ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRICAL AND
ELECTRONICS
ENGINEERING

For

B.Tech., FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2013-14)

JAWAHARLAL NEHRU TECHNOLOGICAL
UNIVERSITY KAKINADA
KAKINADA – 533003, ANDHRA PRADESH, INDIA.
Academic Regulations (R13) for B. Tech. (Regular)

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

1. **Award of B. Tech. Degree**
   A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:
   1. A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years.
   2. The candidate shall register for 180 credits and secure all the 180 credits.

2. **Courses of study**
   The following courses of study are offered at present as specializations for the B. Tech. Courses:

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<tr>
<th>S.No.</th>
<th>Branch</th>
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<td>Electronics and Communication Engineering</td>
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<td>Computer Science and Engineering</td>
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<td>Petro Chemical Engineering</td>
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<td>Electronics and Instrumentation Engineering</td>
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<td>Bio-Medical Engineering</td>
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<td>Automobile Engineering</td>
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<td>14</td>
<td>Electronics and Computer Engineering</td>
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<td>Mining Engineering</td>
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<td>16</td>
<td>Petroleum Engineering</td>
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<td>Metallurgical Engineering</td>
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<td>18</td>
<td>Agricultural Engineering</td>
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3. **Distribution and Weightage of Marks**

(i) The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory subject and 75 marks for practical subject. The project work shall be evaluated for 200 marks.

(ii) For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examinations.

(iii) For theory subjects, during the semester there shall be 2 tests. The weightage of Internal marks for 30 consists of Descriptive – 15, Assignment - 05 (Theory, Design, Analysis, Simulation, Algorithms, Drawing, etc. as the case may be) Objective -10 (Conducted at College level with 20 Multiple choice question with a weightage of ½ Mark each). The objective examination is for 20 minutes duration. The subjective examination is for 90 minutes duration conducted for 15 marks. Each subjective type test question paper shall contain 3 questions and all questions need to be answered. The Objective examination conducted for 10 marks and subjective examination conducted for 15 marks are to be added to the assignment marks of 5 for finalizing internal marks for 30. The best of the two tests will be taken for internal marks. As the syllabus is framed for 6 units, the 1st mid examination (both Objective and Subjective) is conducted in 1-3 units and second test in 4-6 units of each subject in a semester.

(iv) The end semester examination is conducted covering the topics of all Units for 70 marks. Part – A contains a mandatory question (Brainstorming / Thought provoking / case study) for 22 marks. Part – B has 6 questions (One from each Unit). The student has to answer 3 out of 6 questions in Part – B and carries a weightage of 16 marks each.

(v) For practical subjects there shall be continuous evaluation during the semester for 25 internal marks and 50 end examination marks. The internal 25 marks shall be awarded as follows: day to day work - 10 marks, Record-5 marks and the remaining 10 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner.

(vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (20 marks for day – to – day work, and 10 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.
(vii) For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

(viii) Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.

(ix) Laboratory marks and the internal marks awarded by the College are not final. The marks are subject to scrutiny and scaling by the University wherever felt desirable. The internal and laboratory marks awarded by the College will be referred to a Committee. The Committee shall arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University as and when they ask for.

4. **Attendance Requirements**

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

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

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

4. A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.

5. Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.
6. A stipulated fee shall be payable towards condonation of shortage of attendance.

7. A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) credits.

8. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

5. **Minimum Academic Requirements**

   The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 4.

   5.1 A student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.**

   5.2 A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.

   5.3 A student will be **promoted from II year to III year** if he fulfills the academic requirement of **40% of the credits up to II year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.**

   5.4 A student shall be **promoted from III year to IV year** if he fulfills the academic requirements of **40% of the credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.**

   5.5 A student shall register and put up minimum attendance in all 180 credits and earn all 180 credits. **Marks obtained in all the 180 credits shall be considered for the calculation of percentage of marks.**

6. **Course pattern**

   1. The entire course of study is for four academic years, all the years are on semester pattern.

   2. A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
3. When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester / year in which he has been detained. However, the academic regulations under which he was first admitted shall continues to be applicable to him.

7. **Award of Class**

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

<table>
<thead>
<tr>
<th>Class Awarded</th>
<th>% of marks to be secured From the aggregate marks secured from 180 Credits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>70% and above</td>
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<tr>
<td>First Class</td>
<td>Below 70 but not less than 60%</td>
</tr>
<tr>
<td>Second Class</td>
<td>Below 60% but not less than 50%</td>
</tr>
<tr>
<td>Pass Class</td>
<td>Below 50% but not less than 40%</td>
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</table>

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

8. **Minimum Instruction Days**

The minimum instruction days for each semester shall be 90 working days.

9. There shall be no branch transfers after the completion of the admission process.

10. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

11. **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.
12. **TRANSITORY REGULATIONS**

1. Discontinued or detained candidates are eligible for readmission as and when next offered.

2. In case of transferred students from other Universities, the credits shall be transferred to JNTUK as per the academic regulations and course structure of the JNTUK.

13. **General**

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

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

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

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.

5. The students seeking transfer to colleges affiliated to JNTUK from various other Universities/ Institutions have to pass the failed subjects which are equivalent to the subjects of JNTUK, and also pass the subjects of JNTUK on their own without the right to sessional marks which the candidates have not studied at the earlier Institution.

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Academic Regulations (R13) for B. Tech.
(Lateral entry Scheme)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2014-15 onwards

1. **Award of B. Tech. Degree**
   A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:
   
   1.1 A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years.
   1.2 The candidate shall register for 132 credits and secure all the 132 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech.

3. **Promotion Rule**
   A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.
   A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. **Award of Class**
   After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

<table>
<thead>
<tr>
<th>Class Awarded</th>
<th>% of marks to be secured</th>
<th>From the aggregate marks secured from 132 Credits from II year to IV year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>70% and above</td>
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<tr>
<td>First Class</td>
<td>Below 70% but not less than 60%</td>
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<td>Second Class</td>
<td>Below 60% but not less than 50%</td>
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<tr>
<td>Pass Class</td>
<td>Below 50% but not less than 40%</td>
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</table>

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

5. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
MALPRACTICES RULES
Disciplinary Action for / Improper Conduct in Examinations

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<thead>
<tr>
<th>Nature of Malpractices / Improper conduct</th>
<th>Punishment</th>
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<tbody>
<tr>
<td>If the candidate:</td>
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<td>1. (a) Possesses or keeps accessible in</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only.</td>
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<td>examination hall, any paper, note book,</td>
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<td>programmable calculators, Cell phones,</td>
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<td>pager, palm computers or any other form</td>
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<td>of material concerned with or related to</td>
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<td>the subject of the examination (theory</td>
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<td>or practical) in which he is appearing</td>
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<td>but has not made use of (material shall</td>
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<td>include any marks on the body of the</td>
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<td>candidate which can be used as an aid</td>
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<td>in the subject of the examination)</td>
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<td>1. (b) Gives assistance or guidance or</td>
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<td>receives it from any other candidate</td>
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<td>orally or by any other body language</td>
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<td>methods or communicates through cell</td>
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<td>phones with any candidate or persons in</td>
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<td>or outside the exam hall in respect of</td>
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<td>any matter.</td>
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<td>2. Has copied in the examination hall</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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<td>from any paper, book, programmable</td>
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<td>calculators, palm computers or any other</td>
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<td>form of material relevant to the subject</td>
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<td>of the examination (theory or practical)</td>
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<td>in which the candidate is appearing.</td>
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<td>3. Impersonates any other candidate in</td>
<td>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</td>
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<td>connection with the examination.</td>
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<tr>
<td>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.</td>
<td>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>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>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 examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.</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>
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<td>10.</td>
<td>Comes in a drunken condition to the examination hall.</td>
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<td>11.</td>
<td>Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.</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.

**Malpractices**

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**JNTU World**

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www.alljntuworld.in
Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- 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.

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<tr>
<th>Imprisonment upto</th>
<th>Fine Upto</th>
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<tr>
<td>6 Months</td>
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<td>Rs. 2,000/-</td>
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<td>2 Years</td>
<td>Rs. 5,000/-</td>
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<td>5 Years</td>
<td>Rs. 10,000/-</td>
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<td>10 Months</td>
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In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY
Ragging

ABSOLUTELY NOT 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 Cards and show them when demanded.
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288
LET US MAKE JNTUK A RAGGING FREE UNIVERSITY
# COURSE STRUCTURE

## I Year – I SEMESTER

<table>
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<tr>
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<th>Subject</th>
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<td>Mathematics - I</td>
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<td>Engineering Physics</td>
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<td>Professional Ethics and Human Values</td>
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<td>English – Communication Skills Lab - I</td>
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<td>Engineering Physics Laboratory</td>
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<td>Engineering Workshop &amp; IT Workshop</td>
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<td>Mathematics – III</td>
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<td>Engineering Mechanics</td>
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<td>Electrical Circuit Analysis - I</td>
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<td>Computer Programming</td>
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<td>Engineering Chemistry Lab</td>
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## II Year – I SEMESTER

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## II Year – II SEMESTER

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**Total Credits:** 22

## III Year – I SEMESTER

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**Total Credits:** 24

## III Year – II SEMESTER

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**Total Credits**: 22

### IV Year – I SEMESTER

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**Total Credits**: 21

### IV Year – II SEMESTER

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**Total Credits**: 21

**Open Elective:**
1. Energy Audit, Conservation and Management
2. Instrumentation
3. Non Conventional Sources of Energy
4. Optimization Techniques
Elective – I:
1. VLSI Design
2. Electrical Distribution Systems
3. Optimization Techniques

Elective – II:
1. Advanced Control Systems
2. Extra High Voltage Transmission
3. Special Electrical Machines

Elective – III:
1. Electric Power Quality
2. Digital Signal Processing

Elective-IV:
1. OOPS Through Java
2. UNIX and Shell Programming
3. AI Techniques
4. Power System Reforms
5. Systems Engineering
SYLLABUS

I Year – I SEMESTER

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(Common to All Branches)

DETAILED TEXT-I English Essentials : Recommended Topics :

1. **IN LONDON: M.K.GANDHI**
   **OBJECTIVE:** To apprise the learner how Gandhi spent a period of three years in London as a student.
   **OUTCOME:** The learner will understand how Gandhi grew in introspection and maturity.

2. **THE KNOWLEDGE SOCIETY- APJ KALAM**
   **OBJECTIVE:** To make the learners rediscover India as a land of Knowledge.
   **OUTCOME:** The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.

3. **THE SCIENTIFIC POINT OF VIEW- J.B.S. HALDANE**
   **OBJECTIVE:** This essay discusses how scientific point of view seeks to arrive at the truth without being biased by emotion.
   **OUTCOME:** This develops in the student the scientific attitude to solve many problems which we find difficult to tackle.

4. **PRINCIPLES OF GOOD WRITING:**
   **OBJECTIVE:** To inform the learners how to write clearly and logically.
   **OUTCOME:** The learner will be able to think clearly and logically and write clearly and logically.

5. **MAN’S PERIL**
   **OBJECTIVE:** To inform the learner that all men are in peril.
   **OUTCOME:** The learner will understand that all men can come together and avert the peril.

6. **THE DYING SUN—SIR JAMES JEANS**
   **OBJECTIVE:** This excerpt from the book “The Mysterious Universe” presents the mysterious nature of the Universe and the stars which present numerous problems to the scientific mind. Sir James Jeans uses a poetic approach to discuss the scientific phenomena.
OUTCOME: This provides the students to think about the scientific phenomena from a different angle and also exposes the readers to poetic expressions.

7. **LUCK—MARK TWAIN**

**OBJECTIVE:** This is a short story about a man’s public image and his true nature. The theme of the story is that luck can be a factor of life, so that even if one is incompetent but lucky, one can still succeed.

**OUTCOME:** The story is humourous in that it contains a lot of irony. Thus this develops in the learner understand humourous texts and use of words for irony.

**Text Book :** ‘English Essentials’ by Ravindra Publications

**NON-DETAILED TEXT:**

(From Modern Trailblazers of Orient Blackswan)  
(Common single Text book for two semesters)

1. **G.D.Naidu**

**OBJECTIVE:** To inspire the learners by G.D.Naidu’s example of inventions and contributions.

**OUTCOME:** The learner will be in a position to emulate G.D.Naidu and take to practical applications.

2. **G.R.Gopinath**

**OBJECTIVE:** To inspire the learners by his example of inventions.

**OUTCOME:** Like G.R.Gopinath, the learners will be able to achieve much at a low cost and help the common man.

3. **Sudhamurthy**

**OBJECTIVE:** To inspire the learners by the unique interests and contributions of Sudha Murthy.

**OUTCOME:** The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.

4. **Vijay Bhatkar**

**OBJECTIVE:** To inspire the learner by his work and studies in different fields of engineering and science.

**OUTCOME:** The learner will emulate him and produce memorable things.

**Text Book :** ‘Trail Blazers’ by Orient Black Swan Pvt. Ltd. Publishers
I Year – I SEMESTER

MATHEMATICS – I (DIFFERENTIAL EQUATIONS)
(Common to All Branches)

UNIT I: Differential equations of first order and first degree:
Linear-Bernoulli-Exact-Reducible to exact.
Applications: Newton’s Law of cooling-Law of natural growth and decay-
orthogonal trajectories.

Subject Category
ABET Learning Objectives    a  d  e
ABET internal assessments    1  2  6
JNTUK External Evaluation   A  B  E

UNIT II: Linear differential equations of higher order:
Non-homogeneous equations of higher order with constant coefficients with
RHS term of the type $e^{ax}$, Sin ax, cos ax, polynomials in x, $e^{ax} V(x)$, xV(x).
Applications: LCR circuit, Simple Harmonic motion

Subject Category
ABET Learning Objectives    a  d  e
ABET internal assessments    1  2  6
JNTUK External Evaluation   A  B  E

UNIT III Laplace transforms:
Laplace transforms of standard functions-Shifting Theorems, Transforms of
derivatives and integrals – Unit step function –Dirac’s delta function- Inverse
Laplace transforms– Convolution theorem (without proof).
Application: Solutions of ordinary differential equations using Laplace
transforms.

Subject Category
ABET Learning Objectives    a  e
ABET internal assessments    1  2  6
JNTUK External Evaluation   A  B  E

UNIT IV Partial differentiation:
Introduction- Total derivative-Chain rule-Generalized Mean Value theorem
for single variable (without proof)-Taylors and Mc Laurent’s series for two
variables– Functional dependence- Jacobian.
Applications: Maxima and Minima of functions of two variables with constraints and without constraints.

Subject Category
ABET Learning Objectives  a  c  e
ABET internal assessments  1 2 6
JNTUK External Evaluation  A  B  E

UNIT V  First order Partial differential equations:
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations

Subject Category
ABET Learning Objectives  a  e
ABET internal assessments  1 2 6
JNTUK External Evaluation  A  B  E

UNIT VI  Higher order Partial differential equations:
Solutions of Linear Partial differential equations with constant coefficients- Method of separation of Variables.
Applications: One- dimensional Wave, Heat equations - two-dimensional Laplace Equation.

Subject Category
ABET Learning Objectives  a  e
ABET internal assessments  1 2 6
JNTUK External Evaluation  B  E

Books:
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<td>a) Apply knowledge of math, science, &amp; engineering</td>
<td>1. Objective tests</td>
<td>A. Questions should have:</td>
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<tr>
<td>Design</td>
<td>b) Design &amp; conduct experiments, analyze &amp; interpret data</td>
<td>2. Essay questions tests</td>
<td>B. Definitions, Principle of operation or philosophy of concept.</td>
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<td>Analysis</td>
<td>c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, &amp; sustainability constraints</td>
<td>3. Peer tutoring based</td>
<td>C. Mathematical treatment, derivation, analysis, synthesis, numerical problems with inference.</td>
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<tr>
<td>Algorithm s</td>
<td>d) Function on multidisciplinary teams</td>
<td>4. Simulation based</td>
<td>D. Design oriented problems</td>
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<tr>
<td>Drawing</td>
<td>e) Identify, formulate, &amp; solve engineering problems</td>
<td>5. Design oriented</td>
<td>E. Trouble shooting type of questions</td>
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<tr>
<td>Others</td>
<td>f) Understand professional &amp; ethical responsibilities</td>
<td>6. Problem based</td>
<td>F. Applications related questions</td>
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<td></td>
<td>g) Communicate effectively</td>
<td>7. Experimental (project based) based</td>
<td>G. Brain storming questions</td>
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<tr>
<td></td>
<td>h) Understand impact of engineering solutions in global, economic, environmental, &amp; societal context</td>
<td>8. Lab work or field work based</td>
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<tr>
<td></td>
<td>i) Recognize need for &amp; be able to engage in lifelong learning</td>
<td>9. Presentation based</td>
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<td></td>
<td>j) Know contemporary issues</td>
<td>10. Case Studies based</td>
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<td></td>
<td>k) Use techniques, skills, modern tools for engineering practices</td>
<td>11. Role-play based</td>
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<td>12. Portfolio based</td>
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I Year – I SEMESTER

MATHEMATICS – II
(MATHEMATICAL METHODS)
(Common to All Branches)

UNIT I Solution of Algebraic and Transcendental Equations:

Subject Category
ABET Learning Objectives a e k
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT II Interpolation:

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT III Numerical solution of Ordinary Differential equations:

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 4 6
JNTUK External Evaluation A B E

UNIT IV Fourier Series:
Introduction- Determination of Fourier coefficients – even and odd functions –change of interval– Half-range sine and cosine series.
Application: Amplitude, spectrum of a periodic function
UNIT V Fourier Transforms:
Subject Category
ABET Learning Objectives  a e d
ABET internal assessments  1 2 6
JNTUK External Evaluation A B E

UNIT VI Z-transform:
Subject Category
ABET Learning Objectives  a b e k
ABET internal assessments  1 2 6
JNTUK External Evaluation A B E

BOOKS:

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<td>A. Questions should have: B. Definitions,</td>
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<td>experiments, analyze &amp; interpret data</td>
<td>c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, &amp; sustainability constraints</td>
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<td>d) Function on multidisciplinary teams</td>
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<td>6. Problem based</td>
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<td>Principle of operation or philosophy of concept.</td>
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<td>G. Brain storming questions</td>
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UNIT-I

PHYSICAL OPTICS FOR INSTRUMENTS

“Objective Designing an instrument and enhancing the resolution for its operation would be effective as achieved through study of applicational aspects of physical Optics”.


