

**Scheme of Instruction, Examination and**

**Detailed Syllabi of**

**Electrical and Electronics Engineering**

**W.E.F. 2015 – 2016**

**(from the batch admitted in the year 2015)**

ACHARYA NAGARJUNA UNIVERSITY

Nagarjuna Nagar – 522510

Andhra Pradesh, India

4- Year B.TECH

R-2015 REGULATIONS

SEMESTER SYTEM

**ACHARYA NAGARJUNA UNIVERSITY:: NAGARJUNA NAGAR**

**Faculty of Engineering**

**Academic Regulations 2015 (R-15) forB. Tech (Regular)**

(Applicable for the students admitted during the

Academic Year 2015-2016 and onwards)

**1. Eligibility for Admission:**

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

1. Admission shall be made either on the basis of merit/rank obtained by the qualifying candidates in EAMCET/ECET or otherwise specified, whichever is relevant.

The duration of B.Tech program is of four academic years divided into eight semesters comprising of two semesters in each academic year. A student is required to choose a branch of study at the time of admission. Students under lateral entry will be admitted straightaway into Third semester of B.Tech course in the respective branch. No change of branch shall be allowed after the admissions are closed.

1. **Award of B.Tech. Degree:**

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

i. Regular entry students shall pursue a course of study for not less than four academic years and in not more than eight academic years.

ii. Student’s who fail to fulfill all the academic requirements for the award of the degree within eight academic years (for Regular Entry) / six academic years (for Lateral Entry) from the year of their admission, shall forfeit their seat in B.Tech course and their admission is cancelled.

*Completing the course of study shall mean not only satisfying the attendance requirements but also passing of all the subjects within the respective stipulated period*

1. **Branches of study:**

The following Branches of study are offered at present for B. Tech. degree

|  |  |
| --- | --- |
| **S.No.** | **Branch** |
|  | Civil Engineering |
|  | Electrical and Electronics Engineering. |
|  | Mechanical Engineering. |
|  | Electronics and Communication Engineering |
|  | Computer Science and Engineering. |
|  | Chemical Engineering |
| 7. | Electronics & Instrument Engineering |
| 8. | Information Technology |
| 9. | BioTechnology |

and any other branch as approved by the authorities of the University from time to time.

EachBranch will have a curriculum with a syllabi that shall consist of the following:

i. General Core Courses 1. Basic Sciences

2. Engineering Sciences

3. Humanities and social sciences

ii. Program core courses in Engineering / Technology

iii. Elective courses of Engineering / Technology / Management Entrepreneurship / Business Communication and allied fields.

iv. Open Electives/CBCS

v. Mandatory learning courses

vi. Project work

1. **Credits:**

i. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.

ii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

iii. *Credit:* A unit by which the course work is measured.

1. **Distribution and Weightage of Marks (Internal & External):**
2. The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition internship&project work shall be evaluated for 100 and 200 marks respectively.
3. For theory subjects the distribution shall be 40 marks for Internal Evaluation and 60 marks for the External Evaluation.
4. There shall be four units in each of the theory subjects.
5. For theory subjects, there shall be two midterm examinations during the semester. Each midterm examination shall consist of assignment for 12 marks andsessionaltest for 18marks with duration of 120 minutes respectively.

First midterm examination shall be conducted for 50% coverage of syllabus and second midterm examination shall be conducted for remaining 50% of syllabus. Both the midterm exams are compulsory. Final midterm examination marks for a total of 30marks shall be arrived at, by considering the 80% weightage (24 marks) to that midterm examination in which the student scores more marks and the remaining 20% (6 marks) for other midterm exam.

**\***Note 1: The assignmenttest paper shall contain 5 questions of equal weightage and student is asked to answer any 2 questions randomly and shall be condensed for12 marks, any fraction rounded off to the next higher mark.

**\***Note 2: The sessional examination shall contain 3 questions out of which first question is objective and compulsory and remaining two questions having internal choice and shall be considered for 18 marks,any fraction rounded off to the next higher mark.

**\*Note 3:** For the remaining 10 marks in internal evaluation, 5 marks allotted for attendance as indicated in CLAUSE(\_6\_) and the faculty members teaching the subject shall evaluate remaining 5 marks through quiz/online/objective examination at the end of semester.

V.For theory subjects, there will be 5 questions with following pattern in the End-Examination.

* 1. All Questions have to be answered compulsorily.
  2. Question I shall contain 12short Answer questions “a” to “l each of 1 mark. (Total 12 marks) covering one question from each unit.
  3. Out of the remaining four questions, EITHER/OR type shall be followed with 12 marks for each.
  4. In each question as mentioned in (c), one, two or more bits can be set.

vii. Further, whenever any theory subject with two parts is offered (combined subject), for ex:

Electrical & Mechanical Technology, then there shall be only two parts Part A, Part B in the question paper.

First question objective can be equally divided into two parts.

Part – A: shall contain two questions, EITHER/OR type shall be followed with 12 marks for each.

Part – B: shall also contain two questions, EITHER/OR type shall be followed with 12 marks for each.

viii. Model Question paper for each theory course shall be prepared by the teacher within 15 days from the commencement of the semester and the same shall be forwarded to the Controller of Examinations through the Chairman, BOS concerned.

ix. For practical subjects there shall be a continuous evaluation during the semester for 40internal marks and 60 end examination marks. Day-to-day work in the laboratory shall be evaluated for 25marks by the concerned laboratory teacher based on the report of experiments/jobs (10 marks for the record submitted and 15 marks for day to day work). The internal examination for 15 marks (10 marks for experiment and 5 marks for viva-voce) shall be conducted by the laboratory teacher and another examiner from the same department.

\*Note: Day to day performance shall be recorded in student record (each experiment carries 15 marks, at least ten experiments should be done and average marks must be taken at the end of semester).

1. There shall be an audit pass (Mandatory learning Course) course in Human Values &Professional Ethics, Life skills and Advanced Communication Skills lab with no credits. There shall be no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course when he/she secures 40% or more in the internal examinations.
2. There shall be an Discipline centric Elective Course through Massive Open Online Course (MOOC) in III year II semester (For EEE, ECE and CSE branches) and in IV year I semester (For Civil, Mechanical and Chemical branches), where in the student shall register the course offered by authorized institutions/Agencies, through online with the approval of Head of the Department. The Certificate issued by the institution/agency after successful completion of the course will be considered for the award of grade to that course.
3. For the subject having design and / or drawing, such as Engineering Drawing, Machine Drawing and Estimation, the distribution shall be 40 marks for internal evaluation and 60 marks for end examination. The Internal evaluation will be 20 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. Further, there shall be two midterm exams in a Semester for a duration of 2hrs each, evenly distributed over the syllabi for 20 marks and the average marks of both the mid examinations shall be considered as internal test marks. The sum of day to day evaluation and the internal test marks will be the final internal marks for the subject.

1. There shall internship at the end of III year II Semester. For the internship, the student/institute shall select any organization and a minimum of 4 weeks work must be carried at the organization. A report on work done shall be evaluated by the external supervisor/mentor and department committee. The internship shall be evaluated for 100 marks (60 marks shall be awarded by external supervisor and 40 marks by departmental committee). There shall be no external examination for internship.

A student shall acquire 2 credits assigned to the internship only when he/she secures 40 marks on aggregate out of 100 marks allocated.

1. Out of a total of 200 marks for the project work, 80 marks shall be for Internal Evaluation and 120 marks for the End Semester Examination (Viva-voce). The viva-voce shall be conducted by a committee consisting of Head of the Department, Project Supervisor and an External Examiner nominated by the Principal from the panel of 3 members proposed by Head of the Department. The project work shall start in IV year I semester and shall continue in the semester break.The evaluation of project work shall be conducted at the end of the IV year II semester. The Internal Evaluation shall be made on the basis of weekly progress (a minimum of 12 weeks and 3 marks for each week progress) and at least two seminars(one at the beginning of IV B.Tech II semester (20 marks) and the other before submission of project work(24 marks) given by each student on the topic of his project.
2. The laboratory records and internal test papers shall be preserved for minimum of 2 years in the respective departments and shall be produced to the Committees of the college as and when the same are asked for.
3. **Attendance Requirements:**
4. A student shall be eligible to appear for end examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
5. **Shortage of Attendance below 65% in aggregate shall in NO case be condoned**.
6. 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.
7. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
8. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.
9. A stipulated fee shall be payable towards condonation of shortage of attendance to the college.
10. A weightage in sessional marks uptoa maximum of 5 marks out of 40 marks in each theory subject shall be given for those students who put in a minimum of 75% attendance in the respective subject in a graded manner as indicated below.

Attendance of 90% and above 5marks

Attendance of 85% and above and less than 90% 3marks

Attendance of 80% and above and less than 85% 2marks

Attendance of 75% and above and less than 80% 1mark

1. **Minimum Academic Requirements (For Regular Entry Students):**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

1. A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.
2. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, design, drawing subject or project if he secures not less than 40% of marks in the semester end examination. In the internship& project he/she should secure not less than 40% and for practical examination not less than 50% of marks in the semester end examination.
3. A student shall be promoted from I to II year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in I/IV B.Tech.
4. A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also mustsecure70% of the credits of the subjects that have been studied up to I year II semester from irrespective of whether the candidate takes the end examination or not as per the normal course of study. At the time of commencement of class work, he must attain the required credits
5. A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure70% of the credits of the subjects that have been studied upto II year II semester. At the time of commencement of class work, he must attain the required credits

And in case of getting detained for want of credits by sections ii and iii above, the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of Third or Fourth year I semester respectively.

