | If the candidate: | |
| 1. (a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he 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 SEE) | 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 that 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. The Hall Ticket of the candidate shall be cancelled. |
| 3 | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the 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. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against |

| | | |
|---|---|---|
| | | him. |
| 4 | Smuggles 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. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5 | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that course. |
| 6 | Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE)/ Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that 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. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases 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 SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8 | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that 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. 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. | 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. 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. |
| 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 SEE. |
| 12 | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment. | |

**Note:** ***The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.***

**Malpractices identified by squad or special invigilators**

1. Punishments to the students as per the above guidelines.

**MALLAREDDY ENGINEERING COLLEGE (Autonomous)**
**Department of Electrical and Electronics Engineering**
**M. Tech. (Electrical Power Systems)**
**MR17 - Course Structure and Syllabus**
**Academic Year 2017-18 (Choice Based Credit System)**
**(MR17 Regulations)**

**I SEMESTER**

| S. No. | Category | Course code | Name of the course | Contact hours/week | | | Credits | Scheme of Valuation | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Internal (CIE) | External (SEE) | |
| 1 | PC | 72401 | Advanced Power System Analysis | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 2 | PC | 72402 | Advanced Power System Protection | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 3 | PC | 72403 | Modern Control Theory | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 4 | PE | **Professional Elective–I** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 72404 | 1. EHV AC Transmission | | | | | | | |
| | | 72405 | 2. High Voltage Generation and Measurement | | | | | | | |
| | | 70441 | 3. Advanced Digital Signal Processing | | | | | | | |
| 5 | PE | **Professional Elective–II** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 72406 | 1. Power Quality | | | | | | | |
| | | 70420 | 2. Microcontrollers and Applications | | | | | | | |
| | | 72407 | 3. Distribution Automation | | | | | | | |
| 6 | OE | **Open Elective-I** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 70B16 | 1. Optimization Techniques | | | | | | | |
| | | 72408 | 2. Energy Management | | | | | | | |
| | | 70452 | 3. Embedded System Design | | | | | | | |
| 7 | PC | 72409 | Power Systems Simulation Lab | - | - | 4 | 2 | 40 | 60 | 100 |
| 8 | PR | 72410 | Seminar-I | - | - | 4 | 2 | 100 | -- | 100 |
| Total | | | | 12 | 12 | 8 | 22 | Contact Periods: 32 | | |

## II SEMESTER

| S. No. | Category | Course code | Name of the course | Contact hours/week | | | Credits | Scheme of Valuation | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Internal (CIE) | External (SEE) | |
| 1 | PC | 72411 | Power System Dynamics | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 2 | PC | 72412 | Flexible AC Transmission Systems (FACTS) | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 3 | PC | 72413 | Power System Operation and Deregulation | 2 | 2 | - | 3 | 40 | 60 | 100 |
| 4 | PE | **Professional Elective–III** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 72414 | 1. Gas Insulated Systems(GIS) | | | | | | | |
| | | 70223 | 2. Programmable Logic Controllers and their Applications | | | | | | | |
| | | 72415 | 3. High frequency magnetic components | | | | | | | |
| 5 | PE | **Professional Elective–IV** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 72416 | 1. Reactive Power Compensation and Management | | | | | | | |
| | | 72417 | 2. Power System Reliability | | | | | | | |
| | | 72418 | 3. Voltage Stability | | | | | | | |
| 6 | OE | **Open Elective-II** | | 2 | 2 | - | 3 | 40 | 60 | 100 |
| | | 72419 | 1. Smart grid technologies | | | | | | | |
| | | 72420 | 2. AI Techniques in Electrical Engineering | | | | | | | |
| | | 72421 | 3. Digital control systems | | | | | | | |
| 7 | PC | 72422 | Power Systems Lab-II | - | - | 4 | 2 | 40 | 60 | 100 |
| 8 | PR | 72423 | Seminar-II | - | - | 4 | 2 | 100 | -- | 100 |
| Total | | | | 12 | 12 | 8 | 22 | Contact Periods: 32 | | |

**III Semester**

| S. No. | Category | Course Code | Name of the course | Contact hours/week | | | Credits | Scheme of Valuation | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Internal (CIE) | External (SEE) | |
| 1 | PR | 72424 | Comprehensive Viva-Voce | -- | -- | -- | 6 | -- | 100 | 100 |
| 2 | PR | 72425 | Project work Part I | -- | -- | -- | 16 | 100 | -- | 100 |
| Total | | | | -- | -- | -- | 22 | - | | |

**IV Semester**

| S. No. | Category | Course Code | Name of the course | Contact hours/week | | | Credits | Scheme of Valuation | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Internal (CIE) | External (SEE) | |
| 1 | PR | 72426 | Project work Part II | -- | -- | -- | 6 | 100 | -- | 100 |
| 2 | PR | 72427 | Project Viva-Voce | -- | -- | -- | 16 | -- | 100 | 100 |
| Total | | | | -- | -- | -- | 22 | - | | |

*** PC – Professional Core , PE – Professional Elective, OE – Open Elective , PR – Project Work**

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72401 | ADVANCED POWER SYSTEM ANALYSIS | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Power System Analysis

**Course Objectives:**
To analyze a Power System Network using graph theory, interpret the formation of Network matrices. To construct the necessity of load flow studies and various methods of Analysis, examine short circuit analysis using $Z_{Bus}$.

**MODULE I: Admittance Model and Network Calculations 12 Periods**
Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in $Y_{BUS}$ , An Equivalent Admittance Network, Modification of $Y_{BUS}$ , Network Incidence Matrix and $Y_{BUS}$ , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

**MODULE II: Impedance Model and Network Calculations 12 Periods**

Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and $Z_{BUS}$, Algorithms for building $Z_{BUS}$, Modification of existing $Z_{BUS}$, Calculation of $Z_{BUS}$ elements from $Y_{BUS}$, Power Invariant Transformations, Mutually Coupled Branches in $Z_{BUS}$.

**MODULE III: Power flow Analysis 12 Periods**
**A:** Power flow analysis by Gauss Seidel method and N-R Method.
**B:** Power flow analysis by Decoupled method and fast decoupled method. Comparison between power flow solutions. DC load flow.

**MODULE IV: Contingency Analysis 12 Periods**
$Z_{BUS}$ Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

**MODULE V: Fault Analysis 12 Periods**
Symmetrical faults - Fault calculations using $Z_{BUS}$ - Fault calculations using $Z_{BUS}$ equivalent circuits – Selection of circuit breakers - Unsymmetrical faults - Problems on various types of faults.

**TEXT BOOKS**

1. P. Kundur, **"Power System Stability and Control"**, McGraw Hill Education, 1st Edition, 2006.
2. John J.Grainger and W.D. Stevenson, **"Power System Analysis"**, McGraw Hill Education, 1st Edition, 1994.

**REFERENCES**


1. I.J.Nagrath and D.P.Kothari, **"Modern Power System Analysis"**, Tata McGraw Hill, New Delhi, 4th Edition, 2011.
2. Olle. L.Elgard, **"Electrical Energy Systems Theory"**, McGraw Hill Education, 2nd Edition, 2001.
3. M.A. Pai, **"Computer Techniques in Power System Analysis"**, McGraw Hill, New Delhi, 3rd Edition, 2014.
4. Dr. K. Uma Rao, **"Power System: Operation and Control"**, Wiley India Pvt. Ltd., 2012.
5. Robert Miller and James Malinowski, **"Power System Operation (Electronics)"**, McGraw Hill Education, 3rd Edition, 1994.


**E-RESOURCES**

1. http://www.ieee-pes.org/ieee-transactions-on-power-systems
2. http://www.ieee-pes.org/
3. http://nptel.ac.in/courses/108105067/

**Course Outcomes**

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

1. Obtain the different matrices to analyze the power network.
2. Form bus impedance matrix for the given network.
3. Apply numerical methods for power flow analysis.
4. Analyze the power system under single and multiple contingency.
5. Analyze the power system under fault condition.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72402 | ADVANCED POWER SYSTEM PROTECTION | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Switch Gear and Protection

**Course Objectives:**
To distinguish all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. To generalize neutral grounding for overall protection. To illustrate the phenomenon of over voltages and its classification.

**MODULE I: Static Relays and Comparators 12 Periods**
**Static Relays:** Advantages of static relays - Basic construction of static relays - Level detectors - Replica impedance – Mixing circuits - General equation for two input phase and amplitude comparators - Duality between amplitude and phase comparators.
**Amplitude Comparators**: Circulating current type and opposed voltage type - Rectifier bridge comparators, Direct and Instantaneous comparators.