UNIT-II

COHERENT OPTICS – COMMUNICATIONS AND STRUCTURE OF MATERIALS

Objectives while lasers are trusted Non-linear coherent sources established for the fitness of instrumentation, establishing a structure property relationship for materials requires allotment of an equivalent footing in convening the physics knowledge base.


X-RAY DIFFRACTION TECHNIQUES : Directions and planes in crystals – Miller indices – Separation between successive [h k l] planes – Bragg’s law.
UNIT-III
MAGNETIC, ELECTRIC FIELD RESPONSE OF MATERIALS & SUPERCONDUCTIVITY
“Objective many of the Electrical or Electronic gadgets are designed basing on the response of naturally abundant and artificially made materials, while their response to E- or H- fields controls their performance.

MAGNETIC PROPERTIES: Magnetic permeability – Magnetization – Organ or magnetic moment – Classification of Magnetic materials – Dir, para, Ferro, anti ferro and ferri-magnetism – Hysteresis curve.


SUPERCONDUCTIVITY: General properties – Meissner effect – Type I and Type II superconductors – BCS Theory Flux quantization London’s equations – Penetration depth – DC and AC Josephson effects – SQUIDS.

UNIT – IV
ACOUSTICS AND EM – FIELDS:
Objective: The utility and nuances of ever pervading SHM and its consequences would be the first hand-on to as it clearly conveyed through the detailed studies of Acoustics of Buildings, while vectorial concepts of EM fields paves the student to gear – up for a deeper understanding.

ACOUSTICS: Sound absorption, absorption coefficient and its measurements, Reverberations time – Sabine’s formula, Eyring’s formula.

ELECTRO-MAGNETIC FIELDS: Gauss and stokes theorems (qualitative) – Fundamental laws of electromagnetism – Maxwell’s Electromagnetic Equations (Calculus approach).

UNIT – V
QUANTUM MECHANICS FOR ELECTRONIC TRANSPORT
Objective: The discrepancy between classical estimates and laboratory observations of physical properties exhibited by materials would be lifted out through the understanding quantum picture of sub-atomic world dominated by electron and its presence.

QUANTUM MECHANICS: Introduction to matter waves – Schrodinger Time Independent and Time Dependent wave equations – Particle in a box.


UNIT – VI
SEMICONDUCTOR PHYSICS:
Objective: In the wake of ever increasing demand for the space and power the watch word “small is beautiful”, understanding the physics of electronic transport as underlying mechanism for appliances would provide a knowledge base.


TEXT BOOKS
1. Solid state Physics by A.J. Dekker (Mc Millan India Ltd.) .

REFERENCE BOOKS
1. ‘Introduction to solid state physics’ by Charles Kittle (Willey India Pvt. Ltd).
2. ‘Applied Physics’ by T. Bhimasenkaram (BSP BH Publications)
4. ‘Engineering Physics’ by Palanisamy (Scitech Publishers).
5. ‘Engineering Physics’ by D.K.Bhattacharya (Oxford University press).
6. ‘Engineering Physics’ by Mani Naidu S (Pearson Publications)
7. ‘Engineering Physics’ by Sanjay D Jain and Girish G Sahasrabudhe (University Press).
I Year – I SEMESTER

T  P  C
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Professional Ethics and Human Values

UNIT I : Human Values:

UNIT II : Engineering Ethics:

UNIT III : Engineering as Social Experimentation:

UNIT IV : Engineers’ Responsibility for Safety and Risk:

UNIT V : Engineers’ Responsibilities and Rights:
Whistle Blowing-types of whistle blowing-when should it be attempted-preventing whistle blowing.

UNIT VI : Global Issues:

********

Text Books:

3. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M. Jayakumaran- Laxmi Publications
4. “Professional Ethics and Human Values” by Prof. D.R. Kiran.
5. “Indian Culture, Values and Professional Ethics” by PSR Murthy-BS Publication.
Objective:
Engineering drawing being the principle method of communication for engineers, the objective to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

UNIT I
Objective: The objective is to introduce the use and the application of drawing instruments and to make the students construct the polygons, curves and various types of scales. The student will be able to understand the need to enlarge or reduce the size of objects in representing them.
Polygons, Construction of regular polygons using given length of a side; Ellipse, arcs of circles and Oblong methods; Scales – Vernier and Diagonal scales.

UNIT II
Objective: The objective is to introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other.
Introduction to orthographic projections; projections of points; projections of straight lines parallel to both the planes; projections of straight lines – parallel to one plane and inclined to the other plane.

UNIT III
Objective: The objective is to make the students draw the projections of the lines inclined to both the planes.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces.

UNIT IV
Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.
Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.
UNIT V
Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes. Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

UNIT VI
Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa. Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

TEXT BOOKS:

REFERENCE BOOKS:
ENGLISH – COMMUNICATION SKILLS LAB – I

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

BASIC COMMUNICATION SKILLS

UNIT 1
A. Greeting and Introductions
B. Pure Vowels

UNIT 2
A. Asking for information and Requests
B. Diphthongs

UNIT 3
A. Invitations
B. Consonants

UNIT 4
A. Commands and Instructions
B. Accent and Rhythm

UNIT 5
A. Suggestions and Opinions
B. Intonation

Text Book:
‘Strengthen your Communication Skills’ Part-A by Maruthi Publications.

Reference Books:
1. INFOTECH English (Maruthi Publications).
I Year – I SEMESTER

ENGINEERING PHYSICS LAB

List of Experiments

3. Determination of thickness of a thin object using parallel interference fringes.
4. Determination of Rigidity modulus of a material- Torsional Pendulum.
7. Verification of laws of stretched string – Sonometer.
9. L C R Senes Resonance Circuit
10. Study of I/V Characteristics of Semiconductor diode.
11. I/V characteristics of Zener diode.
12. Thermistor characteristics – Temperature Coefficient.
13. Magnetic field along the axis of a current carrying coil – Stewart and Gee’s apparatus.
15. Hall Effect for semiconductor.

REFERENCE:

I Year – I SEMESTER

Engineering Physics
Virtual Labs - Assignments

List of Experiments
1. Hall Effect
2. Crystal Structure
3. Hysteresis
4. Brewster’s angle
5. Magnetic Levitation / SQUID
6. Numerical Aperture of Optical fiber
7. Photoelectric Effect
8. Simple Harmonic Motion
9. Damped Harmonic Motion
10. LASER – Beam Divergence and Spot size

URL: WWW.vlab.co.in
I Year – I SEMESTER

ENGINEERING WORKSHOP & IT WORKSHOP

ENGINEERING WORKSHOP:

Course Objective: To impart hands-on practice on basic engineering trades and skills.
Note: At least two exercises to be done from each trade.

Trade:

**Carpentry**
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tennon Joint

**Fitting**
1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

**Black Smithy**
1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring
4. Round Rod to Square headed bolt

**House Wiring**
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance

**Tin Smithy**
1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

IT WORKSHOP:

Objectives: Enabling the student to understand basic hardware and software tools through practical exposure.
Electrical and Electronics Engineering

PC Hardware:
Identification of basic peripherals, assembling a PC, installation of system
software like MS Windows, device drivers. Troubleshooting Hardware and
software _ some tips and tricks.

Internet & World Wide Web:
Different ways of hooking the PC on to the internet from home and
workplace and effectively usage of the internet, web browsers, email,
newsgroups and discussion forums .Awareness of cyber hygiene( protecting
the personal computer from getting infected with the viruses), worms and
other cyber attacks .

Productivity tools Crafting professional word documents; excel spread
sheets, power point presentations and personal web sites using the Microsoft
suite of office tools

(Note: Student should be thoroughly exposed to minimum of 12 Tasks)

PC Hardware
Task 1: Identification of the peripherals of a computer.
To prepare a report containing the block diagram of the CPU along with the
configuration of each peripheral and its functions. Description of various I/O
Devices.

Task 2 (Optional) : A practice on disassembling the components of a PC
and assembling them back to working condition.

Task 3: Examples of Operating systems- DOS, MS Windows, Installation of
MS windows on a PC.

Task 4: Introduction to Memory and Storage Devices, I/O Port, Device
Drivers, Assemblers, Compilers, Interpreters, Linkers, Loaders.

Task 5:
Hardware Troubleshooting (Demonstration):
Identification of a problem and fixing a defective PC(improper assembly or
defective peripherals).

Software Troubleshooting (Demonstration): Identification of a problem
and fixing the PC for any software issues.

Internet & Networking Infrastructure
Task 6: Demonstrating Importance of Networking, Transmission Media,
Networking Devices- Gateway, Routers, Hub, Bridge, NIC ,Bluetooth
Technology, Wireless Technology, Modem, DSL, Dialup Connection.

Orientation & Connectivity Boot Camp and web browsing: Students are
trained to config the network settings to connect to the Internet. They are
trained to demonstrate the same through web browsing (including all tool bar options) and email access.

**Task 7: Search Engines & Netiquette:**

Students are enabled to use search engines for simple search, academic search and any other context based search (Bing, Google etc). Students are acquainted to the principles of micro-blogging, wiki, collaboration using social networks, participating in online technology forums.

**Task 8: Cyber Hygiene (Demonstration):** Awareness of various threats on the internet. Importance of security patch updates and anti-virus solutions. Ethical Hacking, Firewalls, Multi-factor authentication techniques including Smartcard, Biometrics are also practiced.

**Word**

**Task 9 : MS Word Orientation:**

Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, OLE in Word, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving.

**Task 10: Creating project :** Abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

**Excel**

**Task 11:** Using spread sheet features of EXCEL including the macros, formulae, pivot tables, graphical representations.

**Creating a Scheduler -** Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text.

**LOOKUP/VLOOKUP**

**Task 12: Performance Analysis -** Features to be covered:- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

**Power Point**

**Task 13:** Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word

**Task 14:** Focusing on the power and potential of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides, OLE in PPT.

**TEXT BOOK:**
Faculty to consolidate the workshop manuals using the following references

3. Information Technology Workshop, 3e, G Praveen Babu, MV Narayana BS Publications.

**REFERENCE BOOK:**

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu.
I Year – II SEMESTER

ENGLISH –II
(Common to All Branches)

DETAILED TEXT-II :
Sure Outcomes: English for Engineers and Technologists
Recommended Topics:

1. TECHNOLOGY WITH A HUMAN FACE
OBJECTIVE: To make the learner understand how modern life has been shaped by technology.
OUTCOME: The proposed technology is people’s technology. It serves the human person instead of making him the servant of machines.

2. CLIMATE CHANGE AND HUMAN STRATEGY
OBJECTIVE: To make the learner understand how the unequal heating of earth’s surface by the Sun, an atmospheric circulation pattern is developed and maintained.
OUTCOME: The learner’s understand that climate must be preserved.

3. EMERGING TECHNOLOGIES
OBJECTIVE: To introduce the technologies of the 20th century and 21st centuries to the learners.
OUTCOME: The learner will adopt the applications of modern technologies such as nanotechnology.

4. WATER- THE ELIXIR OF LIFE
OBJECTIVE: To inform the learner of the various advantages and characteristics of water.
OUTCOME: The learners will understand that water is the elixir of life.

5. THE SECRET OF WORK
OBJECTIVE: In this lesson, Swami Vivekananda highlights the importance of work for any development.
OUTCOME: The students will learn to work hard with devotion and dedication.
6. **WORK BRINGS SOLACE**

**OBJECTIVE:** In this lesson Abdul Kalam highlights the advantage of work.

**OUTCOME:** The students will understand the advantages of work. They will overcome their personal problems and address themselves to national and other problems.

**Text Book** : ‘Sure Outcomes’ by Orient Black Swan Pvt. Ltd. Publishers

**NON-DETAILED TEXT:**

(From Modern Trailblazers of Orient Blackswan)

(Common single Text book for two semesters)

1. **J.C. Bose**

**OBJECTIVE:** To apprise of J.C.Bose’s original contributions.

**OUTCOME:** The learner will be inspired by Bose’s achievements so that he may start his own original work.

2. **Homi Jehangir Bhaba**

**OBJECTIVE:** To show Bhabha as the originator of nuclear experiments in India.

**OUTCOME:** The learner will be inspired by Bhabha’s achievements so as to make his own experiments.

3. **Vikram Sarabhai**

**OBJECTIVE:** To inform the learner of the pioneering experiments conducted by Sarabhai in nuclear energy and relevance of space programmes.

**OUTCOME:** The learner will realize that development is impossible without scientific research.

4. **A Shadow- R.K.Narayan**

**OBJECTIVE:** To expose the reader to the pleasure of the humorous story.

**OUTCOME:** The learner will be in a position to appreciate the art of writing a short story and try his hand at it.

I Year – II SEMESTER

MATHEMATICS – III
(LINEAR ALGEBRA & VECTOR CALCULUS)
(Common to All Branches)

UNIT I Linear systems of equations:
Application: Finding the current in a electrical circuit.
Subject Category
ABET Learning Objectives  a e k
ABET internal assessments  1 2 6 4
JNTUK External Evaluation  A B E

UNIT II Eigen values - Eigen vectors and Quadratic forms:
Application: Free vibration of a two-mass system.
Subject Category
ABET Learning Objectives  a d e k
ABET internal assessments  1 2 4 6
JNTUK External Evaluation  A B E

UNIT III Multiple integrals:
Review concepts of Curve tracing (Cartesian - Polar and Parametric curves)- Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates.
Multiple integrals - double and triple integrals – change of variables – Change of order of Integration
Application: Moments of inertia
Subject Category
ABET Learning Objectives  a e d
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E
UNIT IV Special functions:
Beta and Gamma functions- Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals.
Application: Evaluation of integrals
Subject Category
ABET Learning Objectives  a e
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E

UNIT V Vector Differentiation:
Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities.
Application: Equation of continuity, potential surfaces
Subject Category
ABET Learning Objectives  a e
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E

UNIT VI Vector Integration:
Application : work done, Force
Subject Category
ABET Learning Objectives  a e
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E

BOOKS:
<table>
<thead>
<tr>
<th>Subject Category</th>
<th>ABET Learning Objectives</th>
<th>ABET Internal Assessments</th>
<th>JNTUK External Evaluation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>a) Apply knowledge of math, science, &amp; engineering</td>
<td>1. Objective tests</td>
<td>A. Questions should have:</td>
<td></td>
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<tr>
<td>Design</td>
<td>b) Design &amp; conduct experiments, analyze &amp; interpret data</td>
<td>2. Essay questions tests</td>
<td>B. Definitions, Principle of operation or philosophy of concept</td>
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<td>Analysis</td>
<td>c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, &amp; sustainability constraints</td>
<td>3. Peer tutoring based</td>
<td>C. Mathematica l treatment, derivations, analysis, synthesis, numerical problems with inference.</td>
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<tr>
<td>Algorithms</td>
<td>d) Function on multidisciplinary teams</td>
<td>4. Simulation based</td>
<td>D. Design oriented problems</td>
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<tr>
<td>Drawing</td>
<td>e) Identify, formulate, &amp; solve engineering problems</td>
<td>5. Design oriented</td>
<td>E. Trouble shooting type of questions</td>
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<tr>
<td>Others</td>
<td>f) Understand professional &amp; ethical responsibilities</td>
<td>6. Problem based</td>
<td>F. Applications related questions</td>
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<td></td>
<td>g) Communicate effectively</td>
<td>7. Experiential (project based) based</td>
<td>G. Brain storming questions</td>
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<td></td>
<td>h) Understand impact of engineering solutions in global, economic, environmental, &amp; societal context</td>
<td>8. Lab work or field work based</td>
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<td>i) Recognize need for &amp; be able to engage in lifelong learning</td>
<td>9. Presentation based</td>
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<td></td>
<td>j) Know contemporary issues</td>
<td>10. Case Studies based</td>
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<td></td>
<td>k) Use techniques, skills, modern tools for engineering practices</td>
<td>11. Role-play based</td>
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<td>12. Portfolio based</td>
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</tbody>
</table>
UNIT-I: WATER TECHNOLOGY
Hard Water – Estimation of hardness by EDTA method – Potable water-
Sterilization and Disinfection – Boiler feed water – Boiler troubles – Priming
and foaming, scale formation, corrosion, caustic embrittlement, turbine
deposits – Softening of water – Lime soda, Zeolite processes – Reverse
osmosis – Electro Dialysis, Ion exchange process.

Objectives: For prospective engineers knowledge about water used in
industries (boilers etc.) and for drinking purposes is useful; hence chemistry
of hard water, boiler troubles and modern methods of softening hard water is
introduced.

UNIT-II: ELECTROCHEMISTRY
Concept of Ionic conductance – Ionic Mobilities – Applications of
Kohlrausch law – Conductometric titrations – Galvanic cells – Electrode
potentials – Nernst equation – Electrochemical series – Potentiometric
titrations – Concentration cells – Ion selective electrode – Glass electrodes –
Fluoride electrode; Batteries and Fuel cells.

Objectives: Knowledge of galvanic cells, electrode potentials, concentration
cells is necessary for engineers to understand corrosion problem and its
control; also this knowledge helps in understanding modern bio-sensors, fuel
cells and improve them.