1. **Minimum Academic Requirements (For Lateral Entry Students):**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

1. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum total of the internal evaluation and end examination taken together. In the Seminar & Comprehensive viva-voce he/she should secure 40%.
2. A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.
3. A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in II/IV B.Tech
4. A student shall be promoted from III to IV year only if he/she fulfils the academic requirement of attendance and internal marks as stipulated in clause 6 and 7 and also must secure**70%** of the subjects that have been studied up to III year I semester from

**9. Grading:**

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

**Table – Conversion into Grades and Grade Points assigned**

|  |  |  |
| --- | --- | --- |
| Range in which the marks in the subject fall | Grade | Grade points assigned |
| ≥90 | O (Outstanding) | 10 |
| 80-89 | A+ (Excellent) | 9 |
| 70-79 | A (Very Good) | 8 |
| 60-69 | B+ (Good) | 7 |
| 50-59 | B (Above Average) | 6 |
| 45-49 | C (Average) | 5 |
| 40-44 | D (Pass) | 4 |
| < 40 | F (Fail) | 0 |
| Absent | Ab (Absent) | 0 |

i. A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii. For non-credit courses ‘Satisfactory’ or “Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

**9.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):**

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

SGPA = Σ (Ci × Gi)/ Σ Ci

Where, Ci is the number of credits of the ithsubject and Giis the grade point scored by the student in the ith course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

CGPA = Σ (Ci × Si)/ Σ Ci

Where ‘Si’ is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the GPA/CGPA the subjects in which the student is awarded Zero grade points will also be included.

*Grade Point:* It is a numerical weight allotted to each letter grade on a 10-point scale.

*Letter Grade:* It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

*Grade Conversion to Percentage: % = CGPA 9.25*

**10. Gap - Year:**

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for having the Gap Year.

**11. Transitory Regulations :( old regulations changed)**

1. Candidates who admitted into the four year B.Tech degree course under R-15 regulations but who got detained in any year for want of attendance/minimum aggregate sessional marks may join the appropriate year /semester in the semester system applicable for that batch and be governed by the regulations of that batch from then onwards unless otherwise specified.

2. A student admitted under credit based regulations(CR) detained due to lack of sessional marks/attendance at the end of the first semester of II/IV B.Tech shall join II/IV first semester of R-15 batch . Such students will study all the courses prescribed for that R-15 in which the student joins. However the student has to clear all the first year backlog subjects by appearing the supplementary examination. Such candidates will be governed by the regulations applicable to lateral entry candidates of R-15 batch for the award of the degree.

3. A student admitted under CR, detained due to lack of sessional marks/attendance at the end of the second semester of II/IV B.Tech /at the end of subsequent semesters shall follow the credit based regulations only (CR).

**12. With–holding of results**:

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

**13. 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:

|  |  |
| --- | --- |
| **Class Awarded** | **CGPASecured** |
| First Class with Distinction | ≥ 8.0 |
| First Class | ≥ 6.5 < 8.0 |
| Second Class | ≥ 5.5 < 6.5 |
| Pass Class | ≥ 4.0 < 5.5 |

**14. Minimum Instruction Days:**

The minimum instruction period for a semester is 16 weeks. The minimum instruction days including exams for each semester shall be for 90days.

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

**16. General:**

i.The academic regulations should be read as a whole for purpose of any interpretation.

1. Malpractice rules- nature and punishments is appended
2. Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
3. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the BOS is final.
4. The University may from time to time, revise, amend or change the Regulations, Schemes of Examinations, and/or Syllabi.

**17. Conduct and discipline**

Students shall conduct themselves within and outside the premises of the institute in a manner befitting the students of our institution.

(b) As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

(c) The following acts of omission and / or commission shall constitute gross violation of

the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

(i) Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.

(ii) Willful damage of college / individual property

(iii) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

(iv) Mutilation or unauthorized possession of library books.

(v) Noisy and unseemly behavior, disturbing studies of fellow students.

(vi) Hacking of computer systems (such as entering into other person’s areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

(vii) Usage of camera / cell phone in the campus

(viii) Plagiarism of any nature

(ix) Any other acts of gross indiscipline as decided by the academic council from time to time.

(d) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

(e) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

(f) Cases of adoption of unfair means and / or any malpractice in an examination shall be

reported to the principal for taking appropriate action.

(g) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

(h) The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

(i) The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

(j) “Grievance and Redressal Committee” (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

**18. Punishments for Malpractice Cases - Guidelines**

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

|  |  |  |
| --- | --- | --- |
| **S. No** | **Nature of Malpractices/Improper conduct** | **Punishment** |
| 1. | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination) | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| 2. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 3. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 4. | Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 5. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. |
| 6. | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. |
| 7. | Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. |
| 8. | Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects of that semester/year. The students 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. |
| 9. | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work 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. |
| 10. | Possesses any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat. |
| 11. | 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 7 to 9. | For Student of the college: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The candidate is also debarred and forfeits the seat.  Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. |
| 12. | Impersonates any other student in connection with the examination | The student who has impersonated shall be expelled from examinationhall. The student is debarred from writing the remaining exams, and rusticated from the college fur one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.  The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination including practicals and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat |
| 13. | If any malpractice is detected which is not covered in the above clauses 1 to 12 it shall be reported to the college academic council for further action to award suitable punishment. | |
| 14. | Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment. | |

**Program Codes.**

ESC: Engineering Science Core

BSC: Basic Science Core

DEC: Departmental Elective Course

OPC: Open Elective Course

PCC: Program Core Course

PRC: Program Major Project

**COURSE STRUCTURE Regulation- R15**

**For Circuit Branches: CSE/ECE/EEE**

**I YEAR I SEMESTER**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Details** | | **Scheme of Instruction** | | | **Scheme of**  **Examination** | | | |  |
| **Code** | **Subject** | **L** | **T** | **P** | **Maxi**  **Internal**  **Marks** | **Maxi**  **External**  **Marks** | **Total**  **Marks** | **Credits** | **Cat.**  **code** |
| BT/CSE/ECE  /EEE-111 | Mathematics –I | 4 | 1 | - | 40 | 60 | 100 | 4 | BSC |
| BT/CSE/ECE  /EEE-112 | Engineering Physics-1 | 3 | - | - | 40 | 60 | 100 | 3 | BSC |
| BT/CSE/ECE  /EEE-113 | Engineering. Chemsitry-1 | 3 | - | - | 40 | 60 | 100 | 3 | BSC |
| BT/CSE/ECE  /EEE-114 | Basic Mechanical Sciences | 4 | - | - | 40 | 60 | 100 | 3 | ESC |
| BT/CSE/ECE  /EEE-115 | Environmental science and Engineering | 3 | - | - | 40 | 60 | 100 | 3 | ESC |
| BT/CSE/ECE  /EEE-116 | Basic English for Engineers | 4 |  | - | 40 | 60 | 100 | 4 | HSC |
| BT/CSE/ECE  /EEE-151 | Physics Lab | - | - | 3 | 40 | 60 | 100 | 2 | BSC |
| BT/CSE/ECE  /EEE-152 | Engineering Graphics | - | - | 6 | 40 | 60 | 100 | 2 | ESC |
| BT/CSE/ECE  /EEE-153 | English Communication Lab | - | - | 3 | 40 | 60 | 100 | 2 | HSC |
|  | **Total** | **21** | **1** | **12** | **360** | **540** | **900** | **26** |  |

L – Lecture; T – Tutorial: P – Practical

**I YEAR II SEMESTER**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Details** | | **Scheme of**  **Instruction** | | | **Scheme of Examination** | | | |  |
| **Code** | **Subject** | **L** | **T** | **P** | **Maxi**  **Internal Marks** | **Maxi**  **External**  **Marks** | **Total** | **Credits** | **Cat.**  **code** |
| BT/CSE/ECE  /EEE-121 | Mathematics –II | 4 | 1 | - | 40 | 60 | 100 | 4 | HSC |
| BT/CSE/ECE  /EEE-122 | Engineering Physics-II | 3 | - | - | 40 | 60 | 100 | 3 | BSC |
| BT/CSE/ECE  /EEE-123 | Engineering Chemistry-II | 3 | - | - | 40 | 60 | 100 | 3 | BSC |
| BT/CSE/ECE  /EEE-124 | Basic Electrical & Electronic Sciences | 3 | 1 |  | 40 | 60 | 100 | 3 | BSC |
| BT/CSE/ECE  /EEE-125 | Problem solving using C | 3 | 1 | - | 40 | 60 | 100 | 3 | ESC |
| BT/CSE/ECE  /EEE-126 | Advanced English for Engineers | 4 | - | - | 40 | 60 | 100 | 4 | ESC |
| BT/CSE/ECE  /EEE-161 | Chemistry Lab | - | - | 3 | 40 | 60 | 100 | 2 | BSC |
| BT/CSE/ECE  /EEE-162 | Computer Programming Lab | - | - | 6 | 40 | 60 | 100 | 2 | ESC |
| BT/CSE/ECE  /EEE-163 | Workshop(IT) | - | - | 3 | 40 | 60 | 100 | 2 | ESC |
|  | **Total** | **20** | **3** | **12** | **360** | **540** | **900** | **26** |  |

L – Lecture; T – Tutorial: P – Practical

**II YEAR I SEMESTER**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods per week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | CS/IT/ECEE/EI/ME211 | Mathematics-III | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 2. | EE/EC 212 | Network Theory | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE/EC 213 | Electronics Devices & Circuits | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 4. | EE/EC 214 | Digital Electronics | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 5. | EE 215 | Electromagnetic field Theory | 4 | 1 | - | 40 | 60 | 100 | 3 |
| 6. | EE 216 | DC Machines | 4 | 1 | - | 40 | 60 | 100 | 3 |
| 7. | EE 251 | DC Machines Lab | - | -- | 3 | 40 | 60 | 100 | 2 |
| 8. | EE 252 | Networks Lab | - | - | 3 | 40 | 60 | 100 | 2 |
| 9. | EE 253 | EDC Lab | -- | - | 3 | 40 | 60 | 100 | 2 |
|  | Total |  | 24 | 6 | 9 | 360 | 540 | 900 | 28 |