**MODULE II: Phase Comparators and Static over Current Relays 12 Periods**

**Phase Comparators:** Coincidence circuit type - Block spike phase comparator, Techniques to measure the period of coincidence. Phase comparators - Integrating type, Rectifier and Vector product type.
**Static over Current Relays:** Instantaneous over-current relay - Time over - Current relays - Basic principles – Definite time and Inverse definite time over-current relays.

**MODULE III: Static Differential and Distance Relays 12 Periods**
**A: Static Differential Relays:** Analysis of Static Differential Relays – Static Relay schemes – Duo bias transformer differential protection – Harmonic restraint relay.
**B: Static Distance Relays:** Static impedance – Reactance – MHO and angle impedance relay - Sampling comparator – Realization of reactance and MHO relay using sampling comparator.

**MODULE IV: Multi Input Comparators and Power Swings 12 Periods**
**Multi-Input Comparators:** Conic section characteristics - Three input amplitude comparator – Hybrid comparator - Switched distance schemes – Poly phase distance schemes - Phase fault scheme – Three phase scheme – Combined and ground fault scheme.
**Power Swings:** Effect of power swings on the performance of distance relays – Power swing analysis - Principle of out of step tripping and blocking relays - Effect of line and length and source impedance on distance relays.

**MODULE V: Microprocessor based Protective Relays 12 Periods**
(Block diagram and flowchart approach only) - Over current relays – Impedance relays - Directional relay - Reactance relay. Generalized mathematical expressions for distance relays - Measurement of resistance and reactance – MHO and offset MHO relays - Realization of MHO characteristics - Realization of offset MHO characteristics - Basic principle of Digital computer relaying.

**TEXT BOOKS**
1. Badri Ram and D.N.Vishwakarma, **"Power System Protection and Switch Gear"**, Tata

McGraw Hill Publications, New Delhi, 1995.
2. T.S.MadhavaRao, **"Static Relays"**, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 1989.

**REFERENCES**

1. Bhavesh Bhalja, R.P. Maheshwari and Nilesh G. Chothani, **"Protection and Switchgear"**, Oxford University Press, 2012.
2. C.Christopoulos and A. Wright, **"Electrical Power System Protection"**, Springer International Publisher, 2nd Edition, 1999.

**E-RESOURCES**

1. http://www.mytech-info.com/2016/07/types-of-comparator.html
2. http://www.springer.com/energy/systems%2C+storage+and+harvesting/journal/41601
3. http://nptel.ac.in/courses/108101039/26

**Course Outcomes**

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

1. Comprehend the construction and operation of static relays and amplitude comparators.
2. Understand the construction and operation of Phase Comparators and Static over current relays.
3. Apply the differential & static relays for protection schemes.
4. Illustrate the protection system by using Multi-Input comparators, effects of power swings and protection against the power swings.
5. Illustrate how system can be protected against different faults by using microprocessor based relays.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72403 | MODERN CONTROL THEORY | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Control Systems

**Course Objectives:**

To explain the concepts of basic and modern control system for the real time analysis and design of control systems. To explain and apply concepts of state variables analysis. To analyze non linear systems. To apply the comprehensive knowledge of optimal theory for Control Systems.

**MODULE I: Mathematical Preliminaries** **12 Periods**

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

**MODULE II: State Variable Analysis** **12 Periods**

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

**MODULE III: Non Linear Systems** **12 Periods**

**A:**Introduction–Non Linear Systems - Types of Non-Linearities–Saturation–Dead-Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems

**B:** Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

**MODULE IV: Stability Analysis** **12 Periods**

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

**MODULE V: Optimal Control** **12 Periods**

Introduction to optimal control - Formulation of optimal control problems–calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

**TEXT BOOKS**

1. M.Gopal , **"Modern control system theory",** New Age International , 1984

2. Nagrath and Gopal, **"Control System Engineering"**, New Age International,4th Edition, 2006.

**REFERENCES**

1. Kirck, **"Optimal control"** , Dover Publications
2. A. NagoorKani , **"Advanced Control Theory"**, RBA Publications, 1999.
3. Ogata.K ," **Modern Control Engineering"**, Prentice Hall, 1997.

**E-RESOURCES**

1. http://nptel.ac.in/courses/108101037/
2. http://nptel.ac.in/courses/108103007/
3. https://www.electrical4u.com/state-space-analysis-of-control-system/

**Course Outcomes**

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

1. Apply the mathematical analysis for state model and state diagrams.
2. Understand the concepts of state variables analysis.
3. Understand the concepts of Non Linear Systems.
4. Analyze the concept of stability of nonlinear systems.
5. Analyze the concept of Optimal control problems.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72404 | EHV AC TRANSMISSION (Professional Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Power Systems –II

**Course Objectives:**

To identify the different aspects of Extra High Voltage A.C and D.C Transmission design and Analysis. To understand the importance of modern developments of E.H.V and U.H.V transmission systems. To demonstrate EHV ac transmission system components, protection and insulation level for over voltages.

**MODULE I: Introduction to EHVAC** **12 Periods**

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

**MODULE II: Electrostatic field and voltage gradients** **12 Periods**

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.

**MODULE III: Over Voltages in EHV lines** **12 Periods**

**A:** Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – un energized lines.

**B:** 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.

**MODULE IV: Corona in E.H.V. lines** **12 Periods**

Corona in E.H.V. 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.

**MODULE V: Design of EHV lines** **12 Periods**

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.

**REFERENCES**


1. S. Rao, **"EHVAC and HVDC Transmission Engg. Practice"**, Khanna publishers.
2. Arrillaga.J, **,** 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.


**E-RESOURCES**

1. https://www.electrical4u.com/voltage-in-power-lines/
2. https://www.electrical4u.com/corona-effect-in-power-system/
3. http://nptel.ac.in/courses/108108033/

**Course Outcomes**

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

1. List the necessity of EHV AC transmission, choice of voltage for transmission, line losses and power handling capability.
2. Analyze the electrostatic field of AC lines and voltage gradients.
3. Calculate the power frequency voltage control and over voltage in EHV lines.
4. Estimate the Corona loss and Measurements of RI and RIV in EHV lines
5. Emphasize the Statistical procedures for line designs, and characteristics of EHV cables.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72405 | HIGH VOLTAGE GENERATION AND MEASUREMENT (Professional Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Electrical & Electronics Instrumentation

**Course Objectives:**

To understand the generation methods of High A.C, DC & Impulse Voltages required for various application. To apply the measuring techniques of High A.C., D.C & Impulse voltages and currents. To identify the testing techniques for High Voltage Equipment.

**MODULE I: GENERATION OF DIRECT VOLTAGES 12 Periods**

Generation and transmission of electric energy – voltage stress – testing voltages-AC to DC conversion – single phase rectifier circuits – cascaded circuits – voltage multiplier circuits – Cockroft-Walton circuits – voltage regulation – ripple factor – Design of HVDC generator – Vande-Graff generator.

**MODULE II: GENERATION OF ALTERNATING VOLTAGES 12 Periods**

Testing transformer – single unit testing transformer, cascaded transformer – equivalent circuit of cascaded transformer – series resonance circuit – resonant transformer – voltage regulation.

**MODULE III: GENERATION OF IMPULSE VOLTAGES 12 Periods**

**A:** Marx generator – Impulse voltage generator circuit – analysis of various impulse voltage generator circuits.

**B:** Multistage impulse generator circuits Switching impulse generator circuits – impulse current generator circuits – generation of non-standard impulse voltages and nanosecond pulses.

**MODULE IV: MEASURMENT OF HIGH VOLTAGES 12 Periods**

Peak voltage measurements by sphere gaps – Electrostatic voltmeter – generating voltmeters and field sensors – Chubb-Fortescue method – voltage dividers and impulse voltage measurements

**MODULE V: GENERATION AND MEASUREMENT OF IMPULSE CURRENTS 12 Periods**

Generation of impulse currents, measurement of impulse currents – Resistive shunts , measurement using magnetic coupling - Fast digital transient recorders for impulse measurements.

**TEXT BOOKS**


1. Kuffel, E., Zaengl, W.S. and Kuffel J., **"High Voltage Engineering Fundamentals"**, Elsvier India Pvt. Ltd, 2005.
2. Naidu M S and Kamaraju V, **"High Voltage Engineering",** Tata McGraw-hill Publishing Company Ltd., New Delhi, 2004.


