ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

For
M.Tech: EEE

Common Specializations:

I. POWER SYSTEMS
II. POWER SYSTEM CONTROL AND AUTOMATION
III. POWER SYSTEM ENGINEERING
IV. POWER SYSTEM AND CONTROL
V. ADVANCED POWER SYSTEMS
VI. ELECTRICAL POWER ENGINEERING
VII. POWER ENGINEERING & ENERGY SYSTEMS
ACADEMIC REGULATIONS R13 FOR M. Tech (REGULAR) DEGREE COURSE

Applicable for the students of M. Tech (Regular) Course from the Academic Year 2013-14 onwards

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

1.0 ELIGIBILITY FOR ADMISSIONS

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

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

2.0 AWARD OF M. Tech DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

2.2 The student shall register for all 80 credits and secure all the 80 credits.

2.3 The minimum instruction days in each semester are 90.

3.0A. COURSES OF STUDY

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

1. M.Tech- Structural Engineering
2. M.Tech- Transportation Engineering
3. M.Tech- Infrastructure Engineering & Management
4. ME- Soil Mechanics and Foundation Engineering
5. M.Tech- Environmental Engineering
6. M.Tech- Geo-Informatics
7. M.Tech- Spatial Information Technology
8. M.Tech- Civil Engineering
11. M.Tech- Power Electronics
12. M.Tech- Power & Industrial Drives
13. M.Tech- Power Electronics & Electrical Drives
15. M.Tech- Power Electronics & Drives
16. M.Tech- Power Systems
17. M.Tech- Power Systems Engineering
18. M.Tech- High Voltage Engineering
20. M.Tech- Power System and Control
22. M.Tech- Electrical Machines and Drives
23. M.Tech- Advanced Power Systems
25. M.Tech- Control Engineering
26. M.Tech- Control Systems
27. M.Tech- Electrical Power Engineering
28. M.Tech- Power Engineering & Energy System
29. M.Tech- Thermal Engineering
30. M.Tech- CAD/CAM
32. M.Tech- Computer Aided Design and Manufacture
33. M.Tech- Advanced Manufacturing Systems
34. M.Tech- Computer Aided Analysis & Design
35. M.Tech- Mechanical Engineering Design
36. M.Tech- Systems and Signal Processing
38. M.Tech- Electronics & Communications Engineering
39. M.Tech- Communication Systems
40. M.Tech- Communication Engineering & Signal Processing
41. M.Tech- Microwave and Communication Engineering
42. M.Tech- Telematics
43. M.Tech- Digital Systems & Computer Electronics
44. M.Tech- Embedded System
45. M.Tech- VLSI
46. M.Tech- VLSI Design
47. M.Tech- VLSI System Design
48. M.Tech- Embedded System & VLSI Design
49. M.Tech- VLSI & Embedded System
50. M.Tech- VLSI Design & Embedded Systems
51. M.Tech- Image Processing
52. M.Tech- Digital Image Processing
53. M.Tech- Computers & Communication
54. M.Tech- Computers & Communication Engineering
55. M.Tech- Instrumentation & Control Systems
56. M.Tech – VLSI & Micro Electronics
58. M.Tech- Embedded System & VLSI
59. M.Tech- Computer Science & Engineering
60. M.Tech- Computer Science
61. M.Tech- Computer Science & Technology
62. M.Tech- Computer Networks
63. M.Tech- Computer Networks & Information Security
64. M.Tech- Information Technology
65. M.Tech- Software Engineering
66. M.Tech- Neural Networks
67. M.Tech- Chemical Engineering
68. M.Tech- Biotechnology
69. M.Tech- Nano Technology
70. M.Tech- Food Processing
71. M.Tech- Avionics

and any other course as approved by AICTE/ University from time to time.
### 3.0 B. Departments offering M. Tech Programmes with specializations are noted below:

| Civil Engg. | 1. M.Tech- Structural Engineering  
2. M.Tech- Transportation Engineering  
3. M.Tech- Infrastructure Engineering & Management  
4. ME- Soil Mechanics and Foundation Engineering  
5. M.Tech- Environmental Engineering  
6. M.Tech-Geo-Informatics  
7. M.Tech-Spatial Information Technology  
8. M.Tech- Civil Engineering  
|-------------|----------------------------------------------------------------------------------|
| EEE         | 1. M.Tech- Power Electronics  
2. M.Tech- Power & Industrial Drives  
3. M.Tech- Power Electronics & Electrical Drives  
4. M.Tech- Power System Control & Automation  
5. M.Tech- Power Electronics & Drives  
6. M.Tech- Power Systems  
7. M.Tech- Power Systems Engineering  
8. M.Tech- High Voltage Engineering  
10. M.Tech- Power System and Control  
11. M.Tech- Power Electronics & Systems  
12. M.Tech- Electrical Machines and Drives  
15. M.Tech- Control Engineering  
16. M.Tech- Control Systems  
17. M.Tech- Electrical Power Engineering  
18. M.Tech- Power Engineering & Energy System |
| ME          | 1. M.Tech- Thermal Engineering  
2. M.Tech- CAD/CAM  
4. M.Tech- Computer Aided Design and Manufacture  
5. M.Tech- Advanced Manufacturing Systems  
6. M.Tech-Computer Aided Analysis & Design  
7. M.Tech- Mechanical Engineering Design |
| ECE  | 1. M.Tech- Systems and Signal Processing  |
|      | 3. M.Tech- Electronics & Communications Engineering  |
|      | 4. M.Tech- Communication Systems  |
|      | 5. M.Tech- Communication Engineering & Signal Processing  |
|      | 6. M.Tech- Microwave and Communication Engineering  |
|      | 7. M.Tech- Telematics  |
|      | 9. M.Tech- Embedded System  |
|      | 10. M.Tech- VLSI  |
|      | 11. M.Tech- VLSI Design  |
|      | 12. M.Tech- VLSI System Design  |
|      | 14. M.Tech- VLSI & Embedded System  |
|      | 15. M.Tech- VLSI Design & Embedded Systems  |
|      | 16. M.Tech- Image Processing  |
|      | 17. M.Tech- Digital Image Processing  |
|      | 18. M.Tech- Computers & Communication  |
|      | 20. M.Tech- Instrumentation & Control Systems  |
|      | 23. M.Tech- Embedded System & VLSI  |
| CSE  | 1. M.Tech- Computer Science & Engineering  |
|      | 2. M.Tech- Computer Science  |
|      | 3. M.Tech- Computer Science & Technology  |
|      | 4. M.Tech- Computer Networks  |
|      | 5. M.Tech- Computer Networks & Information Security  |
|      | 6. M.Tech- Information Technology  |
|      | 7. M.Tech- Software Engineering  |
|      | 8. M.Tech- Neural Networks  |
| Others | 1. M.Tech- Chemical Engineering  |
|        | 2. M.Tech- Biotechnology  |
|        | 3. M.Tech- Nano Technology  |
|        | 4. M.Tech- Food Processing  |
|        | 5. M.Tech- Avionics  |
4.0 ATTENDANCE

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

4.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

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

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

5.0 EVALUATION

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

5.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted—one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks. End semester examination is conducted for 60 marks for 5 questions to be answered out of 8 questions.
5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

5.3 There shall be two seminar presentations during III semester and IV 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 Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.4 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 End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

5.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to reappear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate’s attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled. For re-registration the candidates have to apply to the University through the college by paying the requisite fees and get approval from the University before the start of the semester in which re-registration is required.
5.6 In case the candidate secures less than the required attendance in any re registered subject(s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

5.7 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the university from the panel of examiners submitted by the respective college.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

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

6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members.

6.2 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.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the Project Review Committee (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.

6.5 A candidate shall submit his status report in two stages at least with a gap of 3 months between them.

6.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after
successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

6.8 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

6.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.

6.10 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate’s work as one of the following:
A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

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

6.11 If the report of the Viva-Voce is unsatisfactory, the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.
7.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

<table>
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<tr>
<th>Class Awarded</th>
<th>% of marks to be secured</th>
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<tr>
<td>First Class with Distinction</td>
<td>70% and above (Without any Supplementary Appearance)</td>
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<tr>
<td>First Class</td>
<td>Below 70% but not less than 60% 70% and above (With any Supplementary Appearance)</td>
</tr>
<tr>
<td>Second Class</td>
<td>Below 60% but not less than 50%</td>
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</table>

The marks in internal evaluation and end examination shall be shown separately in the memorandum of marks.

8.0 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. His degree will be withheld in such cases.

4.0 TRANSITORY REGULATIONS (for R09)

9.1 Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

9.2 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 R13 academic regulations.