L – Lecture; T – Tutorial: P – Practical

**II Year II-Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods per week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | EE/EC 221 | Mathematics-IV | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 2. | EE/EC 222 | Electronics Circuit Analysis | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE223 | Data Structures Using C++ | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 4. | EE 224 | Network Analysis and Synthesis | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 5. | EE 225 | Generation of Electrical Power | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 6. | EE 226 | AC Machines | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 7. | EE 261 | AC Machines Lab-I | - | -- | 3 | 40 | 60 | 100 | 2 |
| 8. | EE 262 | Data Structures Lab | - | - | 3 | 40 | 60 | 100 | 2 |
| 9. | EE 263 | English communication skill& soft skills lab (Audit) | -- | - | 3 |  |  |  | 0 |
|  | Total |  | 24 | 6 | 9 |  |  |  | 28 |

L – Lecture; T – Tutorial: P – Practical

**III Year I-Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods per week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | EE/EC 311 | Linear Control Systems | 3 | - | - | 40 | 60 | 100 | 4 |
| 2. | EE/EC 312 | Linear Integrated Circuits & Analysis | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE/EC 313 | Pulse Circuits | 4 | - | - | 40 | 60 | 100 | 4 |
| 4. | EE 314 | Professional Ethics and Human values | 3 | 1 | - | 40 | 60 | 100 | 0 |
| 5. | EE 315 | Transmission & Distribution | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 6. | EE 316 | Synchronous & Special Machines | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 7. | EE 351 | AC Machines Lab - II | - | -- | 4 | 40 | 60 | 100 | 2 |
| 8. | EE 352 | Pulse& Electronic Circuits Lab | - | - | 4 | 40 | 60 | 100 | 2 |
| 9. | EE 353 | Control Systems Lab | -- | - | 4 | 40 | 60 | 100 | 2 |
|  | Total |  | 22 | 4 | 12 | 360 | 540 | 900 | 26 |

L – Lecture; T – Tutorial: P – Practical

**III Year II-Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.No | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods/week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | EE 321 | Electrical Measurements & Instrumentation | 4 | 1 | - | 40 | 60 | 100 | 3 |
| 2. | EE/EC 322 | Microprocessors& Microcontrollers | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE/EC 323 | Digital Signal Processing | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 4. | EE 324 | Power System Analysis & Stability | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 5. | EE 325 | Power Electronics | 3 | - | - | 40 | 60 | 100 | 4 |
| 6. | EE 326 | Elective –I (MOOCS) | 3 | - | - | 40 | 60 | 100 | 3 |
| 7. | EE 361 | Microprocessors& Microcontrollers Lab | - | -- | 4 | 40 | 60 | 100 | 2 |
| 8. | EE 362 | Power Electronics Lab | - | - | 4 | 40 | 60 | 100 | 2 |
| 9. | EE 363 | Electrical Measurements Lab | -- | - | 4 | 40 | 60 | 100 | 2 |
|  | Total |  | 22 | 4 | 12 | 360 | 540 | 900 | 28 |

L – Lecture; T – Tutorial: P – Practical

**IV Year I-Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods per week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | EE 411 | Industrial Management | 4 | - | - | 40 | 60 | 100 | 3 |
| 2. | EE 412 | Power Systems Operation and Control | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE 413 | Computer applications to Power Systems | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 4. | EE 414 | Switchgear & Protection | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 5. | EE 415 | New and Renewable Energy Sources | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 6. | EE 416 | Elective – II  (Open) | 4 | 0 | - | 40 | 60 | 100 | 3 |
| 7. | EE 451 | Computer Applications to Electrical Systems Lab -I | - | -- | 3 | 40 | 60 | 100 | 2 |
| 8. | EE 452 | Power Systems Lab | - | - | 3 | 40 | 60 | 100 | 2 |
| 9. | EE 453 | Project and Internship Seminar | -- | - | 4 | 40 | 60 | 100 | 2 |
|  | Total |  | 24 | 5 | 10 | 360 | 540 | 900 | 28 |

L – Lecture; T – Tutorial: P – Practical

**IV Year II-Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Course Details** | | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| **Code No.** | **Subject Name** | **Periods/week** | | | **Maximum Marks** | | **Total Marks** |
| **L** | **T** | **P** | **Internal** | **External** |
| 1. | EE 421 | Industrial Drives | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 2. | EE 422 | Utilization of Electrical Energy | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 3. | EE 423 | Elective-III | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 4. | EE 424 | Elective -IV | 4 | 1 | - | 40 | 60 | 100 | 4 |
| 7. | EE 461 | Computer Applications to Electrical Systems Lab -II | - | -- | 3 | 40 | 60 | 100 | 2 |
| 8. | EE 462 | Project Work | - | - | 12 | 80 | 120 | 200 | 10 |
|  | Total |  | 16 | 4 | 15 | 280 | 420 | 700 | 28 |

L – Lecture; T – Tutorial: P – Practical

**Elective – I**

EE326/1: Massive Open Online Courses

**Elective – II (Open)**  (Note: Offered to other Branches)

EE416/1: Renewable Energy Sources

EE416/2: Utilization of Electrical Power

**Elective-III**

EE423/1: HVDC Transmission

EE423/2: Electrical Distribution Systems

EE423/3: Digital Control Systems

EE423/4: Computer Organization

EE423/5:Computer Networks

**Elective – IV**

EE424/1: FACTS Controllers

EE424/2:EHV AC Transmission

EE424/3: Database Management Systems

EE424/4: Embedded Systems & VLSI

EE425/5: ANN and Fuzzy Systems

**Note**: All End Examinations (Theory and Practical) are of three hours duration.

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 111** | **MATHEMATICS – I** | | **4** | **1** | **0** | **100** | **4** |

**Unit-I**

**Matrices:** Rank of a matrix, Consistency of linear system of equations, Linear transformations, vectors, Linear dependence, Eigen values and Eigen vectors, Properties of eigen values, Cayley- Hamilton theorem (without proof), Reduction to diagonal form, reduction of Quadratic form to canonical form, Complex matrices.

**Unit-II**

Rolle’s Theorem( without proof), Lagrange’s Mean value theorem ( without proof), Taylor’s theorem (without proof), Expansions of functions: Maclaurin’s series, Taylor’s series, Maxima and Minima of functions of two variables, Lagrange’s method of undetermined multipliers, Principle of least squares, method of least squares, fitting of other curves.

**Unit-III**

Double integrals, Change of order of integration , Double integrals in polar coordinates, Area enclosed by plane curves, Triple integrals, Change of variables, Beta function, Gamma function, Relation between beta and gamma functions, error function.

**Unit-IV**

Fourier Series: Introduction and Euler’s formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Even and Odd functions, Half range series, Typical wave forms and Parseval’s formulae, Complex form of the Fourier series.

**Text book**

1]. Higher Engineering Mathematics by B.S. Grewal, 43rd Edition, Khanna publishers, New

Delhi.

**Reference books:**

[1]. Advanced Engineering Mathematics by kreyszig.

[2]. Engineering Mathematics by Babu Ram

[3] Engineering Mathematics– I BYN.P. Bali, Satyanarayana Bhavanari and Indrani Kelker Laxmi publications, New Delhi.

[4]Mathematical Foundations for Computer Sciences- by Satyanarayana Bhavanari, Pradeep Kumar T.V, Shaik Mohiddin shaw, BSP Publications.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 112** | **ENGINEERING PHYSICS - I** | | **3** | **1** | **0** | **100** | **3** |

**UNIT-I**

Ultrasonics **12 Periods**

Production of Ultrasonics by Piezo electric oscillator method, Detection by Acoustic grating method, Applications - Pulse echo technique, ultrasonic imaging and some general applications.

Interference

Stokes principle (Phase change on reflection), Interference in thin films due to reflected light (Cosine law), Newton’s rings experiment – Determination of radius of curvature, Michelson’s interferometer: Principle, construction working and its application (Determination of wavelength of monochromatic source).

**UNIT-II 10 Periods**

Diffraction – Single slit (Qualitative and quantitative treatment).

Polarisation – Polarisation by reflection, Refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and half wave plate, circular and elliptical polarization and detection.

**UNIT-III 14 Periods**

**Lasers**: Laser characteristics, Spontaneous and Stimulated emissions, Basic requirements of a laser, Population inversion – Solid state laser (Ruby laser), Gas (He-Ne) laser, Semiconductor (GaAs) laser, Applications of lasers.

**Holography**: Principle, recording, reproduction and applications.

**Fiber optics:** Structure of optical fiber, Types of optical fibers, Numerical aperture, Fiber optics in communications and advantages.

**UNIT –IV 14 Periods**

Electricity and Magnetism

Gauss’s law in electricity (statement & proof), Coulomb’s law from Gauss law, Gauss law for magnetism, Faraday’s law of electromagnetic induction, Lenz’s law, Self Inductance, Mutual inductance, energy stored in a magnetic field, Displacement current, Maxwell’s equations (qualitative treatment), electromagnetic wave equation and Velocity, A.C. circuit containing series LCR circuit (resonance condition).

**TEXT BOOKS:**

1. Engineering Physics - R .K. Gaur & S. L. Gupta ,DanpatiRai Publications, Delhi, 2001.

2. Engineering Physics - Hitendra K. Malik &A.K.Singh, Tata MacGraw Hill, New Delhi,2009.

**REFERENCE BOOKS:**

1. Fundamentals of Physics - Resnick&Halliday, John Wiley sons ,9th Edition.
2. Applied Physics-S. Mani Naidu, Pearson Publishers, Chennai
3. Engineering Physics - M.Arumugam, Anuradha Publications, Chennai ,5thEdition , 2006.
4. Engineering Physics - B. K. Pandey& S. Chaturvedi, CengageLearningIndia Pvt. Ltd., Delhi.