UNIT-III: CORROSION
Causes and effects of corrosion – theories of corrosion (dry, chemical and
electrochemical corrosion) – Factors affecting corrosion – Corrosion control
methods – Cathodic protection – Sacrificial Anodic, Impressed current
methods – Surface coatings – Methods of application on metals (Hot dipping,
Galvanizing, tinning, Cladding, Electroplating, Electroless plating) – Organic
surface coatings – Paints – Their constituents and their functions.

Objectives: the problems associated with corrosion are well known and the
engineers must be aware of these problems and also how to counter them.

UNIT-IV: HIGH POLYMERS
Types of Polymerization – Stereo regular Polymers – Physical and
Mechanical properties of polymers – Plastics – Thermoplastics and thermo

Objectives: Plastics are materials used very widely as engineering materials. An understanding of properties particularly physical and mechanical properties of polymers/plastics/elastomers helps in selecting suitable materials for different purposes.

UNIT-V : FUELS

Objectives: A board understanding of the more important fuels employed on a large scale is necessary for all engineer to understand energy-related problems and solve them.

UNIT-VI : CHEMISTRY OF ADVANCED MATERIALS

Objectives: With the knowledge available now, future engineers should know at least some of the advanced materials that are becoming available. Hence some of them are introduced here.

TEXT BOOKSS

REFERENCES


**OBJECTIVES:**

The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work-energy method.

**UNIT – I**

**Objectives:** The students are to be exposed to the concepts of force and friction, direction and its application.


**UNIT II**

**Objectives:** The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

**Equilibrium of Systems of Forces:** Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

**UNIT – III**

**Objectives:** The students are to be exposed to concepts of centre of gravity.

**Centroid:** Centroids of simple figures (from basic principles) – Centroids of Composite Figures.

**Centre of Gravity:** Centre of gravity of simple body (from basis principles), centre of gravity of composite bodies, pappus theorem.
UNIT IV
Objective: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V
Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.


UNIT – VI
Objectives: The students are to be exposed to concepts of work, energy and particle motion.


TEXT BOOKS:

REFERENCES:


I Year – II SEMESTER

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3+1 0 3

ELECTRICAL CIRCUIT ANALYSIS – I

Preamble:
This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, network theorems, transient analysis and network topology.

Objectives:

i. To study the concepts of passive elements, types of sources and various network reduction techniques.

ii. To understand the behaviour of RLC networks for sinusoidal excitations.

iii. To study the performance of R-L, R-C and R-L-C circuits with variation of one of the parameters and to understand the concept of resonance.

iv. To study the concept of magnetic coupled circuit.

v. To understand the applications of network topology to electrical circuits.

vi. To understand the applications of network theorems for analysis of electrical networks.

UNIT-I

Introduction to Electrical Circuits
Passive components and their V-I relations. Sources (dependent and independent) - Kirchoff’s laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation). Source transformation technique, nodal analysis and mesh analysis.

UNIT-II

Single Phase A.C Systems
Periodic waveforms (determination of rms, average value and form factor). Concept of phase angle and phase difference.
Complex and polar forms of representations, steady state analysis of R, L and C circuits.
Power Factor and its significance – Real, Reactive power and apparent Power.

UNIT-III
Resonance
Locus diagrams for various combination of R, L and C. Resonance, concept of band width and Quality factor.

UNIT-IV
Magnetic Circuit
Basic definition of MMF, flux and reluctance. Analogy between electrical and magnetic circuits.
Faraday’s laws of electromagnetic induction Concept of self and mutual inductance.
Dot convention-coefficient of coupling and composite magnetic circuit. Analysis of series and parallel magnetic circuits.

UNIT-V
Network topology

UNIT-VI
Network theorems (DC & AC Excitations)
Superposition theorem, Thevenin’s theorem, Norton’s theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman’s theorem and compensation theorem.

Outcomes:
Students are able to solve
i. Various electrical networks in presence of active and passive elements.
ii. Any R, L, C network with sinusoidal excitation.
iii. Any R, L, C network with variation of any one of the parameters i.e R, L, C. and f.
iv. Any magnetic circuit with various dot conventions.
v. Electrical networks with network topology concepts.
vi. Electrical networks by using principles of network theorems.
TEXT BOOKS:
2. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.

REFERENCE BOOKS:
1. Introduction to Circuit Analysis and Design by Tildon Glisson, Jr, Springer Publications.
2. Electric Circuit Analysis by K.S. Suresh Kumar, Pearson publications
3. Electric Circuits by David A. Bell, Oxford publications.
I Year – II SEMESTER  

COMPUTER PROGRAMMING

Objectives: Formulating algorithmic solutions to problems and implementing algorithms in C.

UNIT I:
Unit objective: Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editing and executing programs in Linux

Introduction: Computer systems, Hardware and Software Concepts,

Problem Solving: Algorithm / Pseudo code, flowchart, program development steps, computer languages: machine, symbolic and highlevel languages, Creating and Running Programs: Writing, Editing (vi/emacs editor), Compiling (gcc), Linking and Executing in under Linux.

BASICS OF C: Structure of a C program, identifiers, basic data types and sizes. Constants, Variables, Arithmetic, relational and logical operators, increment and decrement operators, conditional operator, assignment operator, expressions, type conversions, Conditional Expressions, precedence and order of evaluation. Sample Programs.

UNIT II:
Unit objective: understanding branching, iteration and data representation using arrays

SELECTION – MAKING DECISION: Two way selection: if-else, null else, nested if, examples, Multi-way selection: switch, else-if, examples.

ITERATIVE: loops- while, do-while and for statements , break, continue, initialization and updating, event and counter controlled loops, Looping applications: Summation, powers, smallest and largest.

ARRAYS: Arrays- concepts, declaration, definition, accessing elements, storing elements, Strings and String Manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix.

STRINGS: concepts, c strings.

UNIT III:
Objective: Modular programming and recursive solution formulation

FUNCTIONS- MODULAR PROGRAMMING: functions, basics, parameter passing, storage classes extern, auto, register, static, scope rules,
block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for fibonacci series, towers of Hanoi, header files, C Preprocessor, example c programs, Passing 1-D arrays, 2-D arrays to functions.

UNIT IV:
Objective: Understanding pointers and dynamic memory allocation
POINTERS: pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address- dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments.

UNIT V:
Objective: Understanding miscellaneous aspects of C
ENUMERATED, STRUCTURE AND UNION TYPES: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields, program applications.
BIT-WISE OPERATORS: logical, shift, rotation, masks.

UNIT VI:
Objective: Comprehension of file operations
FILE HANDLING: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, example programs.

Text Books:
1. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PEARSON.
3. Programming in C, A practical approach Ajay Mittal PEARSON.
4. The C programming Language by Dennis Richie and Brian Kernighan

Reference Books and web links:
3. Programming in C, Reema Thareja, OXFORD.
List of Experiments

1. Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Quantitative analysis etc.
2. Trial experiment – Estimation of HCl using standard Na₂CO₃ solutions
3. Estimation of KMnO₄ using standard Oxalic acid solution.
4. Estimation of Ferric iron using standard K₂Cr₂O₇ solution.
5. Estimation of Copper using standard K₂Cr₂O₇ solution.
7. Estimation of Copper using standard EDTA solution.
8. Estimation of Copper using Colorimeter
10. Conductometric Titrations between strong acid and strong base
11. Conductometric Titrations between strong acid and Weak base
12. Potentiometric Titrations between strong acid and strong base
13. Potentiometric Titrations between strong acid and Weak base
14. Estimation of Zinc using standard potassium ferrocyanide solution
15. Estimation of Vitamin – C

TEXT BOOKS

I Year – II SEMESTER

ENGLISH – COMMUNICATION SKILLS LAB – II

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

ADVANCED COMMUNICATION SKILLS

UNIT 6       Body language
UNIT 7       Dialogues
UNIT 8       Interviews and Telephonic Interviews
UNIT 9       Group Discussions
UNIT 10      Presentation Skills
UNIT 11      Debates

Text Book:

‘Strengthen your Communication Skills’ Part-B by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications).
I Year – II SEMESTER

C PROGRAMMING LAB

Exercise 1
a) Write a C Program to calculate the area of triangle using the formula area = (s(s-a)(s-b)(s-c))^{1/2} where s = (a+b+c)/2
b) Write a C program to find the largest of three numbers using ternary operator.
c) Write a C Program to swap two numbers without using a temporary variable.

Exercise 2
a) 2’s complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2’s complement of 11100 is 00100. Write a C program to find the 2’s complement of a binary number.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement).

Exercise 3
a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.
b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Exercise 4
a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.
b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.
c) Write a C Program to check whether the given number is Armstrong number or not.
Exercise 5
a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to implement a linear search.
c) Write a C program to implement binary search

Exercise 6
a) Write a C program to implement sorting of an array of elements.
b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them.

Exercise 7
Write a C program that uses functions to perform the following operations:
   i. To insert a sub-string in a given main string from a given position.
   ii. To delete n Characters from a given position in a given string.
   iii. To replace a character of string either from beginning or ending or at a specified location.

Exercise 8
Write a C program that uses functions to perform the following operations using Structure:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers

Exercise 9
Write C Programs for the following string operations without using the built in functions.
   - to concatenate two strings
   - to append a string to another string
   - to compare two strings

Exercise 10
Write C Programs for the following string operations without using the built in functions.
   - to find the length of a string
   - to find whether a given string is palindrome or not
Exercise 11
a) Write a C functions to find both the largest and smallest number of an array of integers.
b) Write C programs illustrating call by value and call by reference concepts.

Exercise 12
Write C programs that use both recursive and non-recursive functions for the following
   i) To find the factorial of a given integer.
   ii) To find the GCD (greatest common divisor) of two given integers.
   iii) To find Fibonacci sequence

Exercise 13
a) Write C Program to reverse a string using pointers
b) Write a C Program to compare two arrays using pointers

Exercise 14
a) Write a C program consisting of Pointer based function to exchange value of two integers using passing by address.
b) Write a C program to swap two numbers using pointers.

Exercise 15
Examples which explores the use of structures, union and other user defined variables.

Exercise 16
a) Write a C program which copies one file to another.
b) Write a C program to count the number of characters and number of lines in a file.
c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.
II Year – I Semester

Electrical Circuit Analysis-II

Preamble:
This course aims at study of three-phase systems, transient analysis, network synthesis and Fourier analysis for the future study and analysis of power systems.

Objectives:

i. To study the concepts of balanced three-phase circuits.
ii. To study the concepts of unbalanced three-phase circuits.
iii. To study the transient behaviour of electrical networks with DC, pulse and AC excitations.
iv. To study the performance of a network based on input and output excitation/response.
v. To understand the realization of electrical network function into electrical equivalent passive elements.
vi. To understand the application of Fourier series and Fourier transforms for analysis of electrical circuits.

UNIT-I Balanced Three phase circuits
Phase sequence - star and delta connection - relation between line and phase voltages and currents in balanced systems - analysis of balanced three phase circuits - measurement of active and reactive power in balanced three phase systems.

UNIT-II Unbalanced Three phase circuits
Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique, Two wattmeter methods for measurement of three phase power.
UNIT-III Transient Analysis in DC and AC circuits
Transient response of R-L, R-C, R-L-C circuits for DC and AC excitations, Solution using differential equations and Laplace transforms.

UNIT-IV Two Port Networks
Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations, Cascaded networks - poles and zeros of network functions.

UNIT-V Network synthesis
Positive real function - basic synthesis procedure - LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function - Foster and Cauer methods.

UNIT-VI Fourier analysis and Transforms
Fourier theorem- Trigonometric form and exponential form of Fourier series, Conditions of symmetry- line spectra and phase angle spectra, Analysis of electrical circuits to non sinusoidal periodic waveforms.
Fourier integrals and Fourier transforms – properties of Fourier transforms and application to electrical circuits.

Outcomes:

i. Students are able to solve three-phase circuits under balanced condition.

ii. Students are able to solve three-phase circuits under unbalanced condition.

iii. Students are able find out transient response of electrical networks with different types of excitations.

iv. Students are able to estimate the different types of two port network parameters.

v. Students are able to represent electrical equivalent network for a given network transfer function.

vi. Students are able to extract different harmonics components from the response of a electrical network.
Text Books:
2. Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd.

Reference Books:
1. Introduction to circuit analysis and design by Tildon Glisson, Jr, Springer Publications.
2. Circuits by A.Bruce Carlson, Cengage Learning Publications.
5. Electric Circuits by David A. Bell, Oxford publications.
II Year – I SEMESTER

THERMAL AND HYDRO PRIME MOVERS

Part-A: Thermal prime movers
Course Objectives: To make the student understand the types of prime movers, which can be connected to generators for power production and should obtain the skills of performing the necessary calculations with respect to the functioning of the prime movers.

UNIT I:
Objectives: To make the student learn about the constructional features, operational details of various types of internal combustion engines through the details of several engine systems and the basic air standard cycles, that govern the engines. Further, the student shall be able to calculate the performance of different types of internal combustion engines.


UNIT II:
Objectives: To train the student in the aspects of steam formation and its utilities through the standard steam data tables and charts. To make the student correlate between the air standard cycles and the actual cycles that govern the steam turbines. To train the student to calculate the performance of steam turbines using velocity diagrams.

UNIT III:
Objectives: To impart the knowledge of gas turbine fundamentals, the governing cycles and the methods to improve the efficiency of gas turbines.


Part-B: Hydro prime movers

UNIT IV:
Objectives: To teach the student about the fundamental of fluid dynamic equations and its applications fluid jets. To impart the knowledge of various types of pumps, their constructional features, working and performance.


UNIT V:
Objectives: To make the student learn about the constructional features, operational details of various types of hydraulic turbines. Further, the student shall be able to calculate the performance of hydraulic turbines.

HYDRAULIC TURBINES: Classification of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines; Performance and characteristic curves.

UNIT VI:
Objectives: To train the student in the areas of types of hydro electric power plants, estimation and calculation of different loads by considering various factors.

HYDRO POWER: Components of Hydro electric power plant: pumped storage systems, Estimation of water power potential; Estimation of load on turbines: load curve, load factor, capacity factor, utilization factor, diversity factor, load – duration curve, firm power, secondary power, prediction of load.
Text Books:
1. Thermal Engineering by Rajput, Lakshmi publications

Reference Books:
Preamble: This course introduces the concepts of semi-conductor physics and operation of various semi-conductor devices. Realization of rectifiers, amplifiers and oscillators using semi-conductor devices and their analysis is also introduced in this course.

Unit-I:
Objective: To learn the basics of semiconductor physics.

Outcome:
Students are able to understand the basic concepts of semiconductor physics, which are useful to understand the operation of diodes and transistors.

Unit-II:
Objective: To study the construction details, operation and characteristics of various semiconductor diodes.

Junction Diode Characteristics
Operation and characteristics of p-n junction diode. Current components in p-n diode, diode equation. Temperature dependence on V–I characteristic, diffusion capacitance and diode resistance (static and dynamic), energy band diagram of p-n diode.

Special Diodes: Avalanche and Zener break down, Zener characteristics, tunnel diode, characteristics with the help of energy band diagrams, Varactor diode, LED, PIN diode, Photo diode.

Outcome:
Students are able to explain the operation and characteristics of PN junction diode and special diodes.
Unit-III:
Objective:
To understand the operation and analysis of rectifiers with and without filters. Further study the operation of series and shunt regulators using zener diodes.

Rectifiers and Regulators
Half wave rectifier, ripple factor, full wave rectifier (with and without transformer), harmonic components in a rectifier circuit, inductor filter, capacitor filter, L-section filter, Π-section filter, and comparison of various filter circuits in terms of ripple factors. Simple circuit of a regulator using Zener diode. Types of regulators-series and shunt voltage regulators, overload voltage protection.

Outcome:
Ability to understand operation and design aspects of rectifiers and regulators.

Unit-IV:
Objective:
To study the characteristics of different bipolar junction transistors and their biasing stabilization and compensation techniques. To analyze transistor amplifiers using h-parameters.

Transistors

Outcome:
Students are able to understand the characteristics of various transistor configurations. They become familiar with different biasing, stabilization and compensation techniques used in transistor circuits.

Unit- V:
Objective:
To understand the basics of FET, Thyristors, Power IGBTs and Power MOSFETs.

Power semiconductor devices
Principle of operation and characteristics of Thyristors, Silicon control
rectifiers, power IGBT and power MOSFET their ratings. Comparison of power devices.

**FET:** JFET Characteristics (Qualitative explanation), MOFET Characteristics–static and Transfer (enhancement and depletion mode), low frequency model of FET, FET as an amplifier.

**Outcome:**  
Students are able to understand the operation and characteristics of FET, Thyristors, Power IGBTs and Power MOSFETs.

**Unit VI :**  
**Objective:**  
To understand the concepts of positive and negative feedbacks and their role in amplifiers and oscillators.

**Amplifiers and oscillators**  
Feedback Amplifiers -classification, feedback concept, transfer gain and general characteristics of negative feedback amplifiers, effect of feedback on input and output resistances. Methods of analysis of feedback amplifiers.  
Power Amplifiers – Classification, push-pull amplifiers, Introduction to harmonics (distortion factor).  

**Outcome:**  
Students are able to understand the merits and demerits of positive and negative feedback and the role of feedback in oscillators and amplifiers.