10. GENERAL

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

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

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

10.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.
**MALPRACTICES RULES**  
**DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS**

<table>
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<tr>
<th>Nature of Malpractices/ Improper conduct</th>
<th>Punishment</th>
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<tr>
<td><strong>If the candidate:</strong></td>
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<tr>
<td>1. (a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only.</td>
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<tr>
<td>(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.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.</td>
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<tr>
<td>2. Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project</td>
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</tbody>
</table>
(theory or practical) in which the candidate is appearing. | work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.

3. Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4. Smuggles 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 | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and
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<th>the examination.</th>
<th>shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</th>
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<tr>
<td>5.</td>
<td>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.</td>
<td>Cancellation of the performance in that subject.</td>
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<td>6.</td>
<td>Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty 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</td>
<td>In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.</td>
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<td>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.</td>
<td>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</td>
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<tr>
<td>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.</td>
<td>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</td>
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<td>8. Possess any lethal weapon or firearm in the examination hall.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining</td>
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<td>9.</td>
<td>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.</td>
<td>Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.</td>
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<td>10.</td>
<td>Comes in a drunken condition to the examination hall.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.</td>
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<tr>
<td>11.</td>
<td>Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.</td>
<td>Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.</td>
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<td>12.</td>
<td>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.</td>
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Malpractices identified by squad or special invigilators

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

2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.
Prohibition of ragging in educational institutions Act 26 of 1997

**Salient Features**

1. Ragging within or outside any educational institution is prohibited.
2. Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

<table>
<thead>
<tr>
<th>Offence Description</th>
<th>Imprisonment Upto</th>
<th>Fine Upto</th>
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<tbody>
<tr>
<td>Teasing, Embarrassing and Humiliation</td>
<td>6 Months</td>
<td>+ Rs. 1,000/-</td>
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<td>Assaulting or Using Criminal force or Criminal intimidation</td>
<td>1 Year</td>
<td>+ Rs. 2,000/-</td>
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<td>Wrongfully restraining or confining or causing hurt</td>
<td>2 Years</td>
<td>+ Rs. 5,000/-</td>
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<td>Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence</td>
<td>5 Years</td>
<td>+ Rs. 10,000/-</td>
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<td>Causing death or abetting suicide</td>
<td>10 Months</td>
<td>+ Rs. 50,000/-</td>
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In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

**LET US MAKE JNTUK A RAGGING FREE UNIVERSITY**
ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Card and show them when demanded.
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288
LET US MAKE JNTUK A RAGGING FREE UNIVERSITY
### I SEMESTER

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<tr>
<th>S.No</th>
<th>Name of the Subject</th>
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<td>1</td>
<td>Microprocessors &amp; Microcontrollers</td>
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<td>2</td>
<td>HVDC Transmission</td>
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<td>3</td>
<td>Power System Operation and Control</td>
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<td>Reactive Power Compensation &amp; Management</td>
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<td>Elective – I</td>
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<td>HVAC Transmission</td>
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<td>Analysis of Power Electronics Converters</td>
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<td>Renewable Energy Systems</td>
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<td>Artificial Intelligence Techniques</td>
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<td>Elective – II</td>
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<td>Power System Security</td>
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<td>Modern Control Theory</td>
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<td>Simulation Laboratory</td>
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### II SEMESTER

<p>| 1    | Power System Dynamics and Stability                     | 4 | — | 3 |
| 2    | Flexible AC Transmission Systems                        | 4 | — | 3 |
| 3    | Real Time Control of Power Systems                      | 4 | — | 3 |
| 4    | Advanced Power System Protection                        | 4 | — | 3 |
| 5    | Elective – III                                          | 4 | — | 3 |
|      | Smart Grid                                              |    |    |    |
|      | Power Quality                                           |    |    |    |
|      | Power System Reliability                                |    |    |    |
|      | Voltage Stability                                       |    |    |    |
| 6    | Elective – IV                                           | 4 | — | 3 |
|      | Power System Deregulation                               |    |    |    |
|      | High Voltage Testing Techniques                         |    |    |    |</p>
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### III SEMESTER

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### IV SEMESTER

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MICROPROCESSORS & MICRO CONTROLLERS

UNIT-I

Register Organization of 8086, Architecture, Signal description of 8086, memory segmentation, addressing modes of 8086. 8086/8088 instruction set and assembler directives, machine language instruction formats, Assembly language Programs.

UNIT-II

General Bus Operation, minimum mode operation of 8086 and timing diagrams, Fundamental I/O considerations, Programmed I/O, Interrupt I/O, Block transfers and DMA.