**REFERENCES**


1. Dieter Kind, Kurt Feser, **"High Voltage Test Techniques"**, SBA Electrical Engineering Series, New Delhi, 1999.
2. Gallagher, T.J., and Permain, A., **"High Voltage Measurement, Testing and Design"**, John Wiley Sons, New York, 1983.

3. R.Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, RoshdyRadwan, **"High Voltage Engineering Theory and Practice"** 2nd Edition, Revised and Expanded, Marcel Dekker, Inc., New York, 2000.
4. N.H.Malik, A.A.Al_Arainy, M.I.Qureshi**, " Electrical Insulation in Power Systems",** Marcel Dekker,Inc., New York 1988.
5. Adolf J. Schwab**, "High Voltage Measurement Techniques",** M.I.T Press, 1972.

**E-RESOURCES**

1. http://nptel.ac.in/courses/108104048/
2. http://nptel.ac.in/courses/108104048/ui/TOC.htm
3. http://www.elect.mrt.ac.lk/HV_Chap6.pdf

**Course Outcomes**

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

1. Emphasize the generation of DC voltages.
2. Analyze the generation of AC voltages and calculate the voltage regulation.
3. Analyze the impulse voltages and various impulse voltage generator circuits.
4. Measure the High voltages with different methods.
5. Analyze the generation and measurement of impulse currents.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 70441 | ADVANCED DIGITAL SIGNAL PROCESSING (Professional Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Digital Signal Processing.

**Course Objectives:**

The objective of the course is to introduce the concepts of multi rate Digital signal Processing, to emphasize the importance of estimation of power spectral density and its evaluation using Non-Parametric methods, to evaluate power spectral density using Parametric methods. The course enables the student to learn the design approaches and realization structures of Digital Filters and to know the effect of Finite Word Length.

**MODULE I: Multi-Rate Signal Processing** **8 Periods**

Multi Rate Signal Processing: Introduction, Decimation by a factor D. Interpolation by a factor I.sampling rate conversion by a rational factor I/D. Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion, Applications of Multirate Signal Processing.

**MODULE II: Non - Parametric methods of Power Spectral Estimation** **10 Periods**

Estimation of spectra from finite durationobservation of signals, Non-parametric Methods: Bartlett, Welch & Blackman & Tukey methods, Comparison of all Non-Parametric methods.

**MODULE III: Parametric Methods of Power Spectrum Estimation** **10 Periods**

**A:** Autocorrelation & its Properties, Relation between auto correlation & model parameters
**B:** AR Models - Yule - Waker & Burg Methods, MA & ARMA models for power spectrum estimation.

**MODULE IV: Implementation of Digital Filters** **10 Periods**

Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, implementation of lattice structures for IIR filters, Advantages of lattice structures.

**MODULE V: Finite Word Length Effects** **10 Periods**

Analysis of finite word length effects in Fixed-Point DSP Systems–Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

**TEXT BOOKS:**


1. J. G. Proakis & D. G. Manolokis, **"Digital Signal Processing, Principles, Algorithms & Applications"**, PHI, 4th Edition.
2. Alan V Oppenheim & Ronald W.Schaffer, **"Discrete Time signal processing"**, PHI.
3. Emmanuel C. Ifeacher, Barrie, W.Jervis, **"DSP – A Practical Approach"**, Pearson Education, 2nd Edition.


**REFERENCES:**


1. S. M. Kay, **"Modern nspectral Estimation: Theory & Application"**, PHI, 1988.
2. P. P. Vaidyanathan, **"Multirate Systems and Filter Banks"**, Pearson Education.
3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya ,**"Digital Signal Processing"**, TMH, 2000.

**E-RESOURCES:**

1. http://www-syscom.univ-mlv.fr/~zaidi/teaching/dsp-esipe-oc2/Course-Notes__Advanced-DSP.pdf
2. https://www.dss.tf.uni-kiel.de/en/teaching/lectures/adv.-digital-signal-processing
3. http://www.springer.com/engineering/signals/journal/13634
4. https://www.youtube.com/watch?v=4ufeTZ6fSNY
5. http://www.nptelvideos.in/2012/12/advanced-digital-signal-processing.html

**Course Outcomes:**

After completion of the course, students will be able to:

1. Understand multi-rate signal processing techniques
2. Estimate the power spectrum using non-parametric methods
3. Estimate the power spectrum using parametric methods
4. Implement both IIR and FIR digital filter structures
5. Analyze finite word length effects in fixed point DSP systems

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72406 | POWER QUALITY (Professional Elective - II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Power Systems and Power Electronics

**Course Objectives:**

This subject deals with power quality issues and solutions. It also discussed some of the power quality issues like interruptions and voltage sag with their reliability evaluation.

**MODULE I: Voltage Sags And Interruptions** **12 Periods**

Terms and definitions: Overloading, under voltage - sustained interruption; sags and swells; waveform distortion - Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve - Sources of sags and interruptions – estimating voltage sag performance - fundamental principles of protection - motor starting sags.

**MODULE II: Transient Over voltages** **12 Periods**

Sources of transient over voltages: Capacitor switching - magnification of capacitor switching transients – lightning - ferro resonance and other switching transients; Devices for over voltage protection: Surge arresters and transient voltage surge suppressors – isolation transformers - low pass filters - low impedance power conditioners - -utility surge arresters, utility system Lightning protection : shielding, line arresters - low side surges – cable protection and scout arrester scheme.

**MODULE III: Fundamentals Of Harmonics** **12 Periods**

**A:** Harmonic distortion: Voltage and current distortion - harmonic indices - harmonic sources from commercial and industrial loads.

**B:** Locating harmonic sources - system response characteristics: resonance.

**MODULE IV: Applied Harmonics, Wiring And Grounding** **12 Periods**

Effects of harmonic distortion **-** harmonic distortion evaluation, principles for controlling harmonics - devices for controlling harmonic distortion – inter harmonics caused by induction furnaces - IEEE standard 519-1992 – over view of IEC standards on harmonics – reasons for grounding – typical wiring and grounding problems – isolated ground – summary of wiring and grounding solutions.

**MODULE V: Power Quality Monitoring** **12 Periods**

Monitoring considerations: Disturbance analyzer - harmonic / spectrum analyzer – combination - Disturbance harmonic analyzer - flicker meters - smart power quality monitors - transducers requirements - applications of expert system - power quality monitoring and the internet – EMI - Electromagnetic compatibility.

**TEXT BOOKS**


1. Roger.C.Dugan, Mark.F. Mc Granagham**, "Electrical Power Systems Quality"** 3rd Edition, McGraw Hill, 2012.
2. Ewald F. Fuchs, Mohammad A. S. Masoum**, "Power Quality in Power Systems and Electrical Machines"**, 2nd Edition, Academic Press, 2011.

**REFERENCES**


1. Francisco C. De La Rosa, **"Harmonics and Power Systems",** 1st Edition, CRC Press, 2006.
2. Angelo Baggiri, **"Handbook of Power Quality",** 1st Edition, John Wiley & Sons, 2008.
3. C. Sankaran, **"Power Quality",** 1st Edition, CRC Press, 2002.
4. P.S. Satnam P.S. Kang, **"Power Capacitor for Reactive Compensation",** 1st Edition, Dhanpat Rai & Sons Publications, 2008.


**E-RESOURCES**

1. http://www.elec.uow.edu.au/apqrc/links
2. http://technav.ieee.org/tag/1354/power-quality#concepts
3. http://nptel.ac.in/courses/108106025/

**Course Outcomes**

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

1. Explain power quality disturbances and typical problems associated with it.
2. Describe the causes of transient over voltages and its mitigation methods.
3. Explain the sources of current and voltage harmonics.
4. Understand the concepts of harmonic distortion and controlling methods.
5. Describe the different types of analyzer used in power quality monitoring.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 70420 | MICROCONTROLLERS AND APPLICATIONS (Professional Elective - II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Switching Theory and Logic Design, Computer Organization and Microprocessors and Interfacing

**Course Objective:**

This course introduces the architecture of 8051 Microcontroller, the instruction set of 8051, real-time interrupts, real time Timers and interfacing with 8051 Microcontroller.

**MODULE I: 8051 Microcontroller** **14 periods**

Introduction, Architecture ofa 8051 microcontroller: Internal and External memories – Counters and Timers – Synchronous serial communication, asynchronous serial communication – Interrupts, I/O Ports, signal description of 8051.

**MODULE II: Instruction Set of 8051** **12 periods**

Basic assembly language programming – Data transfer instructions – Data and Bit manipulation instructions – Arithmetic instructions – Logical operations, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

**MODULE III: Real-Time Control - Interrupts** **14 periods**

**A:** Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources

**B:** Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.

**MODULE IV: Real-Time Control – Timers** **12 periods**

Programmable Timers in the MCU's – Free running counter and real time control – Interrupt interval and density constraints, watch dog timer.