**TEXT BOOKS:**  
2. Electronics devices and circuits by Atul P. Godse, Uday, Bakshi, Technical Publication.

**REFERENCE BOOKS:**  
1. Electronic Devices and Circuits by David A. Bell, Oxford University Press.  
II Year – I SEMESTER

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COMPLEX VARIABLE AND STATISTICAL METHODS

UNIT-I Functions of a complex variable:

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT-II Integration and Series Expansions

Subject Category
ABET Learning Objectives a e k
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT III Integration using Residues:
Types of Singularities: Isolated, pole of order m, essential - Residues – Residue theorem (without proof) - Evaluation of real integrals of type (a) (b) (c)

Subject Category
ABET Learning Objectives a e
ABET internal assessments 1 2 6
JNTUK External Evaluation A B E

UNIT IV Conformal Mapping:
Transformation by exp z, lnz, z^2, z^n(n positive integer), Sin z, cos z, z + a/z- Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles.
Subject Category
ABET Learning Objectives  a e k
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E

UNIT V Sampling Distributions:
Review of Normal distribution - Population and samples - Sampling distribution of mean (with known and unknown variance), proportion, variances - Sampling distribution of sums and differences - Point and interval estimators for means, variances, proportions.

Subject Category
ABET Learning Objectives  a e k
ABET internal assessments  1 2 6
JNTUK External Evaluation  A B E

UNIT VI Tests of Hypothesis
Type I and Type II errors - Maximum error - One tail, two-tail tests - Tests concerning one mean and proportion, two means - Proportions and their differences using Z-test, Student’s t-test - F-test and Chi -square test.

Subject Category
ABET Learning Objectives  a b d e h k
ABET internal assessments  1 2 6 7 10
JNTUK External Evaluation  A B E F D

Books:
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<th>ABET Internal Assessments</th>
<th>JNTUK External Evaluation</th>
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<td>Theory Design Analysis Algorithm Drawing Others</td>
<td>a) Apply knowledge of math, science, &amp; engineering</td>
<td>1. Objective tests</td>
<td>A. Questions should have:</td>
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<td>b) Design &amp; conduct experiments, analyze &amp; interpret data</td>
<td>2. Essay questions tests</td>
<td>B. Definition s, Principle of operation or philosoph y of concept.</td>
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<td>c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, &amp; sustainability constraints</td>
<td>3. Peer tutoring based</td>
<td>C. Mathemati cal treatment, derivation s, analysis, synthesis, numerical problems with inference.</td>
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<td>d) Function on multidisciplinary teams</td>
<td>4. Simulation based</td>
<td>D. Design oriented problems</td>
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<td>e) Identify, formulate, &amp; solve engineering problems</td>
<td>5. Design oriented</td>
<td>E. Trouble shooting type of questions</td>
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<td>f) Understand professional &amp; ethical responsibilities</td>
<td>6. Problem based</td>
<td>F. Applicatio ns related questions</td>
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<td>g) Communicate effectively</td>
<td>7. Experimental (project based) based</td>
<td>G. Brain storming questions</td>
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<td>h) Understand impact of engineering solutions in global, economic, environmental, &amp; societal context</td>
<td>8. Lab work or field work based</td>
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<td>i) Recognize need for &amp; be able to engage in lifelong learning</td>
<td>9. Presentation based</td>
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<td>j) Know contemporary issues</td>
<td>10. Case Studies based</td>
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<td>k) Use techniques, skills, modern tools for engineering practices</td>
<td>11. Role-play based</td>
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<td>12. Portfolio based</td>
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II Year – I SEMESTER  

**ELECTROMAGNETIC FIELDS**

Electromagnetic fields is the foremost pre-requisite course for most of the subjects in Electrical Engineering. Either in the enunciation of basics of electrical elements R, L and C that are the building blocks of any electrical device or in the illustration of Energy transfer from mechanical to electrical and vice versa its role is crucial. This course also includes the famous works of Coulomb, Ampere, Faraday, Maxwell etc. to the field of Electrical Engineering.

**UNIT – I   Electrostatics:**

**Objective:**
To study the production of electric field and potentials due to different configurations of static charges.

Electrostatic Fields – Coulomb’s Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Guass’s law — Maxwell’s first law, div \( \mathbf{D} \)=\( \rho \) Laplace’s and Poison’s equations and Solution of Laplace’s equation in one variable.

**Outcome:** Ability to calculate electric field and potentials using guass’s law or solving Laplace’s or Possion’s equations.

**UNIT – II   Conductors – Dielectrics and Capacitance:**

**Objective:**
To study the properties of conductors and dielectrics, calculate the capacitance of different configu-variants and understand the concept of conduction and convection current densities.

Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Behaviour of conductors in an electric field – Conductors and Insulators Polarization – Boundary conditions between conduction to Dielectric and dielectric to dielectrics capacitance – capacitance of parallel plates, spherical and coaxial cables with composite dielectrics –Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm’s law in point form – Equation of continuity.
**Outcome:** Learn how to calculate capacitance, energy stored in dielectrics and get’s the concept of conduction and convection currents.

**UNIT – III  Magneto statics and Ampere’s Law:**

**Objective:**
To study the magnetic fields produced by currents in different configurations, application of ampere’s law and the Maxwell’s second and third equations.

Static magnetic fields – Biot-Savart’s law – Oesterd’s experiment - Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell’s second Equation, \( \text{div}(B)=0 \) –Ampere’s circuitual law and its applications viz. MFI due to an infinite sheet of current and a long filament carrying conductor – Point form of Ampere’s circuitual law –Field due to a circular loop, rectangular and square loops, Maxwell’s third equation, Curl (H)=J.

**Outcome:**
Ability to find magnetic field intensity due to current, the application of ampere’s law and the Maxwell’s second and third equations.

**UNIT – IV  Force in Magnetic fields:**

**Objective :**
To study the magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field.

**Outcome:**
Students can calculate the magnetic forces and torque produced by currents in magnetic field.

**UNIT – V  Self and Mutual inductance:**

**Objective :**
To develop the concept of self and mutual inductances and the energy stored.
Self and Mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.

**Outcome:**
Will the able to calculate self and mutual inductances and the energy stored in the magnetic field.

**UNIT – VI  Time Varying Fields:**
**Objective:**
To study time varying and Maxwell’s equations in different forms and Maxwell’s fourth equation for the induced Emf.


**Outcome:**
Students will gain knowledge on time varying fields and get ability to calculate induced Emf. Concepts of displacement current and Poynting vector and associated problems are solved.

**TEXT BOOKS:**

**REFERENCE BOOKS**
II Year – I SEMESTER

3+1 0 3

ELECTRICAL MACHINES – I

Preamble:
This is a basic course on rotating electrical machines. This course covers the topics related to principles, performance, applications and design considerations of DC machines.

Learning objectives:

i. Appreciate the principles of electromagnetic energy conversion and understand the construction details of DC machine.

ii. Understand the principle of operation and performance of DC generators.

iii. Learn the characteristics and performance of DC generators.

iv. Learn the characteristics and performance of DC motors.

v. Learn the speed control and testing methods of DC motors.

vi. Learn the basic ideas of design of DC machines.

UNIT–I:
Electromechanical Energy Conversion
Introduction to S.I Units - principles of electromechanical energy conversion – forces and torque in magnetic field systems – energy balance- singly excited machine- magnetic force - co-energy – multi excited magnetic field system-construction features of conventional and modern DC machines.

UNIT–II:
D.C. Generators – I

UNIT–III:
D.C. Generators – II
Methods of excitation- self excited and separately excited-types of generators build-up of emf - open circuit characteristics-critical field resistance-critical speed-causes for failure to self excitation-remedial measures – Internal and
external characteristics of separately excited, shunt, series, compound generators-applications, losses and efficiency.

UNIT–IV:
D.C. Motors

UNIT-V:
Speed Control and Testing of D.C. Machines
Speed control by armature voltage and field flux control – testing of DC machines - brake test, Swinburne’s method – principle of regenerative or Hopkinson’s method - retardation test -- separation of losses – methods of electrical braking: plugging, dynamic and regenerative.

UNIT–VI:
Design of D.C. Machines
Design concept - output equation - choice of specific electric and magnetic loadings – separation of D and L - estimation of number of conductors/ turns - coils - armature slots – conductor dimension – slot dimension - choice of number of poles – length of air gap.

Learning outcomes:
  i. Able to explain the concepts of electromagnetic energy conversion.
  ii. Able to explain the operation of dc generator, armature reaction and commutation.
  iii. Able to analyze the characteristics and performance of dc generators.
  iv. Able to explain the torque developed and performance of dc motors.
  v. Able to analyze the speed control and testing methods of dc motors.
  vi. Able to propose design aspects of a dc machine.

TEXT BOOKS:
1. Electrical Machines – P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald,Charles kingsley,Stephen D.Umans, TMH
REFERENCE BOOKS:
3. The Performance and Design of DC machines - Albert E. Clayton.
II Year – I SEMESTER

THERMAL AND HYDRO LAB

Course Objective:
To impart practical knowledge on the performance evaluation methods of various internal combustion engines, flow measuring equipment and hydraulic turbines and pumps.

NOTE: To conduct a minimum of 12 experiments by conducting a minimum of six from each section.

SECTION A - THERMAL ENGINEERING LAB
1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test on 4-stroke Diesel engine.
3. I.C. Engines performance test on 2-stroke petrol engine.
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
5. Determination of FHP by retardation and motoring test on IC engine.
8. Study of boilers.

SECTION B – HYDRAULIC MACHINES LAB
1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Reciprocating Pump.
7. Calibration of Venturimeter.
9. Determination of loss of head due to sudden contraction in a pipeline.
II Year – I SEMESTER

ELECTRICAL CIRCUITS LAB

Any 10 of the following experiments are to be conducted:

1) Verification of Thevenin’s and Norton’s Theorems.
2) Verification of Superposition theorem and Maximum Power Transfer Theorem.
3) Verification of Compensation Theorem.
4) Verification of Reciprocity, Millmann’s Theorems.
5) Locus Diagrams of RL and RC Series Circuits.
6) Series and Parallel Resonance
7) Determination of Self, Mutual Inductances and Coefficient of coupling.
8) Z and Y Parameters
9) Transmission and hybrid parameters
10) Measurement of Active Power for Star and Delta connected balanced loads.
11) Measurement of Reactive Power for Star and Delta connected balanced loads.
II Year – II SEMESTER

ENVIRONMENTAL STUDIES

Course Learning Objectives:
The objectives of the course is to impart
1. Overall understanding of the natural resources.
2. Basic understanding of the ecosystem and its diversity.
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
4. An understanding of the environmental impact of developmental activities.
5. Awareness on the social issues, environmental legislation and global treaties.

Course Outcomes:
The student should have knowledge on
1. The natural resources and their importance for the sustenance of the life and recognise the need to conserve the natural resources.
2. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.
3. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.
4. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices.
5. Social issues both rural and urban environment and the possible means to combat the challenges.
6. The environmental legislations of India and the first global initiatives towards sustainable development.
7. About environmental assessment and the stages involved in EIA and the environmental audit.
Syllabus:

UNIT - I

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT - II
Natural Resources: Natural resources and associated problems
Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III

UNIT - IV
Environmental Pollution: Definition, Cause, effects and control measures

**Solid Waste Management:** Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

UNIT - V


UNIT - VI

**Environmental Management:** Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS; Environmental audit. Ecotourism

The student should submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

**Text Books:**

**Reference:**

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II Year – II SEMESTER

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SWITCHING THEORY AND LOGIC DESIGN

UNIT – I

REVIEW OF NUMBER OF SYSTEMS & CODES:

i) Representation of numbers of different radix, conversation from one radix to another radix, r-1’s compliments and r’s compliments of signed members, problem solving.

ii) 4 bit codes, BCD, Excess-3, 2421, 84-2-1 9’s compliment code etc.,

iii) Logic operations and error detection & correction codes; Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR - Gates, Standard SOP and POS, Forms, Gray code, error detection, error correction codes (parity checking, even parity, odd parity, Hamming code) NAND-NAND and NOR-NOR realizations.

UNIT – II

MINIMIZATION TECHNIQUES:

Boolean theorems, principle of complementation & duality, De-morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 6 variables, tabular minimization, problem solving (code-converters using K-Map etc.).

UNIT – III

COMBINATIONAL LOGIC CIRCUITS DESIGN:

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-a-head adder circuit, Design of decoder, demultiplexer, 7 segment decoder, higher order demultiplexing, encoder, multiplexer, higher order multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, 4-bit digital comparator.

UNIT – IV

INTRODUCTION OF PLD’s:

PROM, PAL, PLA-Basics structures, realization of Boolean function with PLDs, programming tables of PLDs, merits & demerits of PROM, PAL, PLA comparison, realization of Boolean functions using PROM, PAL, PLA, programming tables of PROM, PAL, PLA.
UNIT – V

SEQUENTIAL CIRCUITS I:
Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (nand RS latch, nor RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion from one flip-flop to flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT – VI

SEQUENTIAL CIRCUITS II:
Finite state machine; Analysis of clocked sequential circuits, state diagrams, state tables, reduction of state tables and state assignment, design procedures. Realization of circuits using various flip-flops. Meelay to Moore conversion and vice-versa.

TEXT BOOKS:
2. Switching Theory and Logic Design by A. Anand Kumar.
3. Digital Design by Mano PHI.

REFERENCE BOOKS:
1. Modern Digital Electronics by RP Jain, TMH.
UNIT-I

**Linear Wave Shaping:** High pass, low pass RC circuits-response to sinusoidal, step, pulse, square and ramp inputs. RC circuit as differentiator and integrator.

**Attenuators:** Basic attenuator circuit and compensated attenuator circuit.

**Switching characteristics of devices:** Diode as a switch, transistor as a switch-transistor at cutoff, the reverse collector saturation current $I_{CBO}$, Its variation with the junction temperature. The transistor switch in saturation. Design of transistor switch.

UNIT-II

**Non linear wave shaping:** Diode clippers, Transistor clipper, clippers at two independent levels-transfer characteristics of clippers-emitter coupled clipper, clamping operation, diode clamping circuits with source resistance and diode resistance - transient and steady state response for a square wave input, clamping circuit theorem-practical clamping circuit.

UNIT-III

**Multi vibrators:**

**Bistable multi vibrators:**


**Monostable multi vibrator:**

Basic circuit-collector coupled monostable multivibrator- emitter coupled monostable multivibrator-triggering of monostable multivibrator.

**Astable multi vibrator:**

The Astable collector coupled multivibrator, the Astable emitter coupled multivibrator.

UNIT-IV

**Digital logic circuits:** Introduction, positive and negative logic, Diode OR gate, Diode AND gate, An inverter circuit with transistor, DTL, TTL, ECL,
AOI logic, NMOS logic, PMOS logic, CMOS logic-analysis and problem solving.

NIT-V

Time base generators:
Voltage time base generators: Introduction, definitions of sweep speed error, displacement error, transmission error, various methods of generating time-base waveforms, UJT time base generator, transistor constant current sweep.

Miller time base generators: General considerations, The miller sweep-general considerations of bootstrap time base generator-basic principles, transistor bootstrap time base generator.

UNIT-VI

Synchronization and frequency division:
Pulse synchronization of relaxation devices, frequency division of the sweep circuit-synchronization of Astable multi, Monostable multivibrator, synchronization of sweep circuit with symmetrical signals-sine wave frequency division with a sweep circuit.

Sampling Gates: Basic operating principle, Unidirectional diode gate circuits, bi-directional gates using transistors. A bidirectional diode gate, Four- diode gate.

Text books:

References:
4. Pulse and digital circuitsby Anandkumar, PHI.
Preamble:
Electrical Power plays significant role in day to day life of entire mankind. The aim of this course is to allow the students to understand the concepts of the generation and distribution of power along with economic aspects.

Learning objectives:

i. To study the principle of operation and function of different components of a thermal power station.

ii. To study the principle of operation and function of different components of a Nuclear power station.

iii. To study the concepts of DC and AC distribution systems along with voltage drop calculations.

iv. To study the constructional details, principle of operation and function of different components of an Air and Gas Insulated substations.

v. To study the constructional details and classification of cables with necessary numerical calculations.

vi. To study the concepts of different types of load curves and types of tariffs applicable to consumers.

UNIT-I Thermal Power Stations
Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: Boilers, Super heaters, Economizers, electrostatic precipitators steam Turbines : Impulse and reaction turbines, Condensers, feed water circuit, Cooling towers and Chimney.

UNIT-II Nuclear Power Stations
Location of nuclear power plant, Working principle, Nuclear fission, Nuclear fuels, Nuclear chain reaction, nuclear reactor Components : Moderators, Control rods, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR. Radiation: Radiation hazards and Shielding, nuclear waste disposal.
UNIT-III Distribution Systems
Classification of distribution systems, design features of distribution systems, radial distribution, ring main distribution, voltage drop calculations: DC distributors for following cases - radial DC distributor fed at one end and at both ends (equal / unequal voltages), ring main distributor, stepped distributor and AC distribution, comparison of DC and AC distribution.

UNIT-IV Substations
Classification of substations: Air Insulated Substations - Indoor & Outdoor substations, Substations layouts of 33/11 kV showing the location of all the substation equipment.
Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.
Gas Insulated Substations (GIS) – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, constructional aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-V Underground Cables
Types of Cables, Construction, Types of insulating materials, Calculation of insulation resistance, stress in insulation and power factor of cable, Numerical Problems.

UNIT-VI Economic Aspects of Power Generation & Tariff
Economic Aspects - Load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor and plant use factor, Base and peak load plants, Numerical problems.

Learning Outcomes:
  i. Students are able to identify the different components of thermal power plants.
ii. Students are able to identify the different components of nuclear Power plants.

iii. Students are able to distinguish between AC & DC distribution systems and also estimate voltage drops in both types of distribution systems.

iv. Students are able to locate the different components of an air and gas insulated substations.

v. Students are able to identify single core and multi core cables with different insulating materials.

vi. Students are able to analyse the effect of load factor, demand factor and diversity factor on the cost of generation of electrical power and also able to identify the types of tariff applicable to consumers based on their load demand.