**5.** Engineering Physics, D.K. Bhattacharya and PoonamTandon, oxford university Press,

New Delhi

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 113** | **ENGINEERING CHEMISTRY – I** | | **3** | **1** | **0** | **100** | **3** |

**UNIT-I: WATER TECHNOLOGY**

Various impurities of Water, WHO guidelines, Hardness unit sand determination by EDTA method (simple problems), water treatment for drinking purpose-sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Water treatment for industrial purpose: Boiler troubles, scales, sludges, caustic Embrittlement, boiler corrosion, priming and foaming- causes and prevention, Internal conditioning -Phosphate, Calgon and carbonate treatment, External conditioning-Lime Soda process (simple problems), softening by ion exchange process, Desalination of brackish water by electro dialysis and reverse osmosis.

**UNIT-II: ELECTROCHEMICAL ENERGY SYSTEMS**

Primary and Secondary batteries, Reserve batteries, Solid state and molten solvent batteries, Recent technological trends, Lithium ion batteries, Nanostructured electrode materials, Lithium and carbon based nanomaterials and nanocomposites, Solid-state Lithium ion batteries, Energy storage and backup. Fuel cells, Scientific prospects of fuel cells, Electrochemistry, In-situ and ex-situ electrochemical characterizations, Current-Voltage measurement, Current Interrupt measurements, Porosity, BET surface area analysis, Gas permeability, Hydrogen as future fuel, Alkaline-, acid- and molten carbonate-fuel cells, Solid oxide fuel cells.

**UNIT-III: CORROSION AND ITS PREVENTION**

Introduction, electrochemical theory of corrosion,drycorrosion, corrosion due to differential aeration, Types of corrosion-galvanic corrosion (galvanic series), Pitting, Stress and microbiological corrosion, Factorsaffecting corrosion-oxidizers, pH, over voltage and temperature.

Protection methods: Cathodic protection, (Impressed current and sacrificial anode) anodic protection, corrosion inhibitors- types and mechanism of inhibition

**UNIT-IV: POLYMERS**

Monomer functionality, degree of polymerization, Tacticity, classification of polymerization- addition, condensation and co-polymerization, mechanism of free radical polymerization.

Plastics- Thermoplastic and thermosetting resins, preparation, properties and uses of Bakelite, and PVC. Compounding of plastics.

Conducting polymers: Polyacetylene, mechanism of conduction, examples and applications.

Rubber- Processing of latex, Drawbacks of natural rubber- Vulcanization, Synthetic rubbers- Buna-S and Buna-N.

**Prescribed Text Books**

1. Engineering Chemistry, P.C. Jain and M. Jain - DhanapathiRai& Sons, Delhi

2. A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi

3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut

4. Shashichawla,A text book of engineering chemistry,3rdEdition,Dhanpatrai& co new delhi,2007.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 114** | **BASIC MECHANICAL SCIENCES** | | **4** | **0** | **0** | **100** | **3** |

**Unit – I**

**Transmission of Motion and Power**

Introduction, Methods of drive, Power transmission elements, shaft and axle, Belt-drive, Pulleys, Power transmitted by a belt, Chain drive, Friction drive, Gear drive

**Governors**

Introduction, Speed Control, Types of Governors, Watt Governer, Porter Governer, HartnellGoverner

**Unit – II**

**Basic Thermodynamics:** Work, Power, Energy, Heat, Temperature, Mechanical equivalent of heat, Internal energy, Enthalpy, Entropy, Efficiency, Statements of Zeroth law, First Law and Second Law of Thermodynamics

**Internal Combustion Engines**

Introduction, Classification, Engine details, Otto four-stroke cycle, Diesel-four-stroke cycle, Difference between Otto cycle and Diesel cycle, Two-stroke cycle, Difference between two-stroke and four-stroke cycles, Indicated Power (ip), Brake Power (bp),Efficiencies

**Unit – III**

**Steam Boilers**

Introduction, Classification, Simple vertical boiler, Vertical multi tubular boiler, Cochran type, Lancashire boiler, Locomotive boiler, Babcock and Wilcox boiler, High pressure boilers, Boiler details, Boiler performance. Functioning of different mountings like Pressure guage, Water level indicator, Safety Valve etc. and Accessories like Feed Pump, Injector, Economizer, Steam trap etc.

**Refrigeration & Air Conditioning**

Introduction, Refrigerant, Types of refrigerators, Vapor compression refrigerating system, Window and split-air conditioners.

**Unit – IV**

**Pumps**

Introduction, reciprocating pump types, operation, Air Chamber, Centrifugal pumps types, Priming, Rotary pumps.

**Air Compressors**

Introduction, Uses of Compressed air, Reciprocating compressors, Operation of a compressor, Work for compression, Power required, Reciprocating compressor efficiency, multistage reciprocating compressors, Rotary compressors.

**TEXT BOOKS**

1. Elements of Mechanical Engineering , by Rajput ,Laxmi Publications, New Delhi
2. Elements of Mechanical Engineering by K.P. Roy , Media Promoters
3. Thermal Engineering – by Rajput, Laxmi Publications, New Delhi
4. Theory of Machines , by R.S. Khurmi& Gupta, S.Chand Publishers
5. Elements of Mechanical Engineering -- by K.P. Roy , Media Promoters

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 115** | **ENVIRONMENTAL SCIENCE AND ENGINEERING** | | **3** | **0** | **0** | **100** | **3** |

**UNIT-I**

**Introduction:**

Definition, Scope and Importance.

**Natural Resources:**

Forest Resources – Use and over-exploitation, Deforestation, Mining, dams and their effects on forests and tribal people; Water Resources – Use and over-utilization of surface and ground water, floods and droughts, Water logging and salinity, Dams – benefits and problems, Conflicts overwater; Energy resources – Energy needs, Renewable and non-renewable energy sources; Land resources – Land as a resource, land degradation, soil erosion & desertification, Effects of modern agriculture on land resources.

**Ecosystems:**

Definition, Structure and functions of an Ecosystems, Biogeochemical cycles-water, carbon ,nitrogen and water cycles, Types-Forest, Greenland, Desert, Aquatic ecosystem.

**UNIT-II**

**Biodiversity and its Conservation:**

Definition, Value of biodiversity. Bio-geographical classification of India, India as a mega-diversitynation, Hot-spots of biodiversity, Threats to bio-diversity, Endemic and endangered species of India, Conservation of biodiversity.

**Environmental Pollution:**

Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine

Pollution, Noise pollution, Thermal pollution, nuclear pollution, Solid waste management.

**UNIT-III**

**Social Issues and Environment:**

From unsustainable to sustainable development, Population growth and environment, Green revolution, Rain water harvesting, watershed management, cloud seeding, Resettlement and Rehabilitation of people - problems and concerns, Environmental Impact Assessment.

**Climate Changes:**

Global warming &Greenhouse effect, Acid rain, Ozone layer depletion.

**UNIT-IV**

**Environmental acts:**

Prevention and Control of Water pollution & Air Pollution act, Environmental protection act, Wildlife protection act, Forest Conservation act.

**International Conventions:**

Stockholm Conference 1972, Earth Summit 1992. Copenhagen Summit 2009.

**Case Studies:**

Chipko movement, Narmada Bachao Andolan, Silent Valley Project, Madhura Refinery and TajMahal, Chernobyl Nuclear Disaster, Ralegaon Siddhi, Florosis and Bhopal Tragedy.

**Field work:**

Visit to a local area to document environmental assets – river/ forest/ grassland / hill /mountain. Study of local environment-common plants, insects, birds. Study of simple ecosystems – pond, river, hill, slopes etc. Visits to industries, water treatment plants, effluent treatment plants.

**Text Books**

1. Environmental Studies, by Dr. Suresh K. Dhameja, Published by S.K. Kataria& Sons,

Ludhiana.

**Reference Books**

1. Environmental studies by AnubhaKaushik and C.P.Kaushik., New Age International

Publishers, New Delhi.

2. T Benny Joseph, Environmental Studies, the Tata McGraw-Hill Publishing Company

Limited, New Delhi.

3.Environmental chemistry by A.K.De.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 116** | **BASIC ENGLISH FOR ENGINEERS** | | **3** | **1** | **0** | **100** | **4** |

**UNIT-1:**

1. Listening Skills: The boy who broke the bank (English and Soft Skills)

2. Sonnet - To Science (The Siren’s Song)

3. Vocabulary Building: One-Word Substitutes, Words Often Confused

4. Reading Comprehension

**UNIT- II:**

1. Written Communication Skills: Gateman's Gift (English and Soft Skills)

2. Work without Hope (The Siren’s Song)

3. Grammar: Correction of Sentences

4. Writing: Letter Writing-- Formal and Informal Letters

**UNIT - III:**

1. Assertive Skills: The Verger (English and Soft Skills)
2. Seven Ages of Man (The Siren’s Song)

3. Writing: Note- Taking, Note-Making

4. Paragraph Writing: Technical Description-Process, Object

**UNIT - IV:**

1. Teamwork Skills: Whitewashing the fence (English and Soft Skills)

2. Ozymandias (The Siren’s Song)

3. Vocabulary Building: Idioms

4. Writing: Essay Writing

**TEXTBOOKS:**

1. S.P.Dhanavel, *English and Soft Skills*, New Delhi: Orient Black Swan Pvt. Ltd., 2013.

2. David Murdoch, *The Siren’s Song: An Anthology of British and American Verse*, Madras, Orient Longman, 1993.

3. V.R.Narayanaswami, *Strengthen Writing 3rd Edition* New Delhi: Orient Blackswan Private Ltd., 2009.

**REFERENCE BOOKS:**

1. Dr. ShaliniVerma, *Word Power Made Handy*, S.Chand& Co Ltd., 2009.
2. Sharon J.Gerson, Steven M.Gerson, *Technical Writing*, New Delhi: Pearson education, 2007.
3. Sanjay Kumar and PushpLata, *Communication Skills*, Noida: Oxford University Press, 2012.
4. M. Ashraf Rizvi, *Effective Technical Communication,* New Delhi: Tata Mc-Grew Hill, 2009.