**MODULEV: Interfacing** **12 periods**

Switch and Keypad - LED and Array of LEDs - Seven Segment, LCD and its interfaces Stepper motor and DC motor interfacing.

**TEXT BOOKS:**


1. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal,Pearson Education, 2005.
2. The 8051 Microcontroller and Embedded Systems – Mazidi and Mazidi, PHI, 2000.


**REFERENCES:**


1. Kenneth. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 3rd Edition, 2004.
2. Microcontrollers (Theory & Applications) – A.V. Deshmuk, WTMH, 2005.
3. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.


**E-RESOURCES:**

1. https://www.edgefx.in/8051-microcontroller-architecture/
2. http://www.newagepublishers.com/samplechapter/002079.pdf
3. http://8051-microcontrollers.blogspot.in/2015/11/timers-acounterstimers.html#.WYbVGLpuLIU

4. http://ymk.k-space.org/Lecture_Nov5.pdf
5. http://www.rtcmagazine.com/technologies/view/Microcontrollers
6. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

**Course Outcomes:**

After completion of the course, students will be able to:

1. Describe the basic architecture of 8051microcontroller
2. Write assembly language programs for 8051 microcontroller.
3. Know the interrupt handling techniques.
4. Know the usage of timers in real time applications.
5. Develop a microcontroller based system.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72407 | DISTRIBUTION AUTOMATION (Professional Elective - II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Electrical Distribution Systems

**Course Objectives:**

To list the distribution systems for load modeling. To understand the design & working of substations. To give a comprehensive idea on communication systems.

**MODULE I: Distribution Automation and the Utility System 12 Periods**

Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software.

**MODULE II: Distribution Automation Functions 12 Periods**

DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

**MODULE III: Communication Systems 12 Periods**

**A: Communication Systems for DA:** DA communication requirements, Communication reliability, Cost effectiveness, Data rate Requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow

**B: Communication systems used in DA:** Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. Fiber optics, Hybrid Communication systems, Communication systems used in field tests.

**MODULE IV: DA Technical Benefits 12 Periods**

DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, improved operation, Function benefits, Potential benefits for functions, and function shared benefits, Guidelines for formulation of estimating equations Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

**MODULE V: Economic Evaluation Methods 12 Periods**

Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives. Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

**TEXT BOOKS**


1. James, **"Control and Automation of Electrical Distribution Systems",** Northcote – Green Robert Wilson, CRC Press.
2. Dr. M. K. Khedkar, Dr. G.M.Dhole, **"Electric Power Distribution Automation"**, University Science press.

**REFERENCES**


1. IEEE Tutorial Course **"Distribution Automation"**
2. IEEE Working Group on **"Distribution Automation"**


**E-RESOURCES**

1. http://nptel.ac.in/courses/108106022/LECTURE%2011.pdf
2. http://nptel.ac.in/courses/108106022/
3. http://magazine.ieee-pes.org/

**COURSE OUTCOMES**

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

1. List the distribution systems for load modeling.
2. Understand the various distribution automation functions.
3. Find the transfer of electrical data in distribution system through Digital Communication. Predict load forecasting and reliability in economic point of view
4. Analyze the various technical benefits of DA.
5. Have a comprehensive idea on economic evaluation methods.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 70B16 | OPTIMIZATION TECHNIQUES (Open Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**
This course deals with the extremely important topics under the broad umbrella of optimization. This is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

**MODULE I: Introduction to Operations Research** **12 Periods**
Definition,scope,objectives,phases,objectives, models and limitation of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex method, Artificial variable, big-M method, two-phase method, degeneracy & unbound solution.

**MODULE II: Transportation Problems** **12 Periods**
Formulation, solution, Un balanced Transportation problem, Finding basic feasible solution-Northwest corner rule, least cost method and Vogel's approximation method.Optimality test: the stepping stone method and MODI method.
**Assignment Models:**Formulation.Hungarian method for optimal solution. Solving unbalanced problem.Travelling salesman problem as assignment problem.

**MODULE III:** **12 Periods**
**A: Sequencing Models:** Solution of sequencing problem-processing n jobs through 2 machines, processing n jobs through 3 machines, processing 2 jobs through m machines, processing n jobs through m machines.
**B: Replacement Models**: Replacement of items that deteriorate whose maintenance cost increase with time without change in the money value. Replacement of items that fail suddenly:individual replacement policy, group replacement policy.

**MODULE IV:Game Theory** **12 Periods**
Competitive games, rectangular game,saddle point,minimax(maximin)method of optimal strategies,value of the game. solution of games with saddle points,dominance principal.Rectangular games without saddle points-mixed strategy for2x2 games.

**MODULE V: Inventory Models** **12 Periods**
Inventory cost, Models with deterministic demand-model(a) demand rate uniform and production rate infinite, model(b) demand rate non-uniform and production rate infinite, model(c)demand rate uniform and production rate finite.

**TEXT BOOKS**

1. S.D.Sharma **"Operations Research"** Kedarnath & Ramnath Publisher, 15th edition,2013.
2. J.K. Sharma **"Operations Research Theory & Applications"** Macmillan India Ltd, 4E.


**REFFERENCES**

1. P.Sankara Iyer **"Operations Research"**Tata McGraw-Hill,2008
2. Taha **"Operations Research"** TMH,2010

3. A.M.Natarajan,P.Balasubramani,A.Tamilarasi **"Operations Research"**Pearson Education, 2005
4. Hiller & Libermann **"Introduction to Operations Research""** McGraw Hill Publications, 9th Edition,2010

**E-RESOURCES**

1. http://www.mhhe.com/engcs/industrial/hillier/etext/PDF/chap03.pdf (LPP)
2. http://ocw.nctu.edu.tw/upload/classbfs121001503719748.pdf (Transportation Problems)
3. http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7_chapter%201.pdf (Replacement Models)
4. https://www.math.ucla.edu/~tom/GameTheory/mat.pdf (Game Theory)
5. http://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf (Inventory Models)
6. http://www.researchpublish.com/download.php?file=Some%20Applications-2812.pdf (LPP)
7. http://www.rspq.org/pubs/or.pdf (Sequencing Models)
8. http://elib.mi.sanu.ac.rs/files/journals/yjor/18/yujorn18p197-206.pdf (Inventory Models)

9. https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX (LPP)
10. https://www.youtube.com/watch?v=Q31jKiEXxdc (Transportation Problems)
11. https://www.youtube.com/watch?v=BUGIhEecipE (Assignment Models)
12. https://www.youtube.com/watch?v=533dp83Er6E (Sequencing Models)
13. https://www.youtube.com/watch?v=a52BtWkyjl0&list=PLOEpD2bjMC9K4iTa9Y7xNToVdehbFRmR6 (Game Theory)
14. https://www.youtube.com/watch?v=9tJv5COGkD0 (Inventory Models)

**Course Outcomes:**

**After completion of the course students will be able to:**

1. Students will be able to find feasible solution to LPP by various Methods.
2. Students will be able to minimize the cost and time by using Travelling salesmen Problem.
3. Understand the various concepts of Replacement model problems.
4. Students will able to solve the game theory problems.
5. Understand the various concepts of inventory models.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72408 | ENERGY MANAGEMENT (Open Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To study the concepts behind economic analysis and Load management. To emphasize the energy management on various electrical equipments and metering. To illustrate the concept of lighting systems and cogeneration.

**MODULE I: Introduction to Energy Management 12 Periods**

Principles of Energy Management – Managerial Organization – Functional Areas for i. Manufacturing Industry ii. Process Industry iii. Commerce iv. Government. Role of Energy Manager in each of these organizations. Initiating, Organizing and Managing Energy Management Programs.

**MODULE II: Energy Audit and Conservation 12 Periods**

Definition and Concepts, Types of Energy Audits – Basic Energy Concepts – Resources for Plant Energy Studies – Data Gathering – Analytical Techniques.

Energy Conservation: Technologies for Energy Conservation , Design for Conservation of Energy materials – energy flow networks – critical assessment of energy usage – formulation of objectives and constraints – synthesis of alternative options and technical analysis of options – process integration.

**MODULE III: Scope & Characterization 12 Periods**

**A:** Scope, Characterization of an Investment Project – Types of Depreciation.

**B:** Time Value of money – budget considerations, Risk Analysis.

**MODULE IV: Cost Mecahnism 12 Periods**

Payback – Annualised Costs – Investor‟s Rate of return – Present worth – Internal Rate of Return – Pros and Cons of the common methods of analysis – replacement analysis.