UNIT-III


UNIT-IV

Programmable Interval timer 8254, Programmable Interrupt Controller 8259A, Key Board or Display Controller 8279, Programmable Communication Interface 8251 USART.

UNIT-V

Introduction to 8051/31 Micro Controller, PIN diagram, architecture, Different modes of Operation of timer/counters, addressing modes of 8051 and instruction set. Over view of 16 bit Microcontrollers.

REFERENCE BOOKS:

UNIT-I


UNIT II:

Static Power Converters: 6-pulse bridge circuit and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Comparison of the perform of diametrical connection with 6-pulse bridge circuit

UNIT III

Control of HVDC Converters and systems: constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control. Factors responsible for generation of Harmonics voltage and current harmonics effect of variation of $\alpha$ and $\mu$. Filters Harmonic elimination.

UNIT IV

Interaction between HV AC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation. Development of DC circuit Breakers, Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

UNIT V

Transient over voltages in HV DC systems: Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC Systems: Converter faults, over current protection - valve group, and DC line protection, circuit breakers. Over voltage protection of converters, surge arresters.


5. HVDC Transmission-S Kamakshaih and V Kamaraju MG hill.
UNIT-I

Unit commitment problem and optimal power flow solution: Unit commitment: Constraints in UCP, UC solutions. Methods-priority list method, introduction to Dynamic programming Approach.

UNIT-II

Load Frequency Control-I: Necessity of keeping frequency constant. Definition of control area, single area control, Block diagram representation of an isolated Power System, Steady State analysis, Dynamic response-Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation, steady state response, load frequency control and Economic dispatch control.

UNIT-III

Load Frequency Control-II: Load frequency control of 2-area system: uncontrolled case and controlled case, tie-line bias control. Optimal two-area LF control-steady state representation, performance Index and optimal parameter adjustment.

UNIT-IV

Generation with limited Energy supply: Take-or-pay fuel supply contract, composite generation production cost function. Solution by gradient search techniques, Hard limits and slack variables, Fuel scheduling by linear programming.

UNIT-V

REFERENCE BOOKS:

2. Power system operation and control PSR Murthy B.S publication.
UNIT-I

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

UNIT-II

**Reactive power compensation in transmission system:** Steady state - Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples

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

UNIT-III

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

UNIT-IV


**User side reactive power management:** KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations
UNIT-V

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

REFERENCE BOOKS:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982
UNIT-I

General: Introduction to Distribution systems, an overview of the role of computers in distribution system planning—Load modeling and characteristics: definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor—Relationship between the load factor and loss factor—Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics.

UNIT-II

Distribution Feeders and Substations: Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, feeder-loading. Design practice of the secondary distribution system. Location of Substations: Rating of a Distribution Substation, service area with primary feeders. Benefits derived through optimal location of substations.

UNIT-III

System analysis: Voltage drop and power loss calculations: Derivation for volt-drop and power loss in lines, manual methods of solution for radial networks, three-phase balanced primary lines, non-three-phase primary lines.

UNIT-IV


UNIT-V

Capacitive compensation for power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors
(Fixed and switched ) power factor correction, capacitor location. Economic justification. Procedure to determine the best capacitor location. Voltage control : Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

REFERENCE BOOKS:

3. Electrical Distribution V.Kamaraju-Mc Graw Hill
UNIT-I


UNIT-II

Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings. Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

UNIT-III

Corona: Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

UNIT-IV

Power Frequency voltage control: Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components: Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines.
UNIT–V

Static reactive compensating systems: Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

REFERENCE BOOKS:

UNIT-I

**AC voltage Controllers** Single Phase AC Voltage Controllers with RL and RLE loads-ac voltage controller’s with PWM control-Effects of source and load inductances –synchronous tap changers –Application- numerical problems

Three Phase AC Voltage controllers-Analysis of Controllers with star and delta connected resistive, resistive –inductive loads-Effects of source and load inductances–Application- numerical problems.

UNIT–II


UNIT-III

**Power Factor Correction Converters** Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state- analysis, three phase boost PFC converter

UNIT–IV

**PWM Inverters** Principle of operation-Voltage control of single phase inverters - sinusoidal PWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – numerical problems. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- 60° PWM- Third Harmonic PWM- Space
Vector Modulation- Comparison of PWM Techniques-current source inverters-Variable dc link inverter - numerical problems

UNIT-V


TEXTBOOKS

4. Modern power Electronics and AC Drives – B.K.Bose
UNIT-I


UNIT-II


UNIT-III

UNIT-IV


Wave Energy – Concept of energy and power from waves – Wave characteristics – period and wave velocities - Different wave energy conservation devices (Saltor duck, oscillating water column and dolphin types) – operational experience.