TEXT BOOKS:


REFERENCE BOOKS:


2. Elements of Electrical Power Station Design by – M V Deshpande, PHI, New Delhi.
II Year – II SEMESTER

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ELECTRICAL MACHINES – II

Preamble:
This course covers the topics on single-phase transformers, three-phase transformers and 3-phase induction motor which have wide application in power systems. The main aim of the course is to provide detail concepts, operation and performance of transformers and 3-phase induction motors. A complete design procedure for the design of transformers and 3-phase induction motors can be developed based on basic concepts discussed in unit-VI.

Learning objectives:

i. Appreciate the concept of operation and performance of single-phase transformers.

ii. Understand the methods of testing of single-phase transformer.

iii. Distinguish between single-phase and three-phase transformers.

iv. Understand the concept of operation and performance of 3-phase induction motor.

v. Appreciate the relation between torque and slip, performance of induction motor and induction generator.

vi. Understand the basic concepts of design of transformers and 3-phase induction motors.

UNIT-I

Single-phase Transformers
Types and constructional details - principle of operation - emf equation - operation on no load and on load – lagging, leading and unity power factors loads - phasor diagrams of transformers – equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – All day efficiency.

UNIT-II

Single-phase Transformers Testing
Tests on single phase transformers – open circuit and short circuit tests – Sumpner’s test – separation of losses – parallel operation with equal voltage
ratios – auto transformer - equivalent circuit – comparison with two winding transformers.

UNIT-III
3-Phase Transformers
Polyphase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ -- Third harmonics in phase voltages - three winding transformers: determination of Zp, Zs and Zt -- transients in switching - off load and on load tap changers -- Scott connection.

UNIT-IV
3-phase Induction Motors
construction details of cage and wound rotor machines - production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor current and pf at standstill and during running conditions - rotor power input, rotor copper loss and mechanical power developed and their inter relationship – equivalent circuit – phasor diagram.

UNIT-V
Characteristics, starting and testing methods of Induction Motors
Torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors - crawling and cogging - no load and blocked rotor tests - circle diagram for predetermination of performance - methods of starting – starting current and torque calculations – induction generator operation.

UNIT-VI
Design of transformer and 3-phase induction motor
Transformer: Design concept – output equation – choice of windings – calculation of number of turns – length of mean turn of winding - calculation of resistance and leakage reactance.

Learning outcomes:

i. Able to explain the operation and performance of single phase transformer.

ii. Able to explain the regulation losses and efficiency of single phase transformer.
iii. Able to explain types of three phase transformer connection, tap changing methods and 3-phase to 2-phase transformation.

iv. Able to explain the operation and performance of three phase induction motor.

v. Able to analyze the torque-speed relation, performance of induction motor and induction generator.

vi. Able to explain design procedure for transformers and three phase induction motors.

TEXT BOOKS:

REFERENCE BOOKS:
II Year – II SEMESTER

CONTROL SYSTEMS

Preamble:
This course introduces the elements of linear control systems and their analysis. Classical methods of design using frequency response are included. The state space approach for modeling and analysis is the added feature of this course.

UNIT – I:
Learning Objective:
To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function.

MATHEMATICAL MODELING OF CONTROL SYSTEMS
Open Loop and closed loop control systems and their differences, Classification of control systems, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram algebra – Representation by Signal flow graph - Reduction using Mason’s gain formula.

Outcome:
Ability to derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.

UNIT-II:
Learning Objective:
To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers.

TIME RESPONSE ANALYSIS
Outcome:
Capability to determine time response specifications of second order systems and to determine error constants.

UNIT – III:
Learning Objective :
To investigate the stability of closed loop systems using Routh’s stability criterion and the analysis by root locus method.

STABILITY AND ROOTLOCUS TECHNIQUE

Outcome:
Acquires the skill to analyze absolute and relative stability of LTI systems using Routh’s stability criterion and the root locus method.

UNIT–IV:
Learning Objective :
To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.

FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion.

Outcome:
Capable to analyze the stability of LTI systems using frequency response methods.

UNIT–V:
Learning Objective :
To discuss basic aspects of design and compensation of linear control systems using Bode plots.

CLASSICAL CONTROL DESIGN TECHNIQUES
Lag, Lead, Lag-Lead compensators, design of compensators – using Bode plots.

Outcome:
Able to design Lag, Lead, Lag-Lead compensators to improve system performance from Bode diagrams.
UNIT–VI:
Learning Objective:
Ability to formulate state models and analyze the systems. To present the concepts of Controllability and Observability.

STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it’s Properties – Concepts of Controllability and Observability.

Outcome:
Ability to represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.

TEXT BOOKS:
1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition

REFERENCE BOOKS:
II Year – II SEMESTER

ELECTRICAL MACHINES – I LAB

Any 10 of the following experiments are to be conducted:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson’s test on DC shunt machines. Predetermination of efficiency.
7. Swinburne’s test and Predetermination of efficiencies as Generator and Motor.
8. Speed control of DC shunt motor by Field and armature Control.
10. Load test on DC series generator. Determination of characteristics.
II Year – II SEMESTER

ELECTRONIC DEVICES & CIRCUITS LAB

PART A: Electronic Workshop Practice
1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART B: List of Experiments
(For Laboratory Examination-Minimum of Ten Experiments)
1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias & Reverse bias)
   Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

PART C: Equipment required for Laboratory

1. Boxes
2. Ammeters (Analog or Digital)
3. Voltmeters (Analog or Digital)
4. Active & Passive Electronic Components
5. Regulated Power supplies
6. Analog/Digital Storage Oscilloscopes
7. Analog/Digital Function Generators
8. Digital Multimeters
9. Decade Résistance Boxes/Rheostats
10. Decade Capacitance
III Year – I SEMESTER

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Unit – I:
(*The Learning objective of this Unit is to understand the concept and nature of Managerial Economics and its relationship with other disciplines, Concept of Demand and Demand forecasting)
Introduction to Managerial Economics and demand Analysis:
(**The Learner is equipped with the knowledge of estimating the Demand for a product and the relationship between Price and Demand)

Unit – II:
(*The Learning objective of this Unit is to understand the concept of Production function, Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis)
Production and Cost Analyses:
(**One should understand the Cost Concepts for decision making and to estimate the least cost combination of inputs).

Unit – III:
(*The Learning Objective of this Unit is t understand the Nature of Competition, Characteristics of Pricing in the different market structure and significance of various pricing methods)
Introduction to Markets, Theories of the Firm & Pricing Policies:
(** One has to understand the nature of different markets and Price Output determination under various market conditions)

Unit – IV:
(*The Learning objective of this Unit is to know the different forms of Business organization and their Merits and Demerits both public & private Enterprises and the concepts of Business Cycles)

Types of Business Organization and Business Cycles:
(**One should equipped with the knowledge of different Business Units)

Unit – V:
(*The Learning objective of this Unit is to understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation)

Introduction to Accounting & Financing Analysis:
Introduction to Double Entry Systems – Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow cash flow statements (Simple Problems)
(**The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis)

Unit – VI:
(*The Learning objective of this Unit is to understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods)

(**The Learner is able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making)

Note: *Learning Objective
** Learning Assessment

TEXT BOOKS


REFERENCES:

1. V. Maheswari : Managerial Economics, Sultan Chand.


Preamble:
This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

Learning Objectives:
- To study the principle of operation and working of different types of instruments. Measurement of voltage and current.
- To study the working principle of operation of different types of instruments for measurement of power and energy.
- To understand the principle of operation and working of dc and ac potentiometers.
- To understand the principle of operation and working of various types of bridges for measurement of parameters – resistance, inductance, capacitance and frequency.
- To study the principle of operation and working of various types of magnetic measuring instruments.
- To study the applications of CRO for measurement of frequency, phase difference and hysteresis loop using Lissajous patterns.

UNIT–I:
Measuring Instruments
UNIT –II:
Measurement of Power and Energy

UNIT – III:
Potentiometers

UNIT – IV:
Measurements of Parameters

UNIT – V:
Magnetic Measurements

UNIT – VI:
Digital Meters

**Learning Outcomes:**

- Able to choose right type of instrument for measurement of voltage and current for ac and dc.
- Able to choose right type of instrument for measurement of power and energy – able to calibrate energy meter by suitable method.
- Able to calibrate ammeter and potentiometer.
- Able to select suitable bridge for measurement of electrical parameters.
- Able to use the ballistic galvanometer and flux meter for magnetic measuring instruments.
- Able to measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.

**Text Books:**

3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput, S.Chand

**Reference Books:**

2. Electrical Measurements – by Buckingham and Price, Prentice – Hall
3. Electrical Measurements by Forest K. Harris. John Wiley and Sons
Preamble:
This course is an extension of power systems–I course. It deals with basic theory of transmission lines modeling and their performance analysis. Transient in power system, improvement of power factor and voltage control are discussed in detail. It is important for the student to understand the mechanical design aspects of transmission lines, cables, insulators. These aspects are also covered in detail in this course.

Learning Objectives:
• To compute inductance and capacitance of transmission lines and to understand the concepts of GMD, GMR.
• To study short and medium length transmission lines, their models and performance computation.
• To study the performance and modeling of long transmission lines.
• To study the transient on transmission lines.
• To study the factors affecting the performance of transmission lines and power factor improvement methods.
• To discuss sag and tension computation of transmission lines as well as to study the overhead insulators.

UNIT-I:
Transmission Line Parameters

UNIT–II:
Performance of Short and Medium Length Transmission Lines
Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T–Nominal-Pie and A, B, C, D Constants
for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

**UNIT–III:**

**Performance of Long Transmission Lines**


**UNIT – IV:**

**Power System Transients**


**UNIT–V:**

**Various Factors Governing the Performance of Transmission line**


**UNIT–VI:**

**Sag and Tension Calculations and Overhead Line Insulators**


**Learning Outcomes:**

- Able to understand parameters of various types of transmission lines for using calculation and behavior during different operating conditions.
• Able to understand the insight into specific transmission lines short and medium type which would have application in medium and high voltage power transmission systems.

• Student will be able to understand the surge propagation, reflection and refraction in transmission lines. such output will be useful in protecting transmission line insulators and designing level of insulation coordination at various high voltages.

• Will be able to utilize it for understanding the surge behaviour of transmission line for protection of connects equipments, viz. power transformer and system connected shunt reactors.

• Will be able to understand various phenomenon related to charged line transmitting different level of power.

• Will be able to understand physical and geometrical parameters of transmission line for safe and efficient performance during operating condition of voltage and power.

**Text Books:**

**Reference Books:**
Preamble:
This course essentially covers ac machines. It covers topics related to principle of operation, constructional features and starting of single phase induction motors and three phase synchronous motors. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Learning Objectives:
- To study the application of “Double revolving field” theory for single – phase induction motor and appreciate the function and application of a.c series motor.
- To discuss e.m.f generation principle of synchronous generator and armature reaction effect.
- To study the effect of load at different power factors, methods of predetermination of regulation for non– salient and salient pole generators.
- To study the parallel operation and the concepts of transfer of real and reactive powers.
- To understand the operation and performance of synchronous motor.
- To study the power circle diagrams and methods of starting of synchronous motor.

UNIT – I:
Single Phase Motors

UNIT–II:
Synchronous generator construction and operation
UNIT – III:
**Voltage regulation of synchronous generator**

UNIT – IV:
**Parallel operation of synchronous generators**
Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing – Transfer of real and reactive power– Numerical problems.

UNIT – V:
**Synchronous motor – operation**
Synchronous Motor principle and theory of operation– Phasor diagram – Starting torque– Variation of current and power factor with excitation – Synchronous condenser – Mathematical analysis for power developed– Numerical problems.

UNIT – VI:
**Synchronous motor performance and starting**
Excitation and power circles – Hunting and its suppression – Methods of starting – Synchronous induction motor.

**Learning outcomes:**
At the end of the course the student should be able to
- Analyze the performance of single phase induction and ac series motors.
- Explain the structure of synchronous machines and design the windings.
- Develop solutions for regulation of both non salient pole and salient pole synchronous generators.
- Explain the role of synchronous generators operation when connected to an infinite bus or when operating in parallel.
- Analyze the performance of synchronous motor for development of torque and power factor correction.
- Explain hunting phenomenon and methods of starting of synchronous motor.
Text Books:

Reference Books:
Preamble:
The usage of power electronics in day to day life has increased in recent years. It is important for student to understand the fundamental principles behind all these converters. This course covers characteristics of semiconductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters. The importance of using pulse width modulated techniques to obtain high quality power supply (dc/ac converter) is also discussed in detail in this course.

Learning Objectives:
- To study the characteristics of various power semiconductor derive and analyze the operation of diode bridge rectifier.
- To design firing circuits for SCR. Analyze the operation of AC voltage controller and half–wave phase controlled rectifiers.
- To understand the operation of single phase full–wave converters and analyze harmonics in the input current.
- To study the operation of three phase full–wave converters and dual converter.
- To analyze the operation of single phase cyclo converters and high frequency dc–dc converters.
- To understand the working of inverters and application of PWM techniques for voltage control and harmonic mitigation.

UNIT–I:
Power Semi Conductor Devices
UNIT–II:
Phase Controlled Converters – Single Phase

UNIT–III:
Single Phase Bridge Converter and Harmonic Analysis Fully controlled converters
Semi Converters (Half Controlled):
Operation with R, RL and RLE loads – Harmonic analysis for input current waveform in a system with a large load inductance –Calculation of input power factor.

UNIT–IV:
Three Phase AC–DC Bridge Converters

UNIT – V:
AC–AC and DC–DC Converters

UNIT – VI:
DC–AC Inverters
Inverters
Learning Outcomes:

Student should be able to

- Explain the characteristics of various power semiconductor devices and analyze the operation of a diode bridge rectifier.
- Design firing circuits for SCR. Analyze the operation of AC voltage controller and half-wave phase controlled rectifiers.
- Explain the operation of single phase full-wave converters and analyze harmonics in the input current.
- Explain the operation of three phase full-wave converters and dual converter.
- Analyze the operation of single phase cyclo converters and high frequency dc–dc converters.
- Explain the working of inverters and application of PWM techniques for voltage control and harmonic mitigation.

Text Books:

2. Power Electronics: converters, applications & design -by Nedmohan, Tore M. Undeland, Robbins by Wiley India Pvt. Ltd.

Reference Books:

LINEAR & Digital IC APPLICATIONS

Preamble:
All Electronic devices developed in circuit Concepts. Thus all analog circuits developed on circuit Concept basis. But the advancement of Technology in Fabrication Field gain prominence and all discrete components are fabricated using I.C Technology. On a Single chip millions of transistors are fabricated using Very Large Scale IC. In This context Operational Amplifiers which is an analog device plays an important role for Analog IC Design.

Operational Amplifiers performs Algebraic operations, Logarithmic Operations, Trigonometric Operations etc. Therefore these Operational Amplifiers design goes into System design instead of circuit design. So Linear IC applications plays vital role in the electronic field Starting from home appliances to Super computers.

Learning Objectives:
After completion of this course, the reader should be able to

• Draw a block diagram representing a typical op-amp with various definitions.
• Draw and explain the open-loop configuration and feedback configuration and can determine Voltage gain, the input resistance, the output resistance.
• Differentiate between Ideal and Non-Ideal Op-Amp, Determination of closed loop voltage gain, the input resistance, the output resistance for Non-Ideal Op-Amp Circuits.
• Perform various mathematical Operations, Trigonometric & Logarithmic Operations, and Instrumentation Amplifier with relevant Circuits.
• Design waveform generators (Astable, Monostable, Schmitt Trigger) using Single Op-Amp.
• Study of 555 timer & its applications using Astable and Monostable Operations.
• Can design various types of Active Filters such as LPF, HPF, BPF, BRF, NBPF, Notch Filter, ALL pass filters.
• Study the operation & applications of PLA.
• Explain the operation of A/D and D/A Converters.
UNIT–I:
Introduction To Operational Amplifier

UNIT–II:
OP–AMP Parameter

UNIT–III
Ideal Operational Amplifier Theory and Basic Circuits

UNIT–IV:
multiplier role of each pin frequency translation– AM–FM and FSK demodulators.

UNIT–V:

Active filters

UNIT–VI:

D to A and A to D Convertors

Analog to Digital Convertors
Introduction–Specifications–Parallel comparator type–Counter type–Dual slope–Successive approximation type ADCs– Merits and demerits of each type, Comparison of different types.

Learning Outcomes:

- After completion of this course student can able to differentiate “Analog Circuits & Digital Circuits”.
- The course content gives an insight in to the fundamentals so that one can design the “Linear Circuits” with their own innovative skills.
- Those who are taken this course can specialize in this subject in their Post Graduation. It is a challenging task for the individual to exhibit his logical skills & Analytical ability.
- They can design their own circuits which may be useful for current industry needs.

Text Books:

1. OP–AMPS and liner integrator circuits by Ramakanth A Gayakwad (PHI).
2. Linear Integrated Circuits by D.Roy chowdary, New age international.

**Reference Books:**

2. Analog Electronics– L.K.Maheswari, PHI.
3. Linear Integrated circuits by S.Salivahan, TMH.
III Year – I SEMESTER

ELECTRICAL MACHINES – II LAB

Learning objectives:
- To predetermine the efficiency and regulation of transformers and assess their performance.
- To predetermine the regulation of three-phase alternator by various methods, find $X_d / X_q$ ratio of alternator and assess the performance of three-phase synchronous motor.
- To perform various tests on Induction motor for assessing its performance.