**MODULE V: Solar Energy 12 Periods**

Solar Energy – Types of devices for Solar Energy Collection – Thermal Storage System – Control Systems-Wind Energy – Availability – Wind Devices – Wind Characteristics – Performance of Turbines and systems.

**TEXT BOOKS**


1. W.C. Turner, **"Energy Management Hand book",** 6th Edition,2006
2. H.Koontz and Cyrill O Donnell,**"Management"**, 3rd Edition,2008


**REFERENCES**


1. S.C. Kuchhal **"Financial Management",** 8th Edition,1982.
2. W.R.Murthy and G.Mc Kay **"Energy Management"**,
3. CB Smith, **"Energy Management Principles"**, Edition,1981.

**E-RESOURCES**

1. http://nptel.ac.in/courses/108106022/
2. http://industrialelectricalco.com/wp-content/uploads/2014/01/Understanding-Energy-Efficient-Motors-EASA.pdf
3. https://beeindia.gov.in/

**Course Outcomes**

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

1. Understand the principles of energy management and Managerial organization.
2. Comprehend the types of Energy audits and Energy conservation technologies.
3. Analyze the economic aspects of investment.
4. Recognize the different methods of evaluation of projects.
5. Understand the different alternative energy sources.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 70452 | EMBEDDED SYSTEM DESIGN (Open Elective - I) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites**: Microprocessors and Microcontrollers or an Equivalent course

**Course Objective**:

To introduce various components of a typical embedded system and to teach things required to design a typical embedded system.

**MODULE I: Introduction to Embedded Systems** **08 Periods**

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History ofEmbedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems,Characteristics and Quality Attributes of Embedded Systems.

**MODULE II: Typical Embedded System** **10 Periods**

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs,Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**MODULE III: Embedded Firmware** **10 Periods**

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**MODULE IV: RTOS Based Embedded System Design** **10 Periods**

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads,Multiprocessing and Multitasking, Task Scheduling.

**MODULE V: Task Communication** **10 Periods**

Shared Memory, Message Passing, Remote Procedure Call and Sockets,Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

**TEXT BOOKS**

1. Shibu K. V, "**Introduction to Embedded Systems"**, McGraw Hill, 2013.

**REFERENCES**

1. Raj Kamal, **"Embedded Systems"**, TMH.
2. Frank Vahid, Tony Givargis, John Wiley,**"Embedded System Design"**.
3. Lyla, **"Embedded Systems"**, Pearson, 2013.
4. David E. Simon, **"An Embedded Software Primer",** Pearson Education.

**E-RESOURCES**

1. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.158.9376&rep=rep1&type=pdf
2. http://www.radio-electronics.com/info/processing-embedded/embedded-systems/basics-tutorial.php
3. http://www.gian.iitkgp.ac.in/files/brochures/BR1458666215SESD_brochure_GIAN.pdf
4. http://www.engpaper.com/embedded-system-research-papers-and-projects-11.htm
5. http://www.scirp.org/journal/articles.aspx?searchCode=Embedded+Real-Time+and+Operating+Systems+Program+(ERTOS)%2C+National+ICT+Australia+(NICTA)&searchField=affs&page=1&SKID=0
6. https://onlinecourses.nptel.ac.in/noc17_cs05/preview
7. http://www.nptelvideos.in/2012/11/embedded-systems.html

**Course Outcomes:**

**At the end of the course, students will be able to:**

1. Gain knowledge on the basics of an embedded system
2. Know components of a typical embedded system
3. Understand different embedded firmware
4. Know real-time operating systems used in embedded systems
5. Understand various RTOS concepts

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. I Semester | | |
|---|---|---|---|---|
| Code: 72409 | POWER SYSTEMS SIMULATION LAB | L | T | P |
| Credits: 2 | | - | - | 4 |

**Course Objectives:**

This course deals with the MATLAB application for power system network and to analyze the power system network by MATLAB programming.

**List of Experiments:**

1. Develop MATLAB program for YBUS formation.
2. Load Flow Analysis for given Power system network using G-S method with MATLAB.
3. Load Flow Analysis for given Power system network using N-R method with MATLAB.
4. Develop MATLAB program for FDLF Load Flow Analysis.
5. Develop MATLAB program for Short Circuit Analysis for Single Line to Ground fault (L-G).
6. Develop MATLAB program for Short Circuit Analysis for Line to Line fault (L-L).
7. Develop MATLAB program for Short Circuit Analysis for Double Line to Ground fault (L-L-G).
8. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
9. Develop PSPICE Program for Transient response of RLC Circuit To an input (i) pulse (ii) step and (iii) Sinusoidal signals.
10. Develop PSPICE Program for Analysis of Three Phase Circuit representing the generator transmission line and load .plot three phase currents and neutral current.

**Course Outcomes**

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

1. Develop the programming for YBUS formation
2. Develop MATLAB program for FDLF Load Flow Analysis
3. Obtain Load Flow Analysis for given Power system network using G-S, N-R methods with MATLAB.
4. Develop MATLAB program for Short Circuit Analysis for various faults in power systems.
5. Develop PSPICE Program for Transient response of RLC Circuit for various input signals.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72411 | POWER SYSTEM DYNAMICS | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**
To impart the basics of dynamic characteristics of power system equipment. Analyze the Dynamic performance of power systems, System stability and controls.

**MODULE I: BASIC CONCEPTS 12 Periods**

Power system stability, states of operation and system security - system dynamics – problems, system model analysis of steady state stability and transient stability - simplified representation of Excitation control.

**MODULE II: MODELING OF SYNCHRONOUS MACHINE 12 Periods**

Synchronous machine – park's Transformation-analysis of steady state performance, per unit quantities-Equivalent circuits of synchronous machine-determination of parameters of equivalent circuits.

**MODULE III: EXCITATION SYSTEM 12 Periods**

**A:** Excitation system modeling-excitation systems block Diagram - system representation by state equations- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations.

**B:** Rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

**MODULE IV: ANALYSIS OF SINGLE MACHINE SYSTEM 12 Periods**

Small signal analysis with block diagram - Representation Characteristic equation and application of Routh- Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

**MODULE V: APPLICATION OF POWER SYSTEM STABILIZERS 12 Periods**

Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

**TEXT BOOKS**


1. K R Padiyar, **"Power System Dynamics : Stability and Control",** B.S. Publications, 2006.
2. R. Ramanujam, **"Power System Dynamics : Analysis and Simulation"**, PHI Publications, 2009.


**REFERENCES**


1. P.M. Anderson and A.A. Fouad, **"Power system control and stability",** IEEE Press, 2002.
2. Prabha Kundur, **" Power System Stability And Control"**, McGraw Hill Education Publisher, 1st Edition, 2006.
3. El-Shimy Mohamed, **"Dynamic Security of Interconnected Electric Power Systems - Volume 1"**, LAP Lambert Academic Publishing, 2015.

**E-RESOURCES**

1. ewh.ieee.org/soc/pes/psdpc/
2. http://magazine.ieee-pes.org/
3. nptel.ac.in/courses/108101004/

**Course Outcomes**

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

1. Choose the fundamental dynamic behavior and controls of power systems to perform basic stability analysis.
2. Comprehend concepts in modeling and simulating the dynamic phenomena of power systems.
3. Analyze theory and practice of modeling main power system components, such as synchronous machines.
4. Interpret results of system stability studies
5. Analyze theory and practice of various components power system stabilizers.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72412 | FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:** The course introduces the fundamentals of FACTS Controllers, Importance of controllable parameters and types of FACTS controllers & their benefits.

**MODULE I: Facts Concepts** **12 Periods**

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.

**MODULE II: Voltage Source Converters** **12 Periods**

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.

**MODULE III: Static Shunt Compensation** **12 Periods**

**A:** Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping,

**B:** Methods of controllable VAR generation, variable impedance type static VAR generators, switching converter type VAR generators, hybrid VAR generators.

**MODULE IV: SVC and STATCOM** **12 Periods**

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

**MODULE V: Static Series Compensators** **12 Periods**

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), Control schemes for GSC, TSSC and TCSC.

**TEXT BOOKS**


1. N.G. Hingorani and L. Guygi, **"Understanding FACTS Devices",** IEEE Press Publications, 2000.
2. K.R. Padiyar., **" FACTS Controllers in Power Transmission and Distribution**", New Age International Publishers, 2007.