UNIT-V

Geothermal Energy - Classification- Fundamentals of geophysics - Dry rock and hot aquifier energy analysis - Estimation of thermal power - Extraction techniques - Prime movers.

REFERENCES:
1. Renewable Energy Resources / John Twidell and Tony Weir / E & F.N.Spon
4. Solar Energy Thermal Processes,/Duffie & Beckman
5. Solar Heating and Cooling / Kreith & Kreider
UNIT–I

Introduction to Neural Networks  Introduction, Humans and Computers, Biological Neural Networks, Historical development of neural network, Terminology and Topology, Biological and artificial neuron models, Basic learning laws.

UNIT–II

Feed Forward Neural Networks  Introduction, Perceptron models: Discrete, continuous and multi-category, Training algorithms: Discrete and Continuous Perceptron Networks, Perceptron convergence theorem, Limitations and applications of the Perceptron model, Generalized delta learning rule, Feedforward recall and error back propagation training-Radial basis function algorithms-Hope field networks

UNIT–III

Genetic algorithms & Modelling- introduction-encoding-fitness function-reproduction operators-genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm

UNIT–IV

Classical and Fuzzy Sets  Introduction to classical sets - properties, operations and relations; Fuzzy sets, membership, Uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic System Components-Fuzzification, Membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.

UNIT–V

APPLICATION OF AI TECHNIQUES - load forecasting-load flow studies-economic load dispatch-load frequency control-reactive power control-speed control of dc and ac motors

TEXTBOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI yPublication.
UNIT-I

Short circuit analysis techniques in AC power Systems- Simulation of short circuit and open circuit faults using network theorems- fixed impedance short circuit analysis techniques-time domain short circuit analysis in large scale power systems- analysis of time variation of AC and DC short circuit components

UNIT-II

Fixed impedance Short circuit analysis of large scale power systems- general analysis of balanced, unbalanced and open circuit faults- 3-phase short circuit analysis in large scale power systems, Network equivalents and practical short circuit current assessments in large scale Ac power systems-general studies- uncertainties in short circuit current calculations-probabilistic Short circuit analysis

UNIT-III

Risk assessment and safety considerations-control and limitation of high short circuit currents-limitation of short circuit currents in power system operation, design and planning. Types of short circuit fault current limiters- earthing resistor or reactor connected to transformer neutral-pyrotechnic fault current limiters- series resonant current limiters- saturable reactor limiters-other types of fault current limiters and their applications.

UNIT-IV

Computer control power systems – need for real time and computer control of power systems- operating states of power system – SCADA- implementation considerations – software requirements for implementing above functions.

**REFERENCE BOOKS:**

1. Allen J. Wood and Bruce Woolenberg: Power System Generation, Operation and Control , John Willey and sons, 1996


UNIT-I

Digital Filter Structure  Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.

UNIT-II

Digital filter design Preliminary considerations-Bilinear transformation method of IIR filter design-design of Low pass high pass-Band pass, and Band stop- IIR digital filters-Spectral transformations of IIR filters, FIR filter design-based on Windowed Fourier series- design of FIR digital filters with least –mean- Square-error-constrained Least-square design of FIR digital filters

UNIT-III

DSP algorithm implementation  Computation of the discrete Fourier transform- Number representation-Arithmetic operations-handling of overflow-Tunable digital filters-function approximation.

UNIT-IV


UNIT-V

Power Spectrum Estimation Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum Estimation – parametric method for power spectrum Estimation,

REFERENCE BOOKS:

6. Digital Filter Analysis and Design—Auuntonian—TMH
UNIT-I


UNIT-II

**Generation of High AC & DC Voltages**: Direct Voltages : AC to DC conversion methods electrostatic generators-Cascaded Voltage Multipliers.

**Alternating Voltages**: Testing transformers-Resonant circuits and their applications, Tesla coil.

UNIT-III

**Generation of Impulse Voltages**: Impulse voltage specifications-Impulse generations circuits-Operation, construction and design of Impulse generators-Generation of switching and long duration impulses.