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 151** | **ENGINEERING PHYSICS LAB** | | **0** | **0** | **3** | **100** | **2** |

1. Bikram K. Das, KalyaniSamantray, RathNayak, SusmitaPani&SaveetaMohanty, *An Introduction to Professional English and Soft Skills,* New Delhi: Foundation Books, 2009.

**Any 10 experiments from the following list**

**LIST OF EXPERIMENTS**

1. Compound pendulum –Determination of acceleration due to gravity (g)
2. Interference fringes - measurement of thickness of a foil / diameter of Wire using wedge method.
3. Sensitive galvanometer - Determination of figure of merit
4. Newton’s rings – Measurement of radius of curvature of plano convex lens
5. Lissajous' figures –Calibration of an audio oscillator
6. Photo cell – I-V Characteristic curves and determination of stopping potential
7. Diffraction grating – Measurement of wavelengths
8. Torsional pendulum- Determination of rigidity modulus of the wire material.
9. Carey- Foster’s bridge: Determination of specific resistance/Temperature coefficient of resistance.
10. Photo voltaic cell - Determination of fill-factor
11. Variation of magnetic field along the axis of a current carrying circular coil.
12. Series l LCR resonance circuit - Determination of "Q" factor.
13. Thomson’s method - determination of e/m of an electron.
14. Determination of a.c. Frequency – Sonometer.
15. Prism/Grating - Determination of dispersive power.
16. To determine the wavelength of Laser source.
17. Hall effect – Determination of Hall coefficient.
18. Determination of energy band gap.
19. Determination of Numerical Aperture of an optical fiber.
20. Determination of Amplitude and Frequency of an AC signal using a CRO.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 152** | **ENGINEERING GRAPHICS** | | **2** | **0** | **4** | **100** | **2** |

**Unit – I**

**General:** Use of Drawing instruments, Lettering.-Single stroke letters, Dimensioning- Representation of various type lines. Geometrical Constructions. Representative fraction, Scales.-Plain Scales, Diagonal Scales, Comparative Scales, Vernier Scales.

**Unit – II**

**Curves :** Curves used in Engineering practice - conic sections - general construction and special methods for ellipse, parabola and hyperbola. cycloid, epicycloids, hypocycloid involute of circle and Archemedian Spiral.

**Unit – III**

**Method of Projections:** Principles of projection - First angle and third angle projection of

Points. Projection of Straight lines. Traces of lines. (Limited to first angle projection only)

**Projections of Planes:** Projections of planes, projections on auxiliary planes.

**Unit – IV**

**Projections of Solids:** Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

**Sections Of Solids:** Sections of Cubes, Prisms, Pyramids, cylinders and Cones, true shapes of sections. (Limited to the Section Planes perpendicular to one of the Principal Planes).

**Unit - V(Demonstration only).**

**Computer Aided Drafting (using any Standard Package):** Setting up a drawing, starting main menu (New, Open Save, Save Asetc), Opening Screen error correction on screen units, co-ordinate system, limits, grid, snap, ortho.

Tool bars: Draw tool bar, object snap, tool bar, modify tool bar, dimension tool bar

**TEXT BOOK:**

• Engineering Drawing by N.D. Bhatt & V.M. Panchal. (Charotar Publishing House,Anand).

**REFERENCE BOOK:**

• Engineering Drawing by Prof.K.L.Narayana& Prof. R.K.Kannaiah. SciTech Publisher.

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| **CS/IT/EC/EE/EI 153** | **ENGLISH COMMUNICATION LAB** | | **0** | **0** | **3** | **100** | **2** |

Module-l: Communication Skills

1. Types of Communication
2. Barriers to Communication
3. Strategies for Effective Communication
4. Verbal Communication Skills
5. Non- verbal Communication Skills

Module-2: Advanced Vocabulary

1. Word List (GRE & TOEFL related)
2. Catchphrases
3. Idioms

Module-3: Employability Skills

1. Interview Skills
2. Group Discussion
3. Debate
4. Resume Writing

Module-4: Telephonic Skills

a) Formal &Informal interaction

b) Receiving Messages & Complaints

c) Tone modulation

Module-5: Descriptive Skills

1. Process Description
2. Picture Description
3. Narration
4. Email Etiquette

Module-6: Behavioural Skills

1. Dress code & Conduct
2. Personality Development
3. Team Work
4. Motivation
5. Organization Skills

**Suggested Software:**

1. Globerena Software
2. K-Van Solutions Software
3. Centronix Software
4. Clarity English Software
5. Train 2 Success- CD Series (Zenith Global Consultancy)

**Suggested List of Tasks:**

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| --- | --- |
| **Module 1** | 1. Tips for effective communication 2. Videos can be shown to make the students learn the importance of non-verbal communication |
| **Module 2** | 3. Number of Worksheets will be given on Vocabulary enhancement  4. By conducting Quiz |
| **Module 3** | 1. Mock Interviews can be conducted 2. Peer Discussions can be conducted |
| **Module 4** | 1. Listening to Mock-Telephoning Skills 2. Role Plays can be conducted on telephonic conversations |
| **Module 5** | 1. Pictorial descriptions 2. Narrating situations/stories |
| **Module 6** | 1. Tips to improve personality development 2. Case studies on team work and organizational skills |

**NOTE:** 10 Lab Activities are minimum in Record.

**Reference Books:** Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. *Communicate to Conquer: A Handbook of Group Discussions and Job Interviews* with CD, PHI Publications.
2. *The ACE of Soft Skills: Attitude, communication and Etiquette for Success*, by Pearson Publications.
3. LeenaSen, *Communication Skills2nd Edition*, PHI, 2007.
4. Stephen P. Robbins and Timothy A. Judge, *Organizational Behavior13th Edition*, PHI, 2009.
5. Meenakshi Raman and Prakash Singh, *Business Communication*, Oxford University Press, 2006.
6. Sanjay Kumar and PushpLata, *Communication Skills,* Oxford University Press, 2011.
7. Dr. ShaliniVerma, *Word Power Made Handy*, S.Chand& Co Ltd., 2009.

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| **CS/IT/EC/EE/EI 121** | **MATHEMATICS -II** | | **4** | **1** | **0** | **100** | **4** |

**Unit-I**

Ordinary differential equations (first order): Introduction, variables separable equations, Linear equations, Bernoulli’s equations, Exact equations, equations reducible to exact equations, Orthogonal trajectories, Newton’s law of cooling, Rate of Decay of Radio-Active Materials.

**Unit-II**

Ordinary differential equations (higher order): Linear Differential equations: Definition, Theorem, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral, Working procedure to solve the equation, Linear dependence of solutions, Method of variation of parameters, Equations reducible to linear equations, Cauchy’s homogeneous linear equation, Legendre’s linear equation, Simultaneous linear equations with constant coefficients**.**

**Unit-III**

Laplace Transforms : Introduction, Transforms of elementary functions, Properties of Laplace Transforms, existence conditions, Transforms of derivatives, Integrals, multiplication by tn , division by t, Evaluation of integrals by Laplace Transforms, Inverse transforms, convolution theorem, Application to Differential equations with constant coefficients, transforms of unit step function, unit impulse function, periodic function.

**Unit-IV**

**Vector Calculus**: Scalar and vector point functions, Del applied to scalar point functions. Gradient, Del applied to vector point functions, Physical interpretation of divergence, Del applied twice to point functions, Del applied to products of point functions, Integration of vectors, Line integral, Surfaces, Green’s theorem in the plane (without proof), Stoke’ s theorem (without proof), Volume integral, Gauss divergence Theorem (without proof),.

Text book

1]. Higher Engineering Mathematics by B.S. Grewal, 43rd edition, Khanna publishers, New

Delhi.

**Reference books:**

[1]. Advanced Engineering Mathematics by kreyszig.

[2]. Engineering Mathematics by Babu Ram.

[3] Engineering Mathematics– I BYN.P. Bali, SatyanarayanaBhavanari and Indrani Kelker Laxmipublications, New Delhi.

[4]Mathematical Foundations for Computer Sciences- by Satyanarayana Bhavanari, Pradeep Kumar T.V, Shaik Mohiddin shaw, BSP Publications

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| **CS/IT/EC/EE/EI 122** | **ENGINEERING PHYSICS -II** | | **3** | **1** | **0** | **100** | **3** |

**Unit-I 12 Periods**

**Principles of Quantum Mechanics**

# Dual nature of light, Matter waves & properties, de Broglie’s concept of matter waves, Davisson and Germer experiment, Heisenberg’s uncertainty principle and applications (non-existence of electron in nucleus). One dimensional time independent Schrodinger’s wave equation, Physical significance of the wave function, Particle in a box (one dimensional).

**Unit-II 12 Periods**

**ELECTRON THEORY OF METALS**: Classical free electron theory - Mean free path - Relaxation time and drift velocity - Quantum free electron theory - Fermi - Dirac (analytical) and its dependence on temperature - Fermi energy, Hall effect and its uses.

**BAND THEORY OF SOLIDS**: Bloch theorem (qualitative) - Kronig - Penney model - Origin of energy band formation in solids - Classification of materials into conductors, semi- conductors & insulators -Concept of effective mass of an electron.