The following experiments are required to be conducted as compulsory experiments:
1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner’s test on single phase transformers
3. Scott connection of transformers
4. No-load & Blocked rotor tests on three phase Induction motor
5. Regulation of a three-phase alternator by synchronous impedance & M.M.F. Methods.
7. Equivalent Circuit of a single phase induction motor
8. Determination of $X_d$ and $X_q$ of a salient pole synchronous machine

In addition to the above eight experiments, at least any two of the following experiments are required to be conducted from the following list:
1. Parallel operation of Single phase Transformers
2. Separation of core losses of a single phase transformer
3. Brake test on three phase Induction Motor
4. Regulation of three-phase alternator by Potier triangle method.
5. Efficiency of a three-phase alternator
6. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers.


**Learning outcomes:**

- Able to predetermine the efficiency and regulation of transformers and assess their performance.
- Able to predetermine the regulation of three–phase alternator by various methods, find $X_d / X_q$ ratio of alternator and assess the performance of three–phase synchronous motor.
- Able to perform various tests on Induction motor for assessing its performance.
III Year – I SEMESTER

CONTROL SYSTEMS LAB

Learning Objectives:

• To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors, stepper motor and potentiometer.
• To understand time and frequency responses of control system with and without controllers and compensators.

Any 10 of the following experiments are to be conducted:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – characteristics of stepper motor
4. Effect of feedback on DC servo motor
5. Effect of P, PD, PI, PID Controller on a second order systems
6. Lag and lead compensation – Magnitude and phase plot
7. DC position control system
8. Transfer function of DC motor
9. Temperature controller using PID
10. Characteristics of magnetic amplifiers
11. Characteristics of AC servo motor
12. Characteristics of DC servo motor
13. Potentiometer as an error detector

Learning Outcomes

• Able to analyze the performance and working Magnetic amplifier, D.C. servo motors, A.C. Servo motors and synchronous motors.
• Able to design P,PI,PD and PID controllers
• Able to design lag, lead and lag–lead compensators
• Able to control the temperature using PID controller
• Able to determine the transfer function of D.C.motor
• Able to control the position of D.C servo motor performance
III Year – I SEMESTER

T       P       C
3+1     0       2

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

UNIT VI

REFERENCE BOOKS:
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
Preamble:
In order to supply power from generating end to receiving end several equipments are connected in to the system. In order to protect the equipments and components against various operating conditions and over voltages protective devices are required to be installed in the system. Topics specified in this subject deal with various types of protective equipments and their working principle including limitations etc.

Learning objectives:
- To provide the basic principles of arc interruption, circuit breaking principles, operation of various types of circuit breakers.
- To study the classification, operation, construction and application of different types of electromagnetic protective relays.
- To explain various types of faults in generators and transformers and different types of protective schemes.
- To impart knowledge of various protective schemes used for feeders and bus bars.
- To explain the principles and operations of different types of static relays.
- To study different types of over voltages in a power system and principles of different protective schemes for insulation co-ordination.

UNIT-I:
Circuit Breakers
UNIT–II:
**Electromagnetic Protection**

UNIT–III:
**Generator Protection**
Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

**Transformer Protection**

UNIT–IV:
**Feeder and Bus bar Protection**

UNIT–V:
**Static and Digital Relays**
Static relays: Static relay components– Static over current relay– Static distance relay– Micro processor based digital relays.

UNIT–VI:
**Protection against over voltage and grounding**
Learning Outcomes:

- To be able to understand the principles of arc interruption for application to high voltage circuit breakers of air, oil, vacuum, SF$_6$ gas type.
- Ability to understand the working principle and constructional features of different types of electromagnetic protective relays.
- Students acquire in depth knowledge of faults that is observed to occur in high power generator and transformers and protective schemes used for all protections.
- Improves the ability to understand various types of protective schemes used for feeders and bus bar protection.
- Generates understanding of different types of static relays with a view to application in the system.
- To be able to understand the different types of over voltages appearing in the system, including existing protective schemes required for insulation co–ordination.

Text Books:

2. Power system protection- Static Relays with microprocessor applications, by T.S. Madhava Rao, TMH
3. Electrical Power System Protection by C. CHRISTOPOULOS and A. Wright, Springer publications

Reference Books:

Preamble:
Microprocessor and microcontroller have become important building blocks in digital electronics design. It is important for student to understand the architecture of a microprocessor and its interfacing with various modules. 8086 microprocessor architecture, programming, and interfacing is dealt in detail in this course. Interfacing, assembly language programming and interfacing of 8051 microcontroller and its application in industry are also covered in this course.

Learning objectives:
- To understand the organization and architecture of Micro Processor
- To understand addressing modes to access memory
- To understand 8051 micro controller architecture
- To understand the programming principles for 8086 and 8051
- To understand the interfacing of MP with IO as well as other devices.
- To understand how to develop cyber physical systems

UNIT–I:
Introduction to Microprocessor Architecture

UNIT–II:
Minimum and Maximum Mode Operations
Instruction set, Addressing modes– Minimum and Maximum mode operations of 8086–8086 Control signal interfacing–Read and write cycle timing diagrams.
UNIT–III:
Assembly Language Programming

UNIT–IV:
I/O Interface

UNIT–V:
Introduction to 8051 Micro Controller

UNIT– VI:
Cyber physical systems and industrial applications of 8051
Applications of Micro Controllers– Interfacing 8051 to LED’s–Push button–Relay’s and Latch Connections– Keyboard Interfacing– Interfacing Seven Segment Display–ADC and DAC Interfacing.

Learning Outcomes:
- To be able to understand the microprocessor capability in general and explore the evolution of microprocessors.
- To be able to understand the addressing modes of microprocessors
- To be able to understand the micro controller capability
• To be able to program mp and mc
• To be able to interface mp and mc with other electronic devices
• To be able to develop cyber physical systems

Text Books:


Reference Books:

Preamble:
This course primarily deals with utilization of electrical energy generated from various sources. It is important to understand the technical reasons behind selection of motors for electric drives based on the characteristics of loads. Electric heating, welding and illumination are some important loads in the industry in addition to motor/drives. Another major share of loads is taken by Electric Traction. Utilization of electrical energy in all the above loads is discussed in detail in this course. Demand side management concepts are also introduced as a part of this course.

Learning objectives:
- To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
- To acquaint with the different types of heating and welding techniques.
- To study the basic principles of illumination and its measurement.
- To understand different types of lightning system including design.
- To understand the basic principle of electric traction including speed–time curves of different traction services.
- To understand the method of calculation of various traction system for braking, acceleration and other related parameters, including demand side management of energy.

UNIT – I:
Selection of Motors
Choice of motor, type of electric drives, starting and running characteristics– Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization.

UNIT – II:
Electric Heating
Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.
Electric Welding
Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

UNIT – III:
Illumination fundamentals
Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Sources of light

UNIT – IV:
Various Illumination Methods
Discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting.

UNIT – V:
Electric Traction – I
System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor–Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves.

UNIT – VI:
Electric Traction – II
Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion–Principles of energy efficient motors.

Learning Outcomes:
• Able to identify a suitable motor for electric drives and industrial applications
• Able to identify most appropriate heating or welding techniques for suitable applications.
• Able to understand various level of illuminosity produced by different illuminating sources.
• Able to estimate the illumination levels produced by various sources and recommend the most efficient illuminating sources and should be able to design different lighting systems by taking inputs and constraints in view.
• Able to determine the speed/time characteristics of different types of traction motors.
• Able to estimate energy consumption levels at various modes of operation.

Text Books:

Reference Books:
Preamble:
The course is designed to give students the required knowledge for the design and analysis of electrical power grids. Calculation of power flow in a power system network using various techniques, formation of $Z_{bus}$ and its importance are covered in this course. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

Learning Objectives:
- To study the development of impedance diagram (p.u) and formation of $Y_{bus}$
- To study the Gauss Seidel, Newton raphson, decoupled and fast decoupled load flow methods.
- To study the concept of the $Z_{bus}$ building algorithm.
- To study short circuit calculation for symmetrical faults.
- To study the effect of unsymmetrical faults.
- To study the rotor angle stability analysis of power systems.

UNIT I:
Per Unit Representation & Topology
Per Unit Quantities–Single line diagram– Impedance diagram of a power system – Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods.

UNIT II:
Power Flow Studies
UNIT –III:
Z–Bus formulation
Formation of Z–Bus: Partial network– Algorithm for the Modification of \( Z_{\text{bus}} \) Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).– Modification of Z–Bus for the changes in network (Problems).

UNIT – IV:
Symmetrical Fault Analysis
3–Phase short circuit currents and reactances of synchronous machine–Short circuit MVA calculations.

UNIT –V:
Symmetrical Components & Fault analysis

UNIT – VI:
Power System Stability Analysis

- Able to draw an impedance diagram for a power system network.
- Able to form a \( Y_{\text{bus}} \) matrix for a power system network with or without mutual couplings.
- Able to find out the load flow solution of a power system network using different types of load flow methods.
- Able to formulate the \( Z_{\text{bus}} \) for a power system network.
- Able to find out the fault currents for all types faults with a view to provide data for the design of protective devices.
• Able to find out the sequence components of currents for any unbalanced power system network.
• Able to analyze the steady state, transient and dynamic stability concepts of a power system.

Text Books:

Reference Books:
Preamble:
This course is an extension of power electronics applications to electric drives. This course covers in detail the basic and advanced speed control techniques using power electronic converters that are used in industry. It is equally important to understand the four quadrant operation of electric drives and slip power recovery schemes in induction motors.

Learning Objectives:
- To learn the fundamentals of electric drive and different electric braking methods.
- To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
- To discuss the converter control of dc motors in various quadrants.
- To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
- To learn the principles of static rotor resistance control and various slip power recovery schemes.
- To understand the speed control mechanism of synchronous motors

UNIT–I:
Fundamentals of Electric Drives

UNIT–II:
Three phase converter controlled DC motors
Revision of speed control techniques – Separately excited and series motors controlled by full converters – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics – Numerical problems – Four quadrant operation using dual converters.
UNIT–III:
Control of DC motors by DC–DC converters (Type C & Type D)
Single quadrant – Two quadrant and four quadrant chopper fed separately excited and series excited motors – Continuous current operation– Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics –Four quadrant operations – Closed loop operation (Block diagrams only).

UNIT–IV:
Induction motor control – Stator side
Variable voltage characteristics–Control of Induction Motor by AC Voltage Controllers – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by voltage source inverter – PWM control – Closed loop operation of induction motor drives (Block Diagram Only).

UNIT–V:
Control of Induction motor – Rotor side

UNIT–VI:
Control of Synchronous Motors
Separate control &self control of synchronous motors – Operation of self controlled synchronous motors by VSI– Closed Loop control operation of synchronous motor drives (Block Diagram Only) –Variable frequency control–Pulse width modulation.

Learning Outcomes:
Student should be able to
- Explain the fundamentals of electric drive and different electric braking methods.
- Analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
- Explain the converter control of dc motors in various quadrants.
- Explain the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
- Explain the principles of static rotor resistance control and various slip power recovery schemes.
• Explain the speed control mechanism of synchronous motors

Text Books:

Reference Books:
1. Electric Motors and Drives Fundamentals, Types and Applications, by Austin Hughes and Bill Drury, Newnes.
3. Power Electronic Circuits, Devices and applications by M.H. Rashid, PHI.
UNIT I

UNIT II
Operations Management: Principles and Types of Management – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart).
Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

UNIT III

UNIT IV
Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).

UNIT V

UNIT VI
Contemporary Management Practice: Basic concepts of MIS, MRP, Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levies, Supply Chain Management,
Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.

**Text Books**

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, ‘*Management Science*’ Cengage, Delhi, 2012.

**References**


**Objective:**
To familiarize with the process of management and to provide basic insights into select contemporary management practices.

**Codes/Tables:**
Normal Distribution Function Tables need to be permitted into the examination Halls.
Learning objectives:

- To study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- To analyze the performance of single–phase and three–phase full–wave bridge converters, single–phase dual converter with both resistive and inductive loads.
- To understand the operation of AC voltage controller and cyclo converter with resistive and inductive loads.
- To understand the working of Buck converter, Boost converter, single–phase bridge inverter and PWM inverter.

Any 10 of the Following Experiments are to be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR’s
3. Single -Phase Half controlled converter with R and RL load
4. Single -Phase fully controlled bridge converter with R and RL loads
5. Single -Phase AC Voltage Controller with R and RL Loads
6. Single -Phase Cyclo–converter with R and RL loads
7. Single -Phase Bridge Inverter with R and RL Loads
8. Single -Phase dual converter with RL loads
9. Three -Phase half controlled bridge converter with RL load.
10. Three- Phase full converter with RL–load.
11. DC–DC buck converter.
12. DC–DC boost converter.
15. Forced commutation circuits(Class A, Class B, Class C, Class D and Class E)
Learning outcomes:

- Able to study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- Able to analyze the performance of single–phase and three–phase full–wave bridge converters, single–phase dual converter with both resistive and inductive loads.
- Able to understand the operation of AC voltage controller and cyclo converter with resistive and inductive loads.
- Able to understand the working of Buck converter, Boost converter, single–phase bridge inverter and PWM inverter.
Learning Objectives:

- To understand the correct function of electrical parameters and calibration of voltage, current, single phase and three phase power and energy, and measurement of electrical characteristics of resistance, inductance and capacitance of a circuits through appropriate methods.
- To understand measurement of illumination of electrical lamps.
- To understand testing of transformer oil.
- To measure the parameters of choke coil.

Any 10 of the following experiments are to be conducted

2. Calibration of dynamometer wattmeter using phantom loading UPF
8. Measurement of complex power with Trivector meter and verification.
11. Measurement of 3 phase power with single watt meter and 2 No’s of C.T.
13. P.T. testing by comparison – V.G. as Null detector – Measurement of % ratio error and phase angle of the given P.T.
14. Dielectric oil testing using H.T. testing Kit
15. LVDT and capacitance pickup – characteristics and Calibration
16. Resistance strain gauge – strain measurements and Calibration
17. Polar curve using Lux meter, Measurement of intensity of illumination of fluorescent lamp.
18. Transformer turns ratio measurement using AC. bridge.
21. Parameters of choke coil.

Learning Outcomes:
- To be able to measure accurately the electrical parameters voltage, current, power, energy and electrical characteristics of resistance, inductance and capacitance.
- To be able to measure illumination of electrical lamps.
- To be able to test transformer oil for its effectiveness.
- To be able to measure the parameters of inductive coil.
RENEWABLE ENERGY SOURCES AND SYSTEMS

Preamble:
This course gives a flavor of renewable sources and systems to the students. It introduces solar energy, its radiation, collection, storage and its applications. This covers generation, design, efficiency and characteristics of various renewable energy sources including solar, wind, hydro, biomass, fuel cells and geothermal systems.

Learning Objectives:
- To study the solar radiation data, extra terrestrial radiation, radiation on earth’s surface.
- To study solar thermal collections.
- To study solar photo voltaic systems.
- To study maximum power point techniques in solar pv and wind.
- To study wind energy conversion systems, Betz coefficient, tip speed ratio.
- To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

UNIT-I:
Fundamentals of Energy Systems

UNIT-II:
Solar Thermal Systems
UNIT–III:
Solar Photovoltaic Systems
Balance of systems – IV characteristics – System design: storage sizing – PV system sizing – Maximum power point techniques: Perturb and observe (P&O) technique – Hill climbing technique.

UNIT–IV:
Wind Energy

UNIT–V:
Hydro and Tidal power systems
Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

UNIT–VI:
Biomass, fuel cells and geothermal systems
Fuel cell: Classification – Efficiency – VI characteristics.

Learning Outcomes:
Student should be able to
- Analyze solar radiation data, extraterrestrial radiation, radiation on earth’s surface.
- Design solar thermal collections.
- Design solar photo voltaic systems.
- Develop maximum power point techniques in solar PV and wind.
- Explain wind energy conversion systems, Betz coefficient, tip speed ratio.
- Explain basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.
Text Books:

Reference Books:
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
4. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.
HVAC & DC TRANSMISSION

Preamble:
With the increasing power generation in the country and long distance power transmission, it is necessary that power should be transmitted at extra and ultra high voltage. The topics dealt in this subject relate to phenomena associated with transmission line at higher voltages, equipments generating high voltage and power control strategy.

Learning Objectives:
- To understand the phenomena associated with transmission line, operating at extra high voltages. The unit gives detail analysis of several phenomena viz. electrostatic field, charges, voltage gradient and conductor configuration.
- The objective is to discuss phenomena of corona, losses, audible noise, radio interference and measurement of these quantities.
- To understand the phenomena of HVDC, HVDC equipment comparison with AC and the latest state of art in HVDC transmission.
- To understand method of conversion of AC to DC, performance of various level of pulse conversion and control characteristics of conversion. It also provides knowledge of effect of source inductance as well as method of power control.
- To understand the requirements of reactive power control and filtering technique in HVDC system.
- To understand the harmonics in AC side of power line in a HVDC system and design of filters for various levels of pulse conversion.

UNIT – I:
Introduction of EHV AC transmission
Necessity of EHV AC transmission – Advantages and problems – Power handling capacity and line losses – Mechanical considerations – Resistance of conductors – Electrostatics – Field of sphere gap – Field of line charges and properties – Charge ~ potential relations for multi–conductors – Surface voltage gradient on conductors – Bundle spacing and bundle radius –
Examples – Distribution of voltage gradient on sub conductors of bundle – Examples.