**Impulse Currents**: Generation of High impulse currents and high current pulses.

UNIT-IV


**Measurement of High A.C. Voltages**: Series impedance meters electrostatic voltmeters potential transformers and CVTS-voltage dividers and their applications.
UNIT-V

Measurement of Peak Voltages: Sphere gaps, uniform field gaps, rod gaps. Chubb-Fortesque methods. Passive and active rectifier circuits for voltage dividers.


TEXTBOOKS:

REFERENCE BOOKS:
UNIT-I

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

UNIT-II

**PLC Programming:** Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-III

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

UNIT-IV

**Data Handling functions:** SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

UNIT-V

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

4. Programmable Logic Controllers –W.Bolton-Elsevier publisher
UNIT – I


UNIT – II

State Variable Techniques 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 – State feedback controller design through pole assignment.

UNIT – III


UNIT – IV

Non Linear Systems – 11 Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase – plane analysis of nonlinear control systems.

UNIT – V

Stability Analysis Stability in the sense of Lyapunov, Lyapunov’s stability and Lyapunov’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.

**TEXTBOOKS:**

1. Modern Control System Theory by M. Gopal – New Age International – 1984
Any 10 of the following experiments are to be conducted

List of Experiments:

2. Y Bus formation for p systems with and without mutual coupling, by inspection method.
3. Determination of bus currents, bus power and line flow for a specified system voltage (Bus) Profile
5. ABCD parameters: Formation for symmetric II/I configuration. Verification of AD - BC = 1 Determination of coefficient and regulation
6. Determination of power angle diagrams for salient and non-salient pole synchronous m/c s, reluctance power, excitation, emf and regulation.
7. To determine I) Swing curve  II) critical clearing time for a single m/c connected to infinity bus through a pair of identical transmission lines, 3-phase fault on one of the lines for variation of inertia constant/line parameters/fault location/clearing time/pre-fault electrical output.
8. Formation of Jacobian for a system not exceeding 4 buses *(no PV buses) in polar coordinates
9. Write a program to perform load flow using Gauss- Seidel method (only p q bus)
10. To determine fault currents and voltages in a single transmission line systems with star-delta transformers at a specified location for SLGF, DLGF.
11. Load flow analysis using Gauss- Siedel method for both pq and pv buses.
12. Load flow analysis using NR method for both pq and pv buses.

13. Fast decoupled flow method for both pq and pv buses.

14. Optimal Generator Scheduling for Thermal power plants.

15. Economic dispatch using lambda-iteration method
UNIT-I

System Dynamics: Synchronous machine model in state space from computer representation for excitation and governor system—modeling of loads and induction machines.

UNIT-II


UNIT-III


UNIT-IV

Effect of governor action and excite on power system stability effect of saturation, saliency & automatic voltage regulators on stability.

UNIT-V

Excitation Systems: Rotating Self-excited Exciter with direct acting Rheostatic type voltage regulator – Rotating main and Pilot Exciters with Indirect Acting Rheostatic Type Voltage Regulator – Rotating Main Exciter, Rotating Amplifier and Static Voltage Regulator – Static excitation scheme – Brushless excitation system.

REFERENCE BOOKS:

2. Power System control and stability by Anderson and Fund
3. Power systems stability and control by PRABHA KUNDUR
UNIT-I
FACTS concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

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

UNIT-III
**Static shunt compensation**: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable var generation, variable impedance type static var generators, switching converter type var generators, hybrid var generators.

UNIT-IV
**SVC and STATCOM**: The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

UNIT-V
**Static series compensators**: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.


3. HVDC & FACTS Controllers: applications of static converters in power systems—Vijay K.Sood—Springer publishers
UNIT-I

State Estimation: Different types of State Estimations, Theory of WLS state estimation, sequential and non-sequential methods to process measurements. Bad data Observability, Bad data detection, identification and elimination.

UNIT-II


UNIT-III

Computer Control of Power Systems: Need for real time and computer control of power systems, operating states of a power system, SCADA - Supervisory control and Data Acquisition systems implementation considerations, energy control centres, software requirements for implementing the above functions.

UNIT-III


UNIT-V

Application of AI and ANN in Power System: Basic concepts and definitions, algorithms for load flow, short term load forecasting, fault diagnosis and state estimation.
REFERENCE BOOKS:

2. Allen J.Wood and Bruce F.Wollenberg : Power Generation operation and control, John Wiley & Sons, 1984
UNIT-I


UNIT-II

**Amplitude and Phase Comparators (2 Input)**: Generalized equations for Amplitude and Phase comparison – Derivation of different characteristics of relays – Rectifier Bridge circulating and opposed voltage type amplitude comparators – Averaging & phase splitting type amplitude comparators – Principle of sampling comparators.