**Unit-III 12 Periods**

**Dielectric and Magnetic Materials**

Electric dipole moment, polarization, dielectric constant, polarizability, types of polarizations, internal fields (qualitative), Clausius-Mossotti equation, Frequency dependence of polarization, Ferroelectrics and their applications.

Origin of magnetic moment of an atom, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, Hysteresis curve, soft and hard magnetic materials, Ferrites and their applications.

**UNIT –IV**

**Advanced Materials of Physics 14 Periods**

**Optoelectronic devices:** Qualitative treatments of Photo diode, LED and LCD; Solar cell and its characteristics.

# Superconductivity: First experiment, critical parameters (Tc, Hc, Ic), Meissner effect, types of superconductors, BCS Theory (in brief) and Applications of superconductors.

**NanoTechnology** : Introduction to nano materials, nano scale, surface to volume ratio, fabrication of nanomaterials, sol-gel and chemical vapour deposition methods, Carbon nano tubes-preparation and properties (thermal, electrical and mechanical - in brief), some applications of nanomaterials.

**TEXT BOOKS**

1. Engineering Physics - R .K. Gaur & S. L. Gupta ,DanpatiRai Publications, Delhi, 2001.

2. Engineering Physics – V. Rajendran, Tata MacGraw Hill, New Delhi, 2009.

**REFERENCE BOOKS**

1. Engineering Physics-P.K. Palanisamy, Scitech Publications PVT. Ltd, New Delhi
2. Engineering Physics – M.R. Srinivasan, New age International Publishers, New Delhi
3. Materials science – M.Vijaya and G.Rangarajan, TMH, New Delhi
4. Engineering Physics, D.K. Bhattacharya and PoonamTandon, Oxford university Press,

New Delhi

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| **CS/IT/EC/EE/EI 123** | **ENGINEERING CHEMISTRY - II** | | **3** | **1** | **0** | **100** | **3** |

**UNIT-I: CHEMISTRY OF NANOMATERIALS**

Introduction to nano chemistry, preparation of nano materials - carbon nanotubes and fullerenes and their engineering applications.

**UNIT-II: INSTRUMENTAL METHODS OF ANALYSIS**

Basic principles, instrumentation and applications of UV-Visible, Infra-Red, Nuclear Magnetic Resonance (NMR), Gas Chromatography and High Performance Liquid Chromatography.

**UNIT-III: SOLID STATE CHEMISTRY**

Band theory of solids, types of semiconductors, preparation of semiconductors and semiconductor devices.

**UNIT-IV: SOLAR ENERGY HARNESSING**

Fundamentals, Conversion into electrical energy, Photovoltaic and Photogalvanic energy storage, Semiconductor photoelectrochemical cells, Photoelectrochemical reactions, Regenerative photoelectrochemical cells, Basic problems, Photocorrosion and protection of semiconductor electrodes, Protective coatings, Coatings of metals and electrically conductive polymers, Electrodes with chemically modified surfaces.

**Prescribed Text Books**

1. Engineering Chemistry, P.C. Jain and M. Jain – DhanapathRai& Sons, Delhi

**2.** Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University

press.

3. Text book of engineering chemistry, Shasichawla,Dhanapathrai&sons,Delhi.

4. Gurudeep raj &chatwalanand , “Instrumental methods of analysis “, 7thedition,CBS publications,1986.

5. Quantitative analysis by day&underwood.

6.A Text book of Instrumental methods by Skoog and West.

7. H.W. Wilard and demerit, “Instrumental methods of analysis “, 7thedition,CBS publications,1986.

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| **CS/IT/EC/EE/EI 124** | **BASIC ELECTRICAL AND ELECTRONIC SCIENCES** | | **4** | **0** | **0** | **100** | **3** |

**UNIT – I**

**Basic concept components and Electrical Circuits**: The unit of charge, voltage, current, power and energy. Circuit elements, circuit concept, Kirchhoff’s voltage law and Kirchhoff’s current law applied to simple series and parallel circuits.

**Alternating currents:** Definition of Peak value, RMS value, Average value, Peak factor and Form factor of Alternate current, Behaviour of Resistance, Inductance and Capacitance to Sinusoidal voltage.

Vector and J-notation as applied to the resolution of AC circuit, Vector diagrams, Single-phase series, and Parallel and Series-parallel circuits to sinusoidal excitation. Calculation of Active, Reactive and Complex power and Power factor.

**UNIT-II**

**Polyphase circuits**: 3-phase supply, star-delta connections, Voltage, Current and Power relationships.

**Electromagnetic Induction:** Introduction – Electromagnetic Induction – Faraday’s Laws of Electromagnetic Induction –Direction of Induced EMF and current – Induced EMF – Dynamically induced EMF –Statically induced EMF – Self Inductance – Mutual Inductance - Coefficient of coupling –Inductances in Series – Inductances in parallel – Energy stored in a magnetic field.

**Measuring Instruments:** Classification of instruments, construction and Principle of operation of permanent magnetic moving coil, moving iron dynamo meter type wattmeter Induction Type Energy Meter. Principle of operation of DVMs and CROs.

**UNIT - III**

**Semiconductor Diodes:** Characteristics of Semiconductor junction Diode, Zener diode transistor, JFET, UJT, SCR and their applications. Half-wave, full-wave rectifiers and Bridge rectifier, with (L and LC) and without filters, Zener Voltage Regulator and their applications.

**Bipolar Junction Transistor:** Transistor operation, Common base configuration, Common emitter configuration, Transistor amplifying action, Common collector configuration, Operating point, Principal and characteristics of JFET.

**UNIT - IV**

**AMPLIFIERS:** Need of biasing, Thermal runaway, Types of biasing-fixed bias, collectorbase bias, self-bias, CE amplifier, frequency response.

**Feedback and Oscillator Circuits:** Comment concepts, feedback connection types, Barkhausen criteria, Phase-Shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator.

**LEARNING RESOURCES**

**TEXT BOOKS:**

1. A.Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 3rd Edition, TMH, 2006.

2. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th Edition, PHI.

**REFERENCE BOOKS:**

1. Mahmood Nahvi and Joseph Edminister, Electric Circuits, 4th Edition, Schaum's outline series, TMH, 2004.

2. Electrical Technology, B.L.Theraja&A.K.Theraja, Volume – I & II

3. S.Salivahanan, A.Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill Publishers

4. N.N.Bhargava&D.C.Kulshreshtha, "Basic Electronics", Tata McGrawHill Publishers

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| **CS/IT/EC/EE/EI 125** | **PROBLEM SOLVING USING C** | | **3** | **1** | **0** | **100** | **3** |

**UNIT-1 (16 Periods)**

Computer Basics: The Computer System, Generations of Computer, Classification of Computer, Block diagram of digital Computer, Inside the Computer-Processor, Memory, External Ports, PCI Card, Formatting Hard disk, Understanding BIOS, BIOS Commands, Algorithm, Flowchart, Programming Paradigms.

C-Basics: C-character set, Data types, Constants, Expressions, Structure of C program, Operators and their precedence & associatively, Simple programs in C using all the operators, Type casting, type coercion.

**UNIT-II (16 Periods)**

Control Structures, Basic input and output statements, Preprocessor directives.

Functions: Concept of a function, passing the parameters, automatic variables, scope and extent of variables, storage classes, recursion, iteration vs recursion, types of recursion, Simple recursive and non-recursive programs, Towers of Hanoi problem.

**UNIT-III (16 Periods)**

Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation.

Pointers: Pointers declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.

**UNIT-IV (16 Periods)**

Structures: Declaring and using structures, operations on structures, structures and arrays, user defined data types, pointers to structures. Command line arguments.

Files: Introduction, file structure, file handling functions, file types, file error handling, Programs using file functions.

**Text Books:**

1. Programming with C-Gottfried-Schaums Outline Series-TMH
2. C Programming – AnithaGoel/Ajay Mittal/E.Sreenivasa Reddy-Pearson India

**References :**

1. Problem Solving with C- Somasekharan-PHI.

2. C Programming- Behrouz A forouzan – CENGAGE Learning

3..Test your c skills-Yaswanthkanithker

4.Let us C- Yaswanthkanithker

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| **CS/IT/EC/EE/EI 126** | **ADVANCED ENGLISH FOR ENGINEERS** | | **3** | **0** | **0** | **100** | **4** |

**UNIT-1:**

1. Learning Skills: Three Questions (English and Soft Skills)

2. The Human Seasons (The Siren’s Song)

3. Vocabulary Building: Root Words (100)

4. Writing: Data Interpretation (IELTS Model)

**UNIT- II:**

1. Problem - Solving Skills: (English and Soft Skills)

2. On His having arrived at the Age of Twenty Three (The Siren’s Song)

3. Grammar: Text Completion (GRE Model)

4. Writing; Technical Reports (Factual Reports, Feasibility Reports, Survey Reports)

**UNIT - III:**

1. Interview Skills: The lighthouse keeper of Aspinwall (English and Soft Skills)

2. Youth and Age (The Siren’s Song)

3. Grammar: Sentence Equivalence (GRE Model)

4. Analytical Writing: **Analyzing an Issue, Analyzing an Argument** (GRE Model)

**UNIT - IV:**

1. Adaptability Skills: Senor Payroll (English and Soft Skills)

2. The Marriage of True Minds (The Siren’s Song)

3. Vocabulary Building: Foreign Expressions (100)

4. Writing: Office Correspondences (Memos, Circulars, Notice, Agenda of a meeting)

**TEXTBOOKS:**

1. S.P.Dhanavel, *English and Soft Skills*, New Delhi: Orient Black Swan Pvt. Ltd., 2013.

2. David Murdoch, *The Siren’s Song: An Anthology of British and American Verse*, New Delhi: Orient Longman, 2012.

**REFERENCE BOOKS:**

1. B. Theodore, *Easy Way to Learn Difficult Words: The Unique English Etymology Dictionary,* Theos Publications, 2011.
2. Gill, Japinder. *Vacabulary Advantage*, Perason Publication, 2012.
3. Philip G.,*PearsonsEsential Words for GRE*, New Delhi :New Age International Publishers, 2012.