**REFERENCES**


1. Xiao-Ping Zhang, Christian Rehtanz and Bikash Pal, **"Flexible AC Transmission Systems: Modelling and Control (Power Systems)",** Springer publisher, 2nd Edition, 2012 **.**
2. Rajiv K. Varma R. Mohan Mathur, **"Thyristor-Based FACTS Controllers for Electrical Transmission Systems",** Wiley Publishers, 2011.

3. Nisha Tamta and Ashwini Arya, **"Modelling of Facts Controllers in Power System Networks",** LAP Lambert Academic Publishing, 2012.

**E-RESOURCES**

1. http://www.electronicshub.org/flexible-ac-transmission-systemfacts/
2. http://www.powerqualityworld.com/2011/09/statcom-static-synchronous-compensator.html
3. https://www.youtube.com/watch?v=6u6twyQYFNM

**Course Outcomes**

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

1. Analyze the importance of controllable parameters and basic concepts of FACTS controllers
2. Apply the concepts of Voltage source converters and Current Source Converters.
3. Apply the static shunt compensation by using different VAR generators.
4. Interpret the control circuits of Shunt Controllers like SVC & STATCOM for various functions.
5. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72413 | POWER SYSTEM OPERATION AND DEREGULATION | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

The course introduces the concept of OPF with security constraints. To describe modeling of load frequency control of a power system. To get awareness on reactive power control of a power system.

**MODULE I: Optimal Power Flow** **12 Periods**

Introduction- Solution to the optimal power flow-gradient method-Newton‟s method-Linear sensitivity analysis- Linear programming methods- Security constrained OPF-Interior point algorithm- Bus incremental costs

**MODULE II: Power System Security** **12 Periods**

Introduction –Factors affecting power system security-Contingency analysis-Detection of network problems-Linear sensitivity analysis-AC power flow methods-contingency selection-concentric relaxation-Bounding area method

**MODULE III: State Estimation In Power Systems** **12 Periods**

**A:** Introduction- Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network- State estimation by orthogonal decomposition.

**B:** Detection and identification of Bad measurements- Estimation of quantities not being measured- Network Observability and pseudo measurements

**MODULE IV: Power System Deregulation** **12 Periods**

Introduction- motivation for restructuring of power systems- Electricity market entities model-benefits of deregulation-terminology-deregulation in Indian power sector-Operations in power markets-power pools-transmission networks and electricity markets.

**MODULE V: Available Transfer Capability** **12 Periods**

Introduction methods: of determination of ATC - ATC calculation considering the effect of contingency analysis-Transmission open access and pricing-cost components of transmission system- transmission pricing methods-Incremental cost based transmission pricing.

**TEXT BOOKS**


1. A.J.Wood and B.F.Woollenberg, **" Power Generation Operation and Control",** Wiley-Interscience publication, 2nd Edition, 1996.
2. P.Venkatesh, B.V.Manikandan, S.Charles Raja and A.Srinivasan**, "Electrical Power Systems: Analysis, Security, Deregulation"**, PHI Learning Pvt. Ltd., 2012.


**REFERENCES**


1. P.S.R. Murty, **"Electrical Power Systems",** Butterworth-Heinemann Publishers, 2017.
2. Subir Ray**, "Electrical Power Systems: Concept, Theory and Practice",** PHI Learning Pvt. Ltd., 2014.

3. Hussain Shareef, **"Modern Power Tracing Methods for Deregulated Power Systems",** LAP Lambert Academic Publishing, 2011.

**E-RESOURCES**

1. https://neos-guide.org/content/optimal-power-flow
2. https://albertaviews.ca/electricity-deregulation/
3. http://nptel.ac.in/courses/108101005/
4. https://www.inc.com/magazine/20001101/20897.html

**Course Outcomes**

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

1. Analyze the optimal scheduling of power plants.
2. Analyze the Power system security -Contingency analysis.
3. Power system state estimation by using different measurements
4. Restructuring of power systems and deregulation in Indian Power sector.
5. Calculate ATC and the cost of transmission.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72414 | GAS INSULATED SYSTEMS (GIS) (Professional Elective-III) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:** To impart the GIS concepts and principles, to compare between Air Insulated Substation and GIS. To understand the design and constructional aspects of GIS.

**MODULE I: Introduction To GIS and Properties Of $Sf_6$ 12 Periods**

Characteristics of GIS- Introduction to $SF_6$ - Physical properties-Chemical properties - Electrical properties-Specification of $SF_6$ gas for GIS application - Handling of $SF_6$ gas before use - Safe handling of $Sf_6$ gas in electrical equipment - Equipment for handling the $SF_6$ Gas - $SF_6$ and environment.

**MODULE II: Layout Of GIS Stations 12 Periods**

Advancement Of GIS Station - Comparison With Air Insulated Substation - Economics Of GIS - User Requirements For GIS - Main Features For GIS - Planning And Installation Components Of A GIS Station

**MODULE III: Design And Construction Of GIS Station 12 Periods**

**A:** Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components

**B:** Insulation Design for Components- Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

**MODULE IV: Fast Transient Phenomena In GIS 12 Periods**

Introduction- Disconnect or Switching in Relation to Very fast Transients-Origin of VFTO-Propagation and Mechanism of VFTO-VFTO Characteristics- Effects of VFTO-Testing of GIS for VFTO.

**MODULE V: Special Problems in GIS and GIS Diagnostics 12 Periods**

Introduction - particles their effects and their control- Insulating Spacers and their Reliability - $SF_6$ Gas Decomposition - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

**TEXT BOOKS**

1. M. S. Naidu , **"Gas Insulated Substations",** IK International Publishing House.

**REFERENCES**

1. Hermann J. Koch, "Gas Insulated Substations", Wiley-IEEE Press, 2014.
2. S. A. Boggs, F. Y. Chu and N. Fujimoto, **"Gas-insulated substations: technology and practice"**, Pergamon Press, 1986.

**E-RESOURCES**

1. http://electrical-engineering-portal.com/gas-insulated-substations-gis
2. https://www.electricity-today.com/overhead-td/gas-insulated-switchgear-options-for-substations
3. https://www.youtube.com/watch?v=q025e5dW32c

**Course Outcomes**

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

1. Analyze the properties of SF6 gas and its functioning
2. Analyze the features and layout of GIS systems
3. Observe constructional design features of GIS design
4. Analyze the Fast Transient Phenomena in Gas
5. Discriminate the Problems and design diagnostic methods of GIS

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 70223 | PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS (Professional Elective - III) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:** To impart knowledge on Mode of operation and programming of a Programmable Logic Controller (PLC), to impart knowledge on Characteristics of a PLC (synchronous, asynchronous), Analysis of the process schematic, analog PLC and PID controllers.

**MODULE I: Introduction To PLC** **9 Periods**

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

**MODULE II: Plc Programming** **10 Periods**

PLC programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logical gates programming in the Boolean algebra SYSTEM, CONVERSION EXAMPLES-Ladder diagrams for process control – Ladder diagrams for sequence listings – ladder diagram construction and flow chart for spray process system.

**MODULE III: Registers And Counters** **10 Periods**

**A:** PLC Registers: Characteristics of registers – module addressing – holding registers – output registers – PLC functions – Timer functions and industrial application.

**B:** counters – counter function industrial application – Architecture functions – number function comparison functions.- number conversion functions.

**MODULE IV: Data Handling Fucntions And Sequence Functions** **10 Periods**

Data handling functions: SKIP, Master control relay – Jump Move FIFO, FAL, ONS, CLR and sweep functions and their applications.

Bit pattern and changing a bit shift register, sequence functions and applications – controlling of two axes and three axis Robots with PLC, Matrix functions.

**MODULE V: Analog PLC** **9 Periods**

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

**TEXT BOOKS**


1. W. Bolton, **"Programmable Logic Controllers"** , 5th Edition, Elsevier, 2009.
2. J R Hackworth and F D Hackworth Jr, "**Programmable Logic Controllers – Programming methods and Applications"** 5th Edition,Pearson Publications, 2004.


**REFERENCES**


1. John W Webb and Ronald A Reiss, **"Programmable Logic Controllers – Principles and Applications"**, 5th Edition, Prentice Hall of India, 1998.