**Phase Comparison**: Block Spike and phase Splitting Techniques – Transistor Integrating type, phase comparison, Rectifier Bridge Type Comparison – Vector product devices.

UNIT-III

Static over current (OC) relays – Instantaneous, Definite time, Inverse time OC Relays, static distance relays, static directional relays, static differential relays, measurement of sequence impedances in distance relays, multi input comparators, elliptic & hyperbolic characteristics, switched distance schemes, Impedance characteristics during Faults and Power Swings.

UNIT-IV

**Carrier plot protection scheme**: carrier current protection schemes, relative merits & demerits, carrier aided distance protection schemes, transfer schemes, blocking scheme and acceleration schemes.

Differential relay Principle and characteristics, maloperation of differential relay, protection of transformers, protection of generators.
UNIT-V

**Numerical Protection**: Introduction, numerical relay, numerical relaying algorithms, mann-morrison technique, Differential equation technique, discrete fourier transform technique, rationalised harr transform technique, wavelet transform technique, numerical overcurrent protection, numerical distance protection, numerical differential protection.

**REFERENCE BOOKS:**

1. Power System Protection with Static Relays – by TSM Rao
2. Protective Relaying Vol-II Warrington
3. Art & Science of Protective Relaying - C R Mason
4. Power System Stability Kimbark Vol-II
5. Power system protection & switchgear by Badri Ram & D N viswakarma.
7. Protection & Switchgear –Bhavesh Bhalaja, R.P Maheshwari, Nilesh G.Chothani-Oxford publisher
UNIT-I

**Introduction to Smart Grid:** 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 on Smart Grid. Case study of Smart Grid.

UNIT-II

**Smart Grid Technologies: Part 1:** Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

UNIT-III

**Smart Grid Technologies: Part 2:** Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

UNIT-IV

**Microgrids and Distributed Energy Resources:** Concept of micro grid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

UNIT-V

**Power Quality Management in Smart Grid:** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy
Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

**Information and Communication Technology for Smart Grid:**
Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

**TEXT BOOKS:**


**REFERENCE BOOKS:**

UNIT-I


UNIT-II


UNIT-III


UNIT-IV

Long Duration Voltage Variations  Principles of Regulating the Voltage - Device for Voltage Regulation - Utility Voltage Regulator Application - Capacitor for Voltage Regulation - End-user Capacitor Application - Regulating Utility Voltage with Distributed Resources – Flicker
UNIT-V


**TEXTBOOKS**


**REFERENCES**


6. Power Quality in Power systems and Electrical Machines-Ewald F.fuchs, Mohammad A.S. Masoum-Elsevier
UNIT-I

UNIT-II
Network Modelling and Reliability Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method
Reliability functions f(t), F(t), R(t), h(t) and their relationship – exponential distributions – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF

UNIT-III

UNIT-IV
UNIT-V

Composite system reliability analysis decomposition method – distribution system reliability analysis – radial networks – weather effects on transmission lines – Evaluation of load and energy indices.

REFERENCE BOOKS:

UNIT-I

Reactive Power flow and voltage stability in power systems: Physical relationship indicating dependency of voltage on reactive power flow - reactive power, transient stability; Q-V curve; definition of voltage stability, voltage collapse and voltage security. Voltage collapse phenomenon, Factors of voltage collapse, effects of voltage collapse, voltage collapse analysis.

UNIT-II

Power system loads: Load characteristics that influence voltage stability such as – Discharge lighting, Induction motor, Air conditioning and heat pumps, Electronic power supplies, Over Head lines and cables.

UNIT-III


UNIT-IV

Voltage stability static indices: Development of voltage collapse index – power flow studies – singular value decomposition – minimum singular value of voltage collapse – condition number as voltage collapse index.

UNIT-V


REFERENCES:
UNIT-I


UNIT-II

Electricity sector structures and Ownership /management, the forms of Ownership and management. Different structure model like Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model.

UNIT-III

FRAMEWORK and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment, country practices.