4. V.R.Narayanaswami, *Strengthen Writing 3rd Edition* New Delhi: Orient Blackswan Private Ltd., 2009.

5. Sharma C. *Business Correspondence & Report Writing,* Tata McGraw –Hill, 2002.

6. Kirkman, John .*Good Style: Writing for Science & Technology*, Routledge Study Guides,

7. Alec Fisher, *Critical Thinking An Introduction,* New Delhi: CUP, First South Asian Edition, 2011.

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| **CS/IT/EC/EE/EI 161** | **ENGINEERING CHEMISTRY LABORATORY** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Determination of purity of washing soda
2. Determination of alkalinity of water
3. Determination of iron from Mohr’s salt by permanganometry
4. Determination of iron from hematite by dichrometry
5. Determination of copper from brass by iodometry
6. Determination of available chlorine in bleaching powder.
7. Determination of hardness of water by EDTA method
8. Determination of tin and lead from solder by complex metric titrations
9. Determination of chloride by precipitation titration method
10. Determination of calcium by semi gravimetric method
11. Preparation of phenol-formaldehyde resin
12. Chemistry of blue printing

**DEMONSTRATION:**

1. Acid-Base titration by pH meter, conductivity meter and potentiometer
2. Determination of viscosity of viscosity of lubricating oil.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **CS/IT/EC/EE/EI 162** | **COMPUTER PRGRAMMING LAB** | | **2** | **0** | **6** | **100** | **2** |

**CYCLE-I Basics of Hardware and Software Exercises:**

1. Explore Mother Board components and Layouts, identifying external ports and interfacing, identifying PCI cards and interfacing.

2. Practice partitioning and formatting Hard disks.

3. Install and Uninstall system and application software.

4. Understand BIOS configuration.

5. Connect 2 or more computers in a LAN network.

6. Assembling a Computer and troubleshooting a Computer.

7. Study and practice of operating system commands

a. Study and practice of directory Related Utilities.

b. Study and practice of file and Text Processing Utilities.

c. Study and practice of disk, Compress and Backup Utilities.

d. Study and practice of Networking Utilities

**CYCLE-II Programming Exercises:**

**1.Exercises on data types and operators?**

a) Practice exercises 3.1 to 3.16 and 4.1 to 4.17 and 14.1 to 14.20 Test your C Skills - yaswanthkanitkar text book.

b) Write a program which determines the largest and the smallest number that can be stored in different data types of like short, int., long, float and double. What happens when you add 1 to the largest possible integer number that can be stored?

c) Write a program to find greatest of three numbers using conditional operator?

d) Write a program to swap two numbers with and without temp variable?

e) Practice a program using multiple unary increment and decrement operators in arithmetic

expressions?

**2. Exercises on control structures?**

a) Practice exercise 2.1 to 2.15 Test your C Skills - yaswanthkanitkar text book.

b)Write a program to find greatest of three numbers? Use nested if, if else if and switch statements?

c) Write a program to read marks of a student and print the sum and average? Display the grade based on the sum of marks?

e) write a program to count the digits of a number? Use for loop

f) Write a program to check whether a number is perfect or not? Use do-while

g) Write a program to check whether a number is strong or not? Use while

h) Write a program to check whether a number is amstrong or not? Use for

i) Write a program to check whether a number is palindrome or not? Use for

j) Write a program to find the Fibonacci series upto the given number? Use while

k) Write a program to print the pascals triangle? Used do-while

l) Write a program to print the result of the series 1+x^2/2+x^3/3+….+x^n/n

**3. Exercises on functions?**

a) Practice exercise 5.1 to 5.14 Test your C skills -yaswanthkanitkar text book.

b) Write program to swap two variables using functions?

Write a program to perform menu driven arithmetic operations using functions?

c) Write a program to find the factorial of a number using recursive and non- recursive functions?

d) Write a program to find the Fibonacci series using recursive functions?

e) Write a program to find the solution for towers of Hanoi using recursive function?

f) Write a program to pass parameters to a functions using call by value and call by reference?

4. **Exerciseson Arrays?**

a) Practice exercise 9.1 to 9.17 Test your C skills - yaswanthkanitkar text book.

b) Write a program to read n numbers and sort them?

c) Write a program to find the minimum and maximum numbers of the array?

d) Write a program to read two matrices and find their sum, difference and product of them?

e) Find the transpose of a matrix?

f) Write a program to print upper and lower triangle of a given matrix?

**5. Exercises on strings?**

a) Practice exercise 10.1 to 10.15 yaswanthkanitkar text book.

b) Write a program to demonstrate the use of string manipulation functions?

c) Write a program to compare two strings?

d) Write a program to sort the names in Alphabetical order?

6. **Exerciseson pointers?**

a) Practice exercise 7.1 to 8.26 yaswanthkanitkar text book.

b) Write a program to read dynamic array and sort the elements?

c) Write a program to read dynamic array and find the minimum and maximum of the elements?

d) Write a program to perform pointer arithmetic?

e) Write a program on pointers for strings?

f) Write a program to use array of pointers?

7. **Exerciseson structures?**

a) Practice exercise 11.1 to 11.30 yaswanthkanitkar text book.

b) Write a program to create student structure and read marks of three subjects and find the sum and total of the student?

c) Write a program on arrays of structures for 60 students’ record using the above student structure?

d) Write a program for complex structure? Perform addition, subtraction and multiplication of two complex numbers?

e) Write a program for addition and multiplication of two polinomials?

8. **Write a program on Files?**

a) Practice exercise 12.1 to 12.20 yaswanthkanitkar text book.

b)write a program to append content of a file?

c)Write a program to display the content of a file?

d)Write a program to copy content of one file to other file?

e)Write a program to count the no of characters in a file?

f)Write a program to compare the contents of two files?

**References:**

1. Test your C Skills by – YaswanthKanithkar-BPB Publishers
2. C programming; Testyour skills-A.N.Kamthane-Pearson India

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| **CS/IT/EC/EE/EI 163** | **WORKSHOP (IT)** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS**

PC Hardware

Task 1 :

Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2 :

Every student should disassemble and assemble the PC back to working condition. Lab

instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3 :

Every student should individually install MS windows on the personal computer. Lab instructor should verify the install ation and follow it up with a Viva.

Task 4 :

Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Hardware Troubleshooting:

Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the c omputer

back to working condition. The work done should be verified by the instructor and followed up with a Viva

Task 6 : Software Troubleshooting :

Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The

work done should be verified by the instructor and followed up with a Viva.

**Internet & World Wide Web**

Task 1

Orientation & Connectivity Boot Camp : Students should get connected to their Local Area

Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN

Task 2 : Web Browsers, Surfing the Web :

Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plugins like Macromedia Flash and JRE for applets

should be configured

Task 3

Search Engines &Netiquette :

Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This

should be demonstrated to the instructors by the student.

Task 4:

Cyber Hygiene:

Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install antivirus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Task 5:

Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

**Productivity tools LaTeX and Word**

Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS)

office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in each, using LaTeX and word Accessing, overview of toolbars

, saving files, Using help and resources, rulers, format painter.

Task 1 :

Using LaTeX and Word to create project certificate. Features to be covered:

Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 2:

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.

Task 3 :

Creating a Newsletter : Features to be covered: Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes,

Paragraphs and Mail Merge in word.

**EXCEL-**

Excel Orientation:

The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool

Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel –Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler

Features to be covered:-Gridlines, Format Cells, Summation, auto fill, Formatting Tex

Task 2: Calculating GPA -.Features to be covered:-

Cell Referencing, Formulae in excel –average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP,Sorting, Conditional formatting LaTeX and MS/equivalent (FOSS) tool

**Power Point**

Task1:

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 Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power point. Students will be given model power point presentation which needs to be replicated (exactly how it’s asked).

Task 2:

Second week helps students in making their presentations interactive. Topic covered during this week includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Chart.

Task 3:

Concentrating on the in and out of Microsoft power point and presentations in LaTeX. 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 –Back ground, textures, Design Templates, Hidden slides.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

2. LaTeX Companion Leslie Lamport, PHI/Pearson.

3. Introduction to Computers, Peter Norton, 6/e McGrawHillPublishers.

4. Upgrading and Repairing, PC’s 18, Scott Muller QUE, Pearson Education

5. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech

6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. CISCO Press, Pearson Education.

7. PC Hardware and A+Handbook Kate J. Chase PHI (Microsoft)

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| **CS/IT/EC/EE/EI /ME 211** | **MATHEMATICS – III** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

Partial Differential Equations:

Introduction - Formation of Partial Differential Equations - Solutions of a Partial Differential Equation- Equations solvable by direct Integration - Linear Equations of the first Order- Non-Linear Equations of the first Order- Charpits Method - Homogeneous Linear Equations with Constant Coefficients- Rules for finding The Complementary Function - Rules for finding the Particular Integral- Non – Homogeneous Linear equations.

**UNIT – II**

Integral Transforms:

Introduction- Definition – Fourier integrals – Fourier integral theorem (without proof)-Fourier sine and cosine integrals – complex form of Fourier integral - Fourier Transforms - Properties of Fourier Transforms - Finite Fourier sine and cosine transforms - Convolution theorem (without proof), Parseval's Identity for Fourier Transforms(without proof)

Numerical Solutions of Equations:

Introduction - Solution of Algebraic and Transcendental Equations - Bisection method-

Newton- Raphson Method - Solutions of linear Simultaneous Linear Equations: iterative

Methods - Gauss-Seidel Method.