2. Rajesh Mehra and Vikrant Vij, **"PLCs & SCADA: Theory and Practice", 1st Edition,** Laxmi Publications, 2016.

**E RESOURCES**

1. https://www.amci.com/industrial-automation-resources/plc-automation-tutorials/what-plc/
2. http://library.automationdirect.com/understanding-ladder-logic/
3. nptel.ac.in/courses/112102011/11

**Course Outcomes**

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

1. Understand the basic concepts of PLC and construct the PLC ladder diagrams.
2. Programming the PLC and Analyze the process schematic.
3. Understand the characteristics of PLC registers and Architecture functions.
4. Analyze the data handling functions and sequence functions.
5. Understand the Analog PLC operation & analog signal processing.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72415 | HIGH-FREQUENCY MAGNETIC COMPONENTS (Professional Elective - III) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To study Fundamentals of Magnetic Devices. To study Fundamentals of, Skin effect and Proximity effect. To study the Design of Transformers, Analysis of Integrated inductors and self capacitance.

**MODULE I: Fundamentals Of Magnetic Devices 12 Periods**

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

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

**MODULE II: Skin Effect & Proximity Effect 12 Periods**

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

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

**MODULE III: Transformers 12 Periods**

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

**B: Design of Transformers:** Introduction, Area Product Method, Optimum Flux Density, Transformer Design for Fly-backConverter in CCM, Transformer Design for Fly-back Converter

in DCM, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM.

**MODULE IV: Integrated Inductors 12 Periods**

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

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

**MODULE V: Self-Capacitance 12 Periods**

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

**TEXT BOOKS**


1. Umanand L., Bhat,S.R., **"Design of Magnetic Components for Switched Mode Power Converters"** , ISBN:978-81-224-0339-8, Wiley Eastern Publication, 1992.


**REFERENCES**


1. Marian K. Kazimierczuk, **"High-Frequency Magnetic Components"** , ISBN: 978-0-470-71453-9 John Wiley & Sons, Inc.
2. G.C. Chryssis, **"High frequency switching power supplies"**, McGraw Hill, 2$^{na}$ Edition. 1989.
3. Eric Lowdon, **"Practical Transformer Design Handbook",** Howard W. Sams& Co., Inc., 1980
4. **"Thompson --- Electrodynamic Magnetic Suspension.pdf"**
5. Witulski, **"Introduction to modeling of transformers and coupled inductors"** Beattie "Inductance 101.pdf


**E-RESOURCES**

1. ieeexplore.ieee.org/document/777202/
2. nptel.ac.in/courses/117101057/downloads/lec48.pdf

**Course Outcomes**

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

1. Have the fundamentals of magnetic devices.
2. Understand the Fundamentals of Skin effect, Proximity effect and able to calculate winding resistance at high frequencies.
3. Analyze the transformer function by considering different parameters.
4. Design Inductors and describe various types of inductors.
5. Study the self capacitance concept of different conductors and cables.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72416 | REACTIVE POWER COMPENSATION AND MANAGEMENT (Professional Elective - IV) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To understand the necessity of reactive power compensation. To design load compensation. To analyze various types of reactive power compensation in transmission systems. To get exposed to distribution side and utility side reactive power management.

**MODULE I: Load Compensation** **12 Periods**

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

**MODULE II: Steady – State Reactive Power Compensation In Transmission System** **12 Periods**

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

**Transient state reactive power compensation in transmission systems:** Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers – examples.

**MODULE III: Reactive Power Coordination** **12 Periods**

**A:** Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations.

**B:** Effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

**MODULE IV: Demand Side Management** **12 Periods**

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

**Distribution side Reactive power Management:** System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

**MODULE V: User Side Reactive Power Management** **12 Periods**

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

**TEXT BOOKS**

1. T.J.E.Miller, **"Reactive Power Control in Electric Power Systems",** John Wiley and sons, 1982.
2. D.M.Tagare , **"Reactive Power Management",**Tata McGraw Hill,2004.

**REFERENCES**

1. A.Chakrabarti, D.P Kothari, A.K Mukhopadhyay and D.E Abinandan, **"An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems",**PHI, 2010.
2. George J. Wakileh, **"Power Systems Harmonics; Fundamentals, Analysis and Filter Design"**, Spinger,2014.

**E-RESOURCES**

1. technav.ieee.org/tag/8412/reactive-power-control
2. ieeexplore.ieee.org/iel5/5/32985/01545767.pd
3. nptel.ac.in/courses/108106025/Chapter%203.pdf

**Course Outcomes**

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

1. Understand the importance of load compensation in symmetrical as well as unsymmetrical loads.
2. Analyze the various compensation methods in transmission lines.
3. Understand the mathematical model for reactive power coordination.
4. Understand the different load patterns and distribution side reactive power management
5. Understand user side reactive power management and reactive power management in electric traction systems and furnaces.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72417 | POWER SYSTEM RELIABILITY (Professional Elective-IV) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To develop the generation system model and recursive relation for capacitive model Building.
To evaluate the equivalent transitional rates, cumulative probability and cumulative Frequency.

**MODULE I: Generating System Reliability Analysis–I** **12 Periods**

Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples.

**MODULE II: Generating System Reliability Analysis–Ii** **12 Periods**

Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2- level daily load representation - merging generation and load models – Examples.

**MODULE III: Operating Reserve Evaluation** **12 Periods**

**A:** Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.

**B: Bulk Power System Reliability Evaluation:** Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

**MODULE IV: Inter Connected System Reliability Analysis** **12 Periods**

Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency.

**Distribution System Reliability Analysis – I (Radial configuration):** Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices– load point and system reliability indices – customer oriented, loss and energy oriented indices – Examples.

**MODULE V: Distribution System Reliability Analysis - II** **12 Periods**

Basic techniques – inclusion of bus bar failures, scheduled maintenance – temporary and transient failures – weather effects – common mode failures –Evaluation of various indices –Examples.

**Substations and Switching Stations:** Effects of short-circuits - breaker operation – Open and Short-circuit failures –Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times.

**TEXT BOOKS**

1. Roy Billinton and Ronald N. Allan, **"Reliability Evaluation of Power Systems"**, Plenum press, New York and London, 2nd Edition, 1996.

2. J. Endrenyi,**"Reliability Modeling in Electric Power Systems"**, John Wiley and Sons, 1st Edition, 1978.

**REFERENCES**

1. D. Elmakias, **"Computational Methods in Power system Reliability"**, Springer-Verlag.

**E-RESOURCES**

1. technav.ieee.org/tag/8149/power-system-reliability
2. ieeexplore.ieee.org/document/7042739/
3. nptel.ac.in/syllabus/108101039/

**Course Outcomes**

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

1. Find loss of load and energy indices for generation systems model
2. Describe merging generation and load models
3. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
4. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
5. Analyze the parallel configuration of distribution systems and operation of substations and switching stations.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72418 | VOLTAGE STABILITY (Professional Elective - IV) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To understand SEC Planning and Operational Standards of Security, Reactive Power Control in Generation/Transmission Interconnected Networks. To understand the Stability/Instability in Generation/Transmission Interconnected Networks.

**MODULE I: Introduction To Voltage Stability** **12 Periods**

Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Physical relation indicating dependency of voltage on reactive power flow; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

**MODULE II: Graphical Analysis Of Voltage Stability** **12 Periods**

Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

**MODULE III: Analysis Of Voltage Stability** **12 Periods**

**A:** Analysis of voltage stability on SMLB system: Analytical treatment and analysis.

**B: Voltage Stability Indices:** Voltage collapse proximity indicator; Determinant of Jacobin as proximity indicators; Voltage stability margin.

**MODULE IV: Power System Loads** **12 Periods**

Loads that influences voltage stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.

**Reactive Power Compensation:** Generation and Absorption of reactive power; Series and Shunt compensation;Synchronous condensers, SVC s; OLTCs; Booster Transformers.

**MODULE V: Voltage Stability Margin** **12 Periods**

**Stability Margin:** Compensated and un-compensated systems.Voltage Security Definition; Voltage security; Methods to improve voltage stability and its practical aspects.

**TEXT BOOKS**


1. A.Chakrabarthy, D.P.Kotari and A.K.Mukopadyay, **"Performance, Operation and Control of EHV Power Transmission System"**, A.H. Wheeler Publishing, 1st Edition, 1995.
2. K.R.Padiyar, **"Power System Dynamics: Stability and Control",** 2nd Edition, B.S.Publications.


**REFERENCES**


1. C.W.Taylor, **"Power System Voltage Stability",** McGraw Hill, 1994.


**E-RESOURCES**

1. ieeexplore.ieee.org/document/5448823/
2. ieeexplore.ieee.org/iel1/59/6593/00260881.pdf
3. nptel.ac.in/courses/108102080/35

**Course Outcomes**

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

1. Define various terms in Voltage stability concepts.
2. Understand the P-V and Q-V curves & Graphical methods describing voltage collapse phenomenon.
3. Analyze the voltage stability indices.
4. Understand the concepts of load that influences voltage stability & Reactive power compensation.
5. Analyze the voltage stability margin in various systems.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72419 | SMART GRID TECHNOLOGIES (Open Elective II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**

To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure. To familiarize the power quality management issues in Smart Grid. To familiarize the high performance computing for Smart Grid applications.

**MODULE I: Introduction to Smart Grid** **12 Periods**

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid . CDM opportunities in Smart Grid .

**MODULE II: Smart Grid Technologies: Part 1** **12 Periods**

Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

**MODULE III: Smart Grid Technologies: Part 2:** **12 Periods**

**A:** Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS)

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

**MODULE IV: Micro grids and Distributed Energy Resources** **12 Periods**

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

**MODULE V: Power Quality Management in Smart Grid** **12 Periods**

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 Au

**TEXT BOOKS**


1. Ali Keyhani, Mohammad N. Marwali, Min Dai, **"Integration of Green and Renewable Energy in Electric Power Systems"**, Wiley.
2. Clark W. Gellings, **"The Smart Grid: Enabling Energy Efficiency and Demand Response"**,CRC Press.


**REFERENCES**


1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama**," Smart Grid: Technology and Applications",** Wiley.

2. Jean Claude Sabonnadière, NouredineHadjsaïd, **"Smart Grids",** Wiley Blackwell.

**E-RESOURCES**

1. smartgrid.ieee.org/
2. ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5165411
3. nptel.ac.in/courses/108105067/

**Course Outcomes**

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

1. Group the various aspects of smart grid.
2. Emphasize the use of smart meters and plug in hybrid electric vehicles..
3. Describe smart substations and it functions.
4. Understand the concept of micro grid and distributed energy resources.
5. Analyze the power quality management in smart grid.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72420 | AI TECHNIQUES IN ELECTRICAL POWER SYSTEMS (Open Elective II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**
To cater the knowledge of soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms. To expose the students to the concepts of feed forward neural networks and about feedback neural networks. To understand about genetic algorithm, genetic operations and genetic mutations.

**MODULE I: Artificial Neural Networks** **12 Periods**

Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks–Learning process – Error correction learning – Hebbian learning –Competitive learning –Boltzmann learning – Supervised learning – Unsupervised learning– Reinforcement learning- learning tasks.

**MODULE II: ANN Paradigms** **12 Periods**

Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network – Functional link, network – Hopfield Network.

**MODULE III: Fuzzy Logic** **12 Periods**

**A:** Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets

**B:** Fuzzy Cartesian Product –Operations on Fuzzy relations. Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference-Fuzzy Rule based system-Defuzzification methods.

**MODULE IV: Genetic Algorithms** **12 Periods**

Introduction-Encoding –Fitness Function-Reproduction operators-Genetic Modeling –Genetic operators-Crossover-Single – site crossover-Two point crossover –Multi point crossover-Uniform crossover – Matrix crossover-Crossover Rate-Inversion & Deletion –Mutation operator –Mutation –Mutation Rate-Bit-wise operators-Generational cycle-convergence of Genetic Algorithm.

**MODULE V: Applications Of AI Techniques** **12 Periods**

Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability), Reactive power control – speed control of DC and AC Motors.

**TEXT BOOKS**

1. S.Rajasekaran and G.A.V.Pai, **"Neural Networks, Fuzzy Logic & Genetic Algorithms"**, PHI, New Delhi, 2003.

**REFERENCES**

1. P.D.Wasserman, Van Nostrand Reinhold, **"Neural Computing Theory & Practice",** New York, 1989.
2. Bart Kosko, **"Neural Network & Fuzzy System",** Prentice Hall, 1992.
3. G.J.Klir and T.A.Folger, **"Fuzzy Sets,Uncertainty and Information",** PHI, Pvt.Ltd,1994.

4. D.E.Goldberg, Addison Wesley, **"Genetic Algorithms",** 1999.

**E-RESOURCES**

1. https://aitopics.org/
2. ieeexplore.ieee.org/document/10029/
3. www.nptelvideos.in/2012/11/artificial-intelligence-prof-p-dasgupta.html

**Course Outcomes**

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

1. Concept of artificial neuron models, architectures, learning process, and learning techniques of artificial neutron models.
2. Algorithms like Back propagation algorithm, self organizing map, radial networks.
3. Concept of fuzzy based system, analogy between fuzzy and crisp sets, basic fuzzy set operations, rule based systems, Defuzzification methods.
4. Genetic modeling, fitness function reproduction operators.
5. Apply the Intelligence techniques to real Power Systems.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72421 | DIGITAL CONTROL SYSTEMS (Open Elective II) | L | T | P |
| Credits: 3 | | 2 | 2 | - |

**Prerequisites:** Nil

**Course Objectives:**
To enhance the knowledge of modeling and design of Digital control systems. To emphasis on using control system design tools for analysis of controlled system during its discrete-time implementation.

**MODULE I: Introduction** **12 Periods**

Block Diagram of typical control system- advantages of sampling in control systems – examples examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH.

Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transofmrs –limitations of z-transofrm –pulse transfer function – puulse transfer function of ZOH –relation between G(s) and G(z) – signal flow grapoh method applied to digital systems.

**MODULE II: State Space Analysis** **12 Periods**

State space modeling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach.Stability : Definition of stability – stability tests – The second method of Liapunov.

**MODULE III: Time Domain Analysis** **12 Periods**

**A:** Comparision of time response of continuous data and digital control systems-correlation between time response and root locus j the s-plane and z-plane – effect of pole-zero configuration in the z-plane upon the maximum overshoot and peak time of transient response.

**B:** Root loci for digital control systems – steady state error analysis of digital control syetems – Nyquits plot – Bode plot-G.M aNd P.M.

**MODULE IV: Design** **12 Periods**

The digital control design with digital controller with bilinear transformation – Digital PID controller Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrance Equation – Discrete maximum principle.

**MODULE V: Digital State Observer** **12 Periods**

Design of - Full order and Reduced order observers. Design by max.principle: Discrete Euler language equation-discrete maximum principle.

**TEXT BOOKS**

1. K. Ogata, **"Discrete-Time Control systems",** Pearson Education/PHI, 2nd Edition.
2. M.Gopal, **"Digital Control and State Variable Methods"**, TMH.

**REFERENCES**

1. Kuo, **"Digital Control Systems"** , Oxford University Press, 2nd Edition,2003.
2. M.Gopal, **"Digital Control Engineering"**, John Wiley & Sons Australia, Limited, 1988.

**E-RESOURCES**

1. http://nptel.ac.in/courses/108103008/
2. https://www.electrical4u.com/digital-data-control-system/

**Course Outcomes**

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

1. Understand the concept of A/D and D/A conversion and Z transforms.
2. Analyze State space modeling of digital systems.
3. Comprehend the time domain analysis.
4. Design different digital controllers.
5. Design the digital state observer.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72422 | POWER SYSTEMS LAB-II | L | T | P |
| Credits: 2 | | - | - | 4 |

**Course Objectives:**
To enhance the knowledge of power system protection by studying the characteristics of various relays. To emphasis the performance of transmission line model and transformer.

**List of Experiments:**

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Determination of Sequence Impedances of Three Phase Transformer
4. Characteristics of Over Current Relays
   i) IDMT Electromagnetic Relay (7051 A).
5. Characteristics of Percentage biased Differential Relay.
   i) Electromagnetic Relay (7054 A).
6. Characteristics of Microprocessor based Over Voltage Relay (7053 B).
7. Characteristics of Under Voltage (UV) Microprocessor based Relay (7052 B).
8. Characteristics of Static Negative sequence Relays (7055B).
9. Performance and Testing of Transformer Protection System.
10. Performance and Testing of Transmission Line Model.

**Course Outcomes**

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

1. Determine the equivalent circuit of three winding transformer.
2. Determine the sequence impedances of synchronous machine and three phase transformer.
3. Determine the characteristics of various relays.
4. Emphasis the performance of transmission line model
5. Emphasis the performance of transformer.

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72424 | COMPREHENSIVE VIVA-VOCE | L | T | P |
| Credits: 6 | | - | - | - |

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72425 | PROJECT WORK - I | L | T | P |
| Credits: 16 | | - | - | - |

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72426 | PROJECT WORK - II | L | T | P |
| Credits: 6 | | - | - | - |

| 2017-18 Onwards (MR-17) | MALLA REDDY ENGINEERING COLLEGE (Autonomous) | M.Tech. II Semester | | |
|---|---|---|---|---|
| Code: 72427 | PROJECT VIVA-VOCE | L | T | P |
| Credits: 16 | | - | - | - |