UNIT-IV

Transmission network and market power. Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading; Effect of congestion on LMPs- country practices

UNIT-V


REFERENCE BOOKS:
1. Power System Economics: Designing markets for electricity - S. Stoft
2. Power generation, operation and control, -J. Wood and B. F. Wollenberg

4. Market operations in electric power systems - M. Shahidehpour, H. Yamin and Z. Li

5. Fundamentals of power system economics - S. Kirschen and G. Strbac

6. Optimization principles: Practical Applications to the Operation and Markets of the Electric Power Industry - N. S. Rau

7. Competition and Choice in Electricity - Sally Hunt and Graham Shuttleworth
UNIT-I


UNIT-II


UNIT-III

High voltage AC testing methods-Power frequency tests-Over voltage tests on insulators, Isolators, Circuit Breakers and power cables. Artificial Contamination Tests: Contamination flashover phenomena-Contamination Severity-Artificial contamination tests-Laboratory Testing versus in-Service Performance-Case study.

UNIT-IV

Impulse Testing: Impulse testing of transformers, insulators, Surge diverters, Bushings, cables, circuit breakers.

UNIT-V


5. H.V. Testing Techniques Halfly
UNIT-I

Basic Concepts and Simple Switching Transients; - Switching an LR, LC, RLC circuits

Transients Analysis of Three-Phase power Systems: - Symmetrical components in Three-phase Systems, Sequence Components for Unbalanced Network Impedances, the Sequence Networks, analysis of Unsymmetrical Three-Phase Faults-single line-to-Ground Fault, Three phase-to-ground fault.

UNIT-II

Travelling Waves: - Velocity of Travelling waves and Characteristic Impedance, Energy Contents of Travelling Waves, Attenuation and Distortion of Electromagnetic Waves, telegraph equations-lossless line, distortion less line, Reflection and Refraction of Travelling Waves, Reflection of Travelling Waves against Transformer-and-Generator-windings, the Origin Transient Recovery voltages, bewley-lattice diagram, travelling waves and multi conductor system.

UNIT-III

Switching Transients: - arc interruption in circuit breaker, transient recovery voltage, arc-circuit interaction, interruption of capacitive currents, interruption of inverse currents, interruption of fault current in transmission line and transformers.

UNIT-IV

UNIT-V

Lightning –Induced Transients:- Mechanism of Lightning, wave shape of the lightning current, Direct lighting Stroke to transmission line towers, direct lightening stroke to a line, lightning protection scheme. Numerical simulation of electrical transients, The Electromagnetic Transient Program, principles of numerical techniques used in transient simulation.

REFERENCE BOOKS:

2. Power system grounding & transients by A.P.Sakis Meliopolous.
3. “Transients in power systems” by Lou Van Sluis
UNIT-I

Energy Audit and Energy management information systems: Energy audit: Definitions-Need-concepts-Types of energy audit; Energy management information systems: Introduction-Need-components-designing-using the system-identifying plant outages

UNIT-II

**Energy Economics:** Introduction-Cost benefit risk analysis-Payback period-Straight line depreciation-Sinking fund depreciation—Reducing balance depreciation-Net present value method-Internal rate of return method-Profitability index for benefit cost ratio.

UNIT-III


**Energy –efficient electric motors:** Energy efficient motors-construction and technical features-case studies of EEMs with respect to cost effectiveness-performance characteristics; Economics of EEMs and system: life cycle-direct savings and payback analysis-efficiency factor or efficiency evaluation factor

UNIT-IV

**Electric Lighting:** Introduction-Need for an energy management program-Building analysis-Modification of existing systems-Replacement of existing systems-priorities:

**Illumination requirement :** Task lighting requirements-lighting levels-system modifications-non illumination modifications-lighting for non task areas-reflectances-space geometry ;System elements: light sources - characteristics of families of lamps-lamp substitution in an existing

UNIT-V


Co-generation and storage: Combined cycle cogeneration-energy storage: pumped hydro schemes-compressed air energy storage (CAES)-storage batteries-superconducting magnetic energy storage (SMES)

REFERENCES:

2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company ltd. New Delhi
3. Energy efficient electric motors selection and application by John C. Andreas
4. Hand book on Energy Audit and Management by Amit kumar Tyagi, published by TERI (Tata energy research Institute)
6. Energy conversion systems by Rakosh Das Begamudre New age international publishers
List of Experiments:

1. Determination of Sequence Impedance of an Alternator.
2. Determination of Sequence impedance of an Alternator by fault Analysis.
5. Scott connection of Transformers.
6. ABCD parameter.
7. Break down characteristics of a Sphere gap.
8. Determination of Breakdown strength of transformer oil.
10. Voltage distribution across the string insulator.