**UNIT-III**

Finite Differences and Interpolation:

Finite Differences – Differences of a polynomial – factorial notation – relations between operators – Newton’s Interpolation formulae – central difference interpolation formulae - Gauss interpolation formulae – stirlings formula - interpolation with unequal intervals – Lagranges interpolation – inverse interpolation.

**UNIT-IV**

Numerical Differentiation and Integration:

Numerical Differentiation – Formulae for derivatives.

Numerical Integration: Trapezoidal rule - Simpson's one-third rule - Simpson's three-eighth.

Numerical Solution of Ordinary Differential Equations: Introduction – Picard’s Method- Euler's Method - Runge- Kutta Method of fourth order.

Numerical Solution of Partial Differential Equations: Introduction - Classification of second order equations

TEXT BOOK: 1. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers,

REFERENCE BOOKS:

2. N.P. Bali, A textbook of Engineering Mathematics, Laxmi publications

3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International (P) Ltd

4. Engineering Mathematics– I BYN.P. Bali, Satyanarayana Bhavanari and IndraniKelkerLaxmipublications, New Delhi.

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| **EE/EC/EI 212** | **NETWORK THEORY** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

Review of R,L,C and M (Mutual Inductance) and their V-I characteristics-dot rule-Energy Sources, Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and Current division; V-I characteristics of Passive elements and their series / parallel combination; Star Delta transformation

**Graph Theory:** Introduction to Graph Theory, Tree, Branch, Link, Cutset and loop matrices, relationship among various matrices and parameters, Mesh and Nodal Analysis for DC circuits.Formulation of mesh & nodal equations involving are R,L,C and M.

**UNIT – II**

**Review of sinusoidal analysis:** Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits.

Computation of active, reactive and complex powers; power factor.

First order R-L, R-C circuits, Initial conditions in RLC elements- initial conditions for complicated network-time constant-second order circuits (RLC series and parallel circuits)

**UNIT – III**

**Laplace Transforms:**

Laplace Transforms of typical signals, periodic functions, Inverse transforms, Initial and final value theorems, Application of Laplace transforms in circuit analysis.

**Transformed Network Analysis:**  Response of RL, RC, RLC circuits for impulse and pulse excitations using Laplace Transform method.

Definition of operational/ transformed impedances and admittances of L, C and transformer with initial conditions; development of transformed networks incorporating initial conditions as sources and solution of transformed networks;

**UNIT – IV**

**Network Theorems:** Superposition theorem, Thevenin’s and Norton’s theorems, Reciprocity, Compensation, Maximum power transfer theorems, Tellegan’s and Millman’s theorems, Application of theorems to DC circuits. Sinusoidal steady state Mesh and Node Analysis. Application of network theorems to AC circuits.

**Resonance:** Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, magnification, parallel resonance, resonant frequency, variation of impedance with frequency , Q factor, magnification, reactance curves in parallel resonance. Frequency response of RL, RC circuits.

**TEXT BOOKS:**

1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit

Analysis, 6thEdition,TMH, 2002.

2. M.E.Vanvalkenburg, Network Analysis, 3rd Edition, PHI, 2003.

3. A Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and

Synthesis, 4th Edition, TMH, 2010

**REFERENCE BOOKS:**

1. Franklin F.Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons, 2003.

2. Mahmood Nahvi and Joseph Edminister, Electric Circuits, 4th Edition, Schaum’s outline series, TMH, 2004.

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| **EE/EC 213** | **ELECTRONIC DEVICES AND CIRCUITS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT I**

**THE PN JUNCTION DIODE:** Basic Structure of the PN Junction, Biasing of PN Junction Diode, V-I characteristics of PN junction diode, Diode Current Equation, Effect of temperature on PN junction diodes, Static and Dynamic Resistances, Break Down of PN Junction Diode, Diffusion Capacitance, Transition Capacitance of The Diode, Diode Switching times, Piecewise Linear Diode Model.

**UNIT II**

**BIPOLAR JUNCTION TRANSISTOR (BJT):** Transistor Construction, Operation, Specification Sheet, Transistor Testing, Transistor Casing and Terminal Identification, Transistor Biasing, Operation of NPN and PNP transistor, Transistor as an Amplifier, Transistor configurations and their characteristics, Ebers Moll Model.

**UNIT III**

**TRANSISTOR BIASING AND STABILIZATION:** Need for Biasing, Operating Point, Load lines and Quiescent Point, Fixed Bias Circuit, Self Bias Circuit, Voltage Divider Bias Circuit, Collector to Base Bias Circuit Emitter Stabilized Bias Circuit, Bias Compensation using Diodes and Transistors Stabilization Factors, Stabilization against variations in VBE and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability, .

**UNIT IV**

**JFET BIASING:** Biasing Circuits for FET: Fixed Bias Circuit, Voltage Divider Bias Circuit, Self Bias Circuit, Graphical Solution for Self Bias.

**MOSFET:** Depletion MOSFET, Enhancement MOSFET, Comparison of BJT, JFET and MOSFET, Comparison of DMOSFET and EMOSFET, Biasing of MOSFET.

**TEXT BOOKS**:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit “Electronic devices and Circuits”, 2nd Edition TMH, 1998.
2. Donald A. Neamen, “Semiconductor Physics and Devices”, 3rd edition, TMH,2003
3. Robert L.Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory, Tenth Edition, PEARSON Publications.

**REFERENCE BOOKS:**

1. S.Salivahanan, N.Suresh Kumar and A.Vallavaraju, “Electronic Devices and Circuits” 2nd Edition, 2008, TMH.
2. U.A.Bakshi and A.P.Godse “Electronic Devices and Circuits” 1st Edition, 2014, Technical Publications.

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| **EE/EC/EI 214** | **DIGITAL ELECTRONICS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT-I**

**Number Systems and Codes**: Decimal, Binary, Hexadecimal Number Systems and their Conversions Arithmetic Additions Subtraction using the method of Complements, Multiplication and Division Codes: BCD, Excess-3, Gray and Alphanumeric Codes

**Boolean Algebra**: Boolean Expressions and Theorems, Logic Gates, Universal Gates, Canonical and Standard forms, Boolean functions, Simplification of Boolean functions using K maps, Minimal Functions and their properties, Tabulation Method Nand and Nor Implementations Two Level and Multi Level.

**UNIT-II**

**Combinational Logic Circuits**: EX-OR EX-NOR Circuits, General Design procedure for Combinational Logic Circuits, Design and Applications of Binary Adders and Subtractors, Comparators, Encoders, Decoders Multiplexers and Demultiplexers, Design of BCD to 7 Segment Decoder, Parity Generator and Checker, BCD Adder /Subtractor, Carry Look Ahead Adders.

**UNIT-III**

**Sequential Logic Circuits**: Lathes, Characteristic Table, Characteristic Equation, Excitation Table, State table and State Diagrams for SR, JK, Master Slave JK, D and T flip-flops, Conversion from one type of Flip-Flop to another, Shift Registers Analysis and Synthesis of Sequential Circuits, Sequence Generator, Sequence Detector, Parity Generator

**Counters Using Flip-Flops**: Design of Ripple Counters, Synchronous Counters Up/Down Counters using Flip-Flops.

**UNIT-IV**

**Synchronous Sequential Circuits**: Basic Design Steps, Sate Assignment Problem, Mealy State Model, Serial Adder Example, State Minimization, Design of a Counter using the Sequential Circuit Approach, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits, ASM Charts, Formal Model for Sequential Circuits

IC LOGIC FAMILIES: RTL, DTL, TTL, ECLand IIL families and their comparison

**TEXT BOOKS:**

1. M Morris Mano and Micael D. Ciletti, Digital Design, Pearson Education, 2008
2. Digital Principles and Design, Donald D. Givone,TMH,2003

**REFERENCE BOOKS:**

* + 1. Thomas L. Floyd, Digital Fundamentals,7th Edition, Pearson Education,2000
    2. Charles H. Roth Jr., Fundamentals of Logic Design, Jaico Publications,1992
    3. Taub and Schilling, Digital Integrated Electronics, McGraw Hill,1977

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| **EE 215** | **ELECTROMAGNETIC FIELD THEORY** | | **4** | **0** | **0** | **100** | **3** |

**UNIT – I**

**Electrostatics –I:** The experimental law of coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field of a line charge, sheet of charge. Electric Flux Density, Gauss’s law , Applications of Gauss law, Divergence, Maxwell’s First equation (Electrostatics), Energy expended in moving a point charge in an electric field, The line integral, Definition of potential and potential difference. The potential field of a point charge, system of charges, potential gradient, the dipole and Energy density in electrostatic field.

**UNIT – II**

**Electrostatics – II:** The nature of dielectric materials, boundary conditions for perfect dielectric materials. Capacitance. Several capacitance examples. Capacitance of a two wire line. Derivations of Poisson’s and Laplace’s equations, Examples of the solution of Laplace’s equation. Current and current density, continuity of current, conductor properties and boundary conditions

**UNIT – III**

**The Steady Magnetic Field:** Biot-Savart Law, Ampere’s Circuital Law, Magnetic Flux and Magnetic Flux Density, The scalar and vector magnetic potentials

**Magnetic Forces and Materials:** Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and Permeability. Magnetic boundary conditions. Potential energy in magnetic fields.

**UNIT – IV**

**Time Varying Fields and Maxwell’s Equations:** Faraday’s law, Displacement current, Maxwell’s equations in point form, integral form.

**The Uniform Plane Wave:** Wave propagation in free space, dielectrics. Poynting theorem and wave power. Propagation in good conductors: skin effect. Wave polarization. Reflection of uniform plane waves at normal incidence. Plane wave propagation in