UNIT – II:
Corona effects

UNIT – III:
Basic Concepts of DC Transmission

UNIT – IV:
Analysis of HVDC Converters and System Control

UNIT – V:
Reactive Power Control in HVDC

UNIT – VI:
Harmonics and Filters
Learning Outcomes:

- To be able to acquaint with HV transmission system with regard to power handling capacity, losses, conductor resistance and electrostatic field associate with HV. Further knowledge is gained in area of bundle conductor system to improve electrical and mechanical performance.
- To develop ability for determining corona, radio interference, audible noise generation and frequency spectrum for single and three phase transmission lines.
- To be able to acquire knowledge in transmission of HVDC power with regard to terminal equipments, type of HVDC connectivity and planning of HVDC system.
- To be able to develop knowledge with regard to choice of pulse conversion, control characteristic, firing angle control and effect of source impedance.
- To develop knowledge of reactive power requirements of conventional control, filters and reactive power compensation in AC side of HVDC system.
- Able to calculate voltage and current harmonics, and design of filters for six and twelve pulse conversion.

Text Books:

3. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (P) Ltd.

Reference Books:

2. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications
Preamble:
This subject deals with Economic operation of Power Systems, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

Learning Objectives:
- To understand optimal dispatch of generation with and without losses.
- To study the optimal scheduling of hydro thermal systems.
- To study the optimal unit commitment problem.
- To study the load frequency control for single area system
- To study the PID controllers for single area system and two area system.
- To understand the reactive power control and compensation of transmission lines.

UNIT–I:
Economic Operation of Power Systems

UNIT–II:
Hydrothermal Scheduling
UNIT–III:
Unit Commitment

UNIT–IV:
Load Frequency Control

UNIT–V:
Load Frequency Controllers
Proportional plus Integral control of single area and its block diagram representation – Steady state response – Load Frequency Control and Economic dispatch control.

UNIT–VI:
Reactive Power Control

Learning Outcomes:
- Able to compute optimal scheduling of Generators.
- Able to understand hydrothermal scheduling.
- Understand the unit commitment problem.
- Able to understand importance of the frequency.
- Understand importance of PID controllers in single area and two area systems.
- Will understand reactive power control and line power compensation.
Text Books:
2. Power System stability & control, Prabha Kundur,TMH

Reference Books:
Preamble:
This is an open elective course developed to cater current needs of the industry. This course covers topics such as energy conservation act and energy conservation. It also covers energy efficient lighting design, student will learn power factor improvement techniques, energy efficiency in HVAC systems. In addition, economic aspects such as payback period calculations, life cycle costing analysis is covered in this course.

Learning Objectives:
- To understand energy efficiency, scope, conservation and technologies.
- To design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Unit–I:
Basic Principles of Energy Audit and management

Unit–II:
Lighting
Modification of existing systems – Replacement of existing systems – Priorities: Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam

Unit–III:
**Power Factor and energy instruments**

Unit–IV:
**Space Heating and Ventilation**

Unit–V
**Economic Aspects and Analysis**

Unit–VI:
**Computation of Economic Aspects**

**Learning Outcomes:**
Student will be able to
- Explain energy efficiency, conservation and various technologies.
- Design energy efficient lighting systems.
- Calculate power factor of systems and propose suitable compensation techniques.
- Explain energy conservation in HVAC systems.
- Calculate life cycle costing analysis and return on investment on energy efficient technologies.
Text Books:

Reference Books:

Note : This Elective can be offered to Students of All Branches including EEE.
INSTRUMENTATION
(Open Elective)

Preamble:
Electrical and Electronic Instrumentation plays a key role in the industry. With the advancement of technology day to day manual maintenance is replaced by simply monitoring using various instruments. Thus this course plays very important role in overall maintenance of the industry.

Learning Objectives:
- To study various types of signals and their representation.
- To study various types of transducers: Electrical, Mechanical, Electromechanical, Optical etc.
- To study and measure the various types of Non–electrical quantities.
- To study various types of digital voltmeters
- To study the working principles of various types of oscilloscopes and their applications.
- To study various types of signal analyzers.

UNIT–I:
Signals and their representation

UNIT–II:
Transducers
UNIT–III:
Measurement of Non–Electrical Quantities

UNIT–IV:
Digital Voltmeters

UNIT–V:
Oscilloscope

UNIT–VI:
Signal Analyzers

Learning Outcomes:
- Able to represent various types of signals.
- Acquire proper knowledge to use various types of Transducers.
- Able to monitor and measure various parameters such as strain, velocity, temperature, pressure etc.
- Acquire proper knowledge and working principle of various types of digital voltmeters.
- Able to measure various parameter like phase and frequency of a signal with the help of CRO.
- Acquire proper knowledge and able to handle various types of signal analyzers.
Text Books:

Reference Books:
1. Measurement and Instrumentation theory and application, Alan S.Morris and Reza Langari, Elsevier
2. Measurements Systems, Applications and Design – by D O Doeblin
3. Principles of Measurement and Instrumentation – by A.S Morris, Pearson / Prentice Hall of India
4. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India.

Note : This Elective can be offered to Students of All Branches including EEE.
NON–CONVENTIONAL SOURCES OF ENERGY
(Open Elective)

Preamble:
This course gives a flavor of non–conventional sources of energy to the students. It introduces solar energy its radiation, collection, storage and its applications. This covers generation, design, efficiency and characteristics of various non–conventional energy sources including solar, wind, hydro, biomass, fuel cells and geothermal systems.

Learning Objectives
- To study the solar radiation data, extraterrestrial radiation, radiation on earth’s surface.
- To study solar thermal collections.
- To study solar photo voltaic systems.
- To study maximum power point techniques in solar pv and wind.
- To study wind energy conversion systems, Betz coefficient, tip speed ratio.
- To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.


UNIT–II: Solar Thermal Systems

UNIT–III: Solar Photovoltaic Systems
Balance of systems – IV characteristics – System design: Storage sizing, PV system sizing, Maximum power point techniques: Perturb and observe (P&O) technique – Hill climbing technique.
UNIT–IV: 
**Wind Energy**

UNIT–V: 
**Hydro and Tidal power systems**
Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

UNIT–VI: 
**Biomass, fuel cells and geothermal systems**

**Learning Outcomes:**
Student should be able to
- Analyze solar radiation data, extraterrestrial radiation, radiation on earth’s surface.
- Design solar thermal collections.
- Design solar photo voltaic systems.
- Develop maximum power point techniques in solar PV and wind.
- Explain wind energy conversion systems, Betz coefficient, tip speed ratio.
- Explain basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

**Text Books:**

Reference Books:

2. Renewable Energy Technologies / Ramesh & Kumar / Narosa.
3. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.

Note: This Elective can be offered to Students of All Branches including EEE.
OPTIMIZATION TECHNIQUES
(Open Elective)

Preamble:
Optimization techniques have gained importance to solve many engineering design problems by developing linear and nonlinear mathematical models. The aim of this course is to educate the student to develop a mathematical model by defining an objective function and constraints in terms of design variables and then apply a particular mathematical programming technique. This course covers classical optimization techniques, linear programming, nonlinear programming and dynamic programming techniques.

Learning Objectives:
1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
6. To explain Dynamic programming technique as a powerful tool for making a sequence of interrelated decisions.

UNIT – I:
Introduction and Classical Optimization Techniques:

UNIT – II:
Classical Optimization Techniques
Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of
Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – III:
Linear Programming

UNIT – IV:
Transportation Problem
Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

UNIT – V:
Nonlinear Programming:
Unconstrained cases - One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method - Univariate method, Powell’s method and steepest descent method.

Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – VI:
Dynamic Programming:

Learning Outcomes:
The student should be able to:

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.

3. Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.

4. Solve transportation and assignment problem by using Linear programming Simplex method.

5. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.

6. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

**Text Books:**


**Reference Books:**

2. Operations Research – by Dr. S.D.Sharma, Kedarnath, Ramnath & Co
4. Linear Programming–by G.Hadley.

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**Note:** This Elective can be offered to Students of All Branches except EEE.
Preamble:
In the recent times fabrication technology is revolutionized and especially LSI has become so dense that on a single IC tens and thousands of transistors are placed. Thus integrated circuits have become integrated systems and the development of fabrication technology VLSI plays very important role.

Learning Objectives:
• To provide the basic fundamentals of fabrication technology, generations of IC and speed, power consumptions of various fabrication technologies.
• To understand the knowledge of electrical properties of MOS circuits.
• To learn the design concepts of stick diagrams, layouts for various MOS technologies.
• To understand the concepts of design rules, scaling, subsystem design semiconductor IC design.
• To understand the synthesis, simulation design verification tools, CMOS testing.

UNIT –I
Introduction
Introduction to IC technology – The IC era – MOS and related VLSI technology – Basic MOS transistors – Enhancement and depletion modes of transistor action – IC production process – MOS and CMOS fabrication process – BiCMOS technology – Comparison b/w CMOS and bipolar technologies.

UNIT – II
Basic electrical properties of MOS and BiCMOS circuits
$I_{ds}$–$V_{ds}$ relationships – Aspects of MOS transistor threshold voltage – MOS Trans–conductance and output conductance – MOS Transistor – Figure of merit – The pMOS transistor – The nMOS inverter – Determination of pull–up to pull–down ratio for nMOS inverter driven by another nMOS inverter.
for an nMOS inverter driven through one or more pass Transistors – Alternative forms of pull up – The CMOS Inverter MOS transistor Circuit model – Bi–CMOS Inverters.

UNIT – III
MOS and BiCOMS circuit design processes

UNIT – IV
Basic circuit concepts

UNIT – V
Scaling of MOS circuit
Scaling models and scaling factors – Scaling factors for device parameters – Limitations of scaling – Limits due to sub threshold currents – Limits on logic level and supply voltage due to noise – Limits due to current density – Some architectural Issues – Introduction to switch logic and gate logic.

UNIT – VI
Digital design using HDL

VHDL MODELLING
– Major net list formats for design representation – VHDL synthesis – Programming approach.

Learning Outcomes

- Ability to demonstrate the fundamentals of IC technology such as various MOS fabrication technologies.
- Ability to calculate electrical properties of MOS circuits such as Ids – Vds relationship, Vt, gm, gds, figure of merit, sheet resistance, area capacitance.
- Ability to demonstrate semi conductor IC design such as PLA’s, PAL, FPGA, CPLS’s design.
- Ability to demonstrate VHDL synthesis, simulation, design capture tools design verification tools, CMOS testing.

Text Books:


References Books:

ELECTRICAL DISTRIBUTION SYSTEMS
(ELECTIVE–I)

Preamble:
This subject deals with the general concept of distribution system, substations and feeders as well as discusses distribution system analysis, protection and coordination, voltage control and power factor improvement.

Learning Objectives
- To study different factors of Distribution system.
- To study and design the substations and distribution systems.
- To study the determination of voltage drop and power loss.
- To study the distribution system protection and its coordination.
- To study the effect of compensation on p.f improvement.
- To study the effect of voltage control on distribution system.

UNIT – I:
General Concepts
Introduction to distribution systems, Load modeling and characteristics – Coincidence factor – Contribution factor loss factor – Relationship between the load factor and loss factor – Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT – II:
Substations
Location of substations: Rating of distribution substation – Service area within primary feeders – Benefits derived through optimal location of substations.

Distribution Feeders
Design Considerations of distribution feeders: Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.

UNIT – III:
System Analysis
UNIT – IV: 
Protection

Coordination
Coordination of protective devices: General coordination procedure – Residual current circuit breaker RCCB (Wikipedia).

UNIT – V: 
Compensation for Power Factor Improvement
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 allocation – Economic justification – Procedure to determine the best capacitor location.

UNIT – VI: 
Voltage Control

Learning Outcomes:
- Able to understand the various factors of distribution system.
- Able to design the substation and feeders.
- Able to determine the voltage drop and power loss
- Able to understand the protection and its coordination.
- Able to understand the effect of compensation on p.f improvement.
- Able to understand the effect of voltage, current distribution system performance.

Text Book:

Reference Books:

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Preamble:
Optimization techniques have gained importance to solve many engineering design problems by developing linear and nonlinear mathematical models. The aim of this course is to educate the student to develop a mathematical model by defining an objective function and constraints in terms of design variables and then apply a particular mathematical programming technique. This course covers classical optimization techniques, linear programming, nonlinear programming and dynamic programming techniques.

Learning Objectives:
1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
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UNIT – I:
Introduction and Classical Optimization Techniques:

UNIT – II:
Classical Optimization Techniques
Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of
Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – III:
Linear Programming

UNIT – IV:
Transportation Problem
Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

UNIT – V:
Nonlinear Programming:
Unconstrained cases - One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method - Univariate method, Powell’s method and steepest descent method.

Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – VI:
Dynamic Programming:

Learning Outcomes:
The student should be able to:
1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.

3. Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.

4. Solve transportation and assignment problem by using Linear programming Simplex method.

5. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.

6. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

Text Books:


Reference Books:


2. Operations Research – by Dr. S.D.Sharma, Kedarnath, Ramnath & Co


4. Linear Programming–by G. Hadley.
Learning Objectives:

- To study programming based on 8086 microprocessor and 8051 microcontroller.
- To study 8056 microprocessor based ALP using arithmetic, logical and shift operations.
- To study modular and Dos/Bios programming using 8086 microprocessor.
- To study to interface 8086 with I/O and other devices.
- To study parallel and serial communication using 8051 microcontroller.

Any 8 of the following experiments are to be conducted:

I. Microprocessor 8086:

Introduction to MASM/TASM.

1. Arithmetic operation – Multi byte addition and subtraction, multiplication and division – Signed and unsigned arithmetic operation, ASCII – Arithmetic operation.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3. By using string operation and Instruction prefix: Move block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
5. Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.
6. Interfacing 8255–PPI
7. Programs using special instructions like swap, bit/byte, set/reset etc.
8. Programs based on short, page, absolute addressing.
9. Interfacing 8259 – Interrupt Controller.
10. Interfacing 8279 – Keyboard Display.

Any 2 of the following experiments are to be conducted:

**Microcontroller 8051**
12. Reading and Writing on a parallel port.
13. Timer in different modes.
14. Serial communication implementation.
15. Understanding three memory areas of 00 – FF (Programs using above areas).
   Using external interrupts.

**Learning Outcomes:**
- Will be able to write assembly language program using 8086 micro based on arithmetic, logical, and shift operations.
- Will be able to do modular and Dos/Bios programming using 8086 micro processor.
- Will be able to interface 8086 with I/O and other devices.
- Will be able to do parallel and serial communication using 8051 micro controllers.
ELECTRICAL SIMULATION LAB

Learning objectives:

- To simulate integrator circuit, differentiator circuit, Boost converter, Buck converter, full convertor and PWM inverter.
- To simulate transmission line by incorporating line, load and transformer models.
- To perform transient analysis of RLC circuit and single machine connected to infinite bus (SMIB).
- To find load flow solution for a transmission network with Newton–Rampson method.

Following experiments are to be conducted:

1. Simulation of transient response of RLC circuits
   a. Response to pulse input
   b. Response to step input
   c. Response to sinusoidal input
2. Analysis of three phase circuit representing the generator transmission line and load. Plot three phase currents & neutral current.
4. Plotting of Bode plots, root locus and nyquist plots for the transfer functions of systems up to 5th order.
6. Simulation of Boost and Buck converters.
8. Simulation of D.C separately excited motor using transfer function approach.

Any 2 of the following experiments are to be conducted:

1. Modeling of transformer and simulation of lossy transmission line.
2. Simulation of single phase inverter with PWM control.
3. Simulation of three phase full converter using MOSFET and IGBTs.
4. Transient analysis of single machine connected to infinite bus (SMIB).
Learning outcomes:

- Able to simulate integrator circuit, differentiator circuit, Boost converter, Buck converter, full converter and PWM inverter.
- Able to simulate transmission line by incorporating line, load and transformer models.
- Able to perform transient analysis of RLC circuit and single machine connected to infinite bus (SMIB).
- Able to find load flow solution for a transmission network with Newton–Rampson method.

Reference Books:

2. Pspice for circuits and electronics using PSPICE – by M.H.Rashid, M/s PHI Publications.
3. Pspice A/D user`s manual – Microsim, USA.
4. Pspice reference guide – Microsim, USA.
5. MATLAB user`s manual – Mathworks, USA.
6. MATLAB – control system tool box – Mathworks, USA.
7. SIMULINK user`s manual – Mathworks, USA.
IV Year – I SEMESTER

POWERSYSTEMS LAB

Learning Objectives:
To impart the practical knowledge of functioning of various power system components and determination of various parameters and simulation of load flows, transient stability, LFC and Economic dispatch.

Any 10 of the Following experiments are to be conducted:
1. Sequence impedances of 3 phase Transformer.
2. Sequence impedances of 3 phase Alternator by Fault Analysis.
3. Sequence impedances of 3 phase Alternator by Direct method.
4. ABCD parameters of Transmission network.
5. Power Angle Characteristics of 3phase Alternator with infinite bus bars.
6. Dielectric strength of Transformer oil.
7. Calibration of Tong Tester.
8&9. Load flow studies any two methods.
10. Transient Stability Analysis
11. Load frequency control without control
12. Load frequency control with control
13. Economic load dispatch without losses

Learning Outcomes:
The student is able to determine the parameters of various power system components which are frequently occur in power system studies and he can execute energy management systems functions at load dispatch centre.
Preamble:
In recent years digital controllers have become popular due to their capability of accurately performing complex computations at high speeds and versatility in leading non linear control systems. In this context, this course focuses on the analysis and design of digital control systems.

Learning objectives:
• To understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.
• The theory of z–transformations and application for the mathematical analysis of digital control systems.
• To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
• To examine the stability of the system using different tests.
• To study the conventional method of analyzing digital control systems in the w–plane.
• To study the design of state feedback control by “the pole placement method.”

UNIT – I:
Introduction and signal processing
Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

UNIT–II:
Z–transformations

UNIT–III:
State space analysis and the concepts of Controllability and observability
State Space Representation of discrete time systems – State transition matrix and

UNIT – IV:

**Stability analysis**


UNIT – V:

**Design of discrete–time control systems by conventional methods**

Transient and steady state specifications – Design using frequency response in the w–plane for lag and led compensators – Root locus technique in the z–plane.

UNIT – VI:

**State feedback controllers:**

Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman’s formula.

**Learning outcomes:**

- The students learn the advantages of discrete time control systems and the “know how” of various associated accessories.
- The learner understand z–transformations and their role in the mathematical analysis of different systems(like laplace transforms in analog systems).
- The stability criterion for digital systems and methods adopted for testing the same are explained.
- Finally, the conventional and state–space methods of design are also introduced.

**Text Book:**


**Reference Books:**

2. Digital Control and State Variable Methods by M.Gopal, TMH
ELECTIVE – II

ADVANCED CONTROL SYSTEMS

Preamble:
This subject aims to study state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

Learning Objectives:
- Review of the state space representation of a control system: Formulation of different models from the signal flow graph, diagonalization.
- To introduce the concept of controllability and observability. Design by pole placement technique.
- Analysis of a nonlinear system using Describing function approach and Phase plane analysis.
- The Lyapunov’s method of stability analysis of a system.
- Formulation of Euler Lagrange equation for the optimization of typical functionals and solutions.
- Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccati equation.

UNIT – I:
State space analysis
State Space Representation – Solution of state equation – State transition matrix, –Canonical forms – Controllable canonical form – Observable canonical form, Jordan Canonical Form.

UNIT – II:
Controllability, observability and design of pole placement
UNIT – III:
Describing function analysis
Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

UNIT–IV:
Stability analysis
Stability in the sense of Lyapunov – Lyapunov’s stability and Lypanov’s instability theorems – Direct method of Lypanov for the linear and nonlinear continuous time autonomous systems.

UNIT–V:
Calculus of variations
Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangeine equation.

UNIT –VI:
Optimal control
Linear quadratic optimal regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by continuous time algebraic riccatti equation (CARE) - Optimal controller design using LQG framework.

Learning Outcomes:
- State space representation of control system and formulation of different state models are reviewed.
- Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
- Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
- Able to analyse the stability analysis using lyapnov method.
- Minimization of functionals using calculus of variation studied.
- Able to formulate and solve the LQR problem and riccatti equation.

Text Books:
- Automatic Control Systems by B.C. Kuo, Prentice Hall Publication
Reference Books:

5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

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HIGH VOLTAGE ENGINEERING
(ELECTIVE – II)

Preamble:
With the growth of power, HV power transmission has become an important subject. The performance of generating equipment requires knowledge of different phenomena occurring at higher voltage. Thus evaluations of various insulating materials are required for protection of HV equipments. Keeping this in view the course is designed to understand various phenomena related to breakdown study and withstand characteristics of insulating materials. The course also describes the generation and measurement of DC, AC and Impulse voltages as well various testing techniques.

Learning Objectives:
• To understand electric field distribution and computation in different configuration of electrode systems.
• To understand HV breakdown phenomena in gases, liquids and solids dielectric materials.
• To acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and impulse currents.
• To understand various techniques of AC, DC and Impulse measurement of high voltages and currents.
• To understand the insulating characteristics of dielectric materials.
• To understand the various testing techniques of HV equipments.

UNIT-I:
Introduction to High Voltage Technology
Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

UNIT-II:
Break down phenomenon in gaseous, liquid and solid insulation
UNIT–III:
Generation of High voltages and High currents

UNIT–IV:
Measurement of high voltages and High currents
Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

UNIT–V:
Non–destructive testing of material and electrical apparatus

UNIT–VI:
High voltage testing of electrical apparatus

Learning Outcomes:
- To be acquainted with the performance of high voltages with regard to different configurations of electrode systems.
- To be able to understand theory of breakdown and withstand phenomena of all types of dielectric materials.
- To acquaint with the techniques of generation of AC, DC and Impulse voltages.
- To be able to apply knowledge for measurement of high voltage and high current AC, DC and Impulse.
- To be in a position to measure dielectric property of material used for HV equipment.
- To know the techniques of testing various equipment’s used in HV engineering.

Text Books:


**Reference Books:**


Preamble:
This is an advanced course on electrical machines. Students will be exposed to various special machines which are gaining importance in industry. This course covers topics related to principles, performance and applications of these special machines including switched reluctance motors, stepper motors, permanent magnet dc motors, linear motors and electric motors for traction drives.

Learning Objective:
- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor.
- To explain the theory of travelling magnetic field and applications of linear motors.
- To understand the significance of electrical motors for traction drives.

UNIT I:
Switched Reluctance Motor
Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

UNIT II:
Stepper Motors

UNIT III:
Permanent Magnet DC Motors
Construction – Principle of working – Torque equation and equivalent circuits – Performance characteristics – Moving coil motors.
UNIT IV:
Permanent Magnet Brushless DC Motor

UNIT V:
Linear motors

UNIT VI:
Electric Motors for traction drives
AC motors– DC motors –Single sided linear induction motor for traction drives – Comparison of AC and DC traction.

Learning Outcomes:
The student should be able to
- Explain theory of operation and control of switched reluctance motor.
- Explain the performance and control of stepper motors, and their applications.
- Describe the operation and characteristics of permanent magnet dc motor.
- Distinguish between brush dc motor and brush less dc motor.
- Explain the theory of travelling magnetic field and applications of linear motors.
- Understand the significance of electrical motors for traction drives.

Text Books:
ELECTRIC POWER QUALITY

Preamble:
Power quality is a major problem for utilities and customers. Customers using sensitive critical loads need quality power for proper operation of the electrical equipment. It is important for the student to learn the power quality issues and improvement measures provided by the utility companies. This course covers the topics on voltage and current imperfections, harmonics, voltage regulation, power factor improvement, distributed generation, power quality monitoring and measurement equipment.

Learning Objectives:
- To learn different types of power quality phenomena.
- To identify sources for voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
- To describe power quality terms and study power quality standards.
- To learn the principle of voltage regulation and power factor improvement methods.
- To explain the relationship between distributed generation and power quality.
- To understand the power quality monitoring concepts and the usage of measuring instruments.

UNIT–I:
Introduction

UNIT–II:
Voltage imperfections in power systems
Power quality terms – Voltage sags – Voltage swells and interruptions –

UNIT–III
Voltage Regulation and power factor improvement:
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 – Power factor penalty – Static VAR compensations for power factor improvement.

UNIT–IV
Harmonic distortion and solutions

UNIT–V
Distributed Generation and Power Quality

UNIT–VI
Monitoring and Instrumentation

Learning Outcomes:
At the end of this course the student should be able to
- Differentiate between different types of power quality problems.
- Explain the sources of voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
- Analyze power quality terms and power quality standards.
Electrical and Electronics Engineering

- Explain the principle of voltage regulation and power factor improvement methods.
- Demonstrate the relationship between distributed generation and power quality.
- Explain the power quality monitoring concepts and the usage of measuring instruments.

Textbooks:


Reference Books:

DIGITAL SIGNAL PROCESSING
(Elective – III)

Preamble:
Signals analysis is very important in daily life. Hence it is required to study the different signals (continuous and discrete) and their properties. The behavior of the signals in time and frequency domain are important in analyzing the response of the network. The tools like FFT, DFT, Z–transforms may be used in the analysis of the signals. Filters must be required to eliminate the unwanted signals. Hence digital filter design also required to be studied. Sampling of signals are required to convert continuous to discrete signals. To have knowledge on the implementation signals, DSP processors must be studied.

Learning Objectives:
• To study different types of signals and properties of systems.
• To study the application of Fourier transform to discrete time systems.
• To study the FFT and inverse FFT and its applications to discrete sequences.
• To study the realization of digital filters and their design.
• To study the multi–rate signal processing.
• To study the architecture of digital signal processors.

UNIT–I:
Introduction
Introduction to Digital Signal Processing: Discrete time signals & sequences – Linear shift invariant systems – Stability and causality – Linear constant coefficient difference equations.

UNIT–II:
Discrete Fourier Series

UNIT–III:
Fast Fourier Transforms
Frequency domain representation of discrete time signals and systems – Fast
Fourier transforms (FFT) – Radix–2 decimation in time and decimation in frequency FFT Algorithms – Inverse FFT – and FFT for composite N.

UNIT–IV:
Realization of Digital Filters
Solution of difference equations of digital filters – Block diagram representation of linear constant – Coefficient difference equations – Basic structures of IIR systems – Transposed forms – Basic structures of FIR systems – System function.

IIR Digital Filters

FIR Digital Filters

UNIT–V:
Multirate Digital Signal Processing:

UNIT–VI:
Introduction to Digital Signal Processors(DSP):

Learning outcomes:
- Able to study different types of signals and properties of systems.
- Able to apply of Fourier transform to discrete time systems.
- Able to apply the FFT and inverse FFT to discrete sequences.
• Able to realize and design digital filters.
• Able to understand the multi-rate signal processing.
• Able to understand architecture of digital signal processors.

Text Books:

Reference Books:
FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS (FACTS)  
(Elective – III)

Preamble:
Flexible Alternating Current Transmission System controllers have become a part of modern power system. It is important for the student to understand the principle of operation of series and shunt compensators by using power electronics. As the heart of many power electronic controllers is a voltage source converter (VSC), the student should be acquainted with the operation and control of VSC. Two modern power electronic controllers are also introduced.

Learning Objectives:
• To learn the basics of power flow control in transmission lines by using FACTS controllers
• To explain the operation and control of voltage source converter.
• To discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
• To learn the method of shunt compensation by using static VAR compensators.
• To learn the methods of compensation by using series compensators
• To explain the operation of two modern power electronic controllers (Unified Power Quality Conditioner and Interline Power Flow Controller).

UNIT–I:
Introduction to FACTS

UNIT–II:
Voltage source and Current source converters
converter – Comparison of current source converter with voltage source converter.

UNIT–III:
Shunt Compensators–1
Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping.

Methods of controllable VAR generation
Variable impedance type static VAR generators – Thyristor Controlled Reactor (TCR) and Thyristor Switched Reactor (TSR).

UNIT–IV:
Shunt Compensators–2
Thyristor Switched Capacitor(TSC)– Thyristor Switched Capacitor – Thyristor Switched Reactor (TSC–TCR). Static VAR compensator(SVC) and Static Compensator(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:
Series Compensators
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).

UNIT–VI:
Combined Controllers
Schematic and basic operating principles of unified power flow controller(UPFC) and Interline power flow controller(IPFC) – Application of these controllers on transmission lines.

Learning Outcomes:
The student should be able to

- Determine power flow control in transmission lines by using FACTS controllers.
- Explain operation and control of voltage source converter.
• Discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
• Explain the method of shunt compensation by using static VAR compensators.
• Appreciate the methods of compensations by using series compensators.
• Explain the operation of modern power electronic controllers (Unified Power Quality Conditioner and Interline Power Flow Controller).

Text Books:
2. “Flexible ac transmission system (FACTS)” Edited by Yong Hue Song and Allan T Johns, Institution of Electrical Engineers, London.
Electrical and Electronics Engineering

IV Year – II SEMESTER

T P C
3+1 0 3

ELECTIVE – IV

OOPS THROUGH JAVA

Preamble:
This course teaches students how to develop Java applications. Topics covered include the Java programming language syntax, OO programming using Java, exception handling, file input/output, threads, collection classes, and networking.

Learning Objectives:
- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.
- Understanding of various components of Java AWT and Swing and writing code snippets using them.

UNIT I:
Introduction to OOP
Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

UNIT II:
Programming Constructs
Variables, Primitive Datatypes, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules
and Associativity, Primitive TypeConversion and Casting, Flow of control-Branching, Conditional, loops.

Classes and Objects - classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

UNIT III:
Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class.
Exceptions & Assertions - Introduction, Exception handling techniques - try... catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions.

UNIT IV:
MultiThreading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive () and join (), Synchronization, suspending and Resuming threads, Communication between Threads
Input/Output: reading and writing data, java.io package

UNIT V:
Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint (), update () and repaint ()
Event Handling -Introduction, Event Delegation Model, java.awt.event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

UNIT VI:
Abstract Window Toolkit
Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar
Swing:
Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel.
Learning Outcomes:

- Understand the format and use of objects.
- Understand basic input/output methods and their use.
- Understand object inheritance and its use.
- Understand development of JAVA applets vs. JAVA applications.
- Understand the use of various system libraries.

Text Books:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH.
5. Introduction to Java programming, 7th ed, Y Daniel Liang, Pearson.

Reference Books:

2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
UNIX AND SHELL PROGRAMMING
(Elective – IV)

Learning Objectives:
- to provide a comprehensive introduction to Shell Programming.
- have the fundamental skills required to write simple and complex Shell scripts to automate jobs and processes in the Unix environment.

UNIT I:
Introduction to Unix:- Architecture of Unix, Features of Unix, Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip.

UNIT II:
Unix Utilities:- Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text processing utilities and backup utilities, detailed commands to be covered are tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

UNIT III:


Filters : Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files.

UNIT IV:
Grep : Operation, grep Family, Searching for File Content.
Sed : Scripts, Operation, Addresses, commands, Applications, grep and sed.
**awk**: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String.

Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands, in awk, Applications, awk and grep, sed and awk.

**UNIT V:**

**Korn Shell Programming**: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

**UNIT VI:**

**C Shell Programming**: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

**Learning Outcomes:**

Upon completing this course students will have skills in:

1. Use UNIX shells and commands to create powerful data processing applications.
2. Build UNIX applications using the shell command interpreter and UNIX commands.
3. Use UNIX at the command line to manage data, files, and programs.
4. Use UNIX editors and tools to create and modify data files and documents.

**Text Books:**


References Books:

1. Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson Education.

2. Unix programming environment, Kernighan and Pike, PHI. / Pearson Education.

AI TECHNIQUES
(Elective IV)

Preamble:
The aim of this course is to study the AI techniques such as neural networks and fuzzy systems. The course focuses on the application of AI techniques to electrical engineering.

Learning Objectives:
• To study various methods of AI
• To study the models and architecture of artificial neural networks.
• To study the ANN paradigms.
• To study the fuzzy sets and operations.
• To study the fuzzy logic systems.
• To study the applications of AI.

UNIT–I:
Introduction to AI techniques

UNIT–II:
Neural Networks

UNIT–III:
ANN paradigm
Multi-layer feed-forward network (based on Back propagation algorithm)– Radial-basis function networks- Recurrent networks (Hopfield networks).

UNIT – IV:
Classical and Fuzzy Sets
UNIT–V:
Fuzzy Logic System Components
Fuzzification – Membership value assignment – Development of rule base and decision making system – Defuzzification to crisp sets – Defuzzification methods – Basic hybrid system.

UNIT–VI:
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.

Text Books:
2. Fuzzy logic with fuzzy applications - by T.J. Ross, TMH.

Reference Books:
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S N Deepa TMGH

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POWER SYSTEM REFORMS
(Elective IV)

Preamble:
This course introduces the concepts and issues of power system reforms and aims at computation of Available Transfer Capability (ATC), Congestion Management, Electricity Pricing, Ancillary services Management and Power system operation in competitive environment.

Learning Objectives:
• To study fundamentals of power system deregulation and restructuring.
• To study available transfer capability.
• To study congestion management.
• To study various electricity pricing.
• To study operation of power system in deregulated environment.
• To study importance of Ancillary services management.

UNIT–I
Over view of key issues in electric utilities

UNIT–II
OASIS: Open Access Same–Time Information System

UNIT–III
Congestion Management
Introduction to congestion management – Methods to relieve congestion

UNIT–IV
Electricity Pricing:
Introduction – Electricity price volatility electricity price indexes –
Challenges to electricity pricing – Construction of forward price curves – Short–time price forecasting.

UNIT–V

**Power system operation in competitive environment:**

UNIT–VI

**Ancillary Services Management:**
Introduction – Reactive power as an ancillary service – A review – Synchronous generators as ancillary service providers.

**Learning Outcomes:**
- Will understand importance of power system deregulation and restructuring.
- Able to compute ATC.
- Will understand transmission congestion management.
- Able to compute electricity pricing in deregulated environment.
- Will be able to understand power system operation in deregulated environment.
- Will understand importance of ancillary services.

**Text Books:**
4. Electrical Power Distribution Case studies from Distribution reform, upgrades and Management (DRUM) Program, by USAID/India, TMH.
Preamble:
This course is intended to introduce the student to the systems engineering process used to create multidisciplinary solutions to complex problems which have multiple, often conflicting objectives. The course will provide an overview of systems engineering in the context of large developmental programs. By focusing on the objectives, principles and practices of systems engineering, the course will enable the student to better understand the functions, capabilities and limitations of systems engineering.

Learning Objectives:
• To understand the foundations of systems Engineering.
• To understand the process of engineering systems systematically
• To understand how to deploy (put to use) the systems engineered.
• To understand the supporting systems during systems life cycle.
• To understand the application of systems engineering in product and service space.
• To understand systems engineering in perspective of related disciplines project management and software engineering.

UNIT–I:

UNIT –II:

UNIT – III:

UNIT – IV:
Systems engineering management – Planning – Assessment and Control –

UNIT – V:
Applications of systems engineering – Product systems engineering – Services Systems engineering – Enterprise systems engineering

UNIT – VI:
Enabling systems engineering – People: Enabling teams and individuals – Software engineering, Project management – Case studies.

Learning Outcomes:
- To be able to appreciate and evaluate systems in general and apply to specific systems.
- Should engineer successful systems fit for intended purpose. Right from concept to development.
- Should be able to successfully deploy the new systems developed.
- Should be able to leverage the support systems for success of systems from womb to tomb.
- Should be able to apply systems engineering in engineering product and services.
- Should be able to relate systems engineering with project management and software engineering.

Text books:

Reference Books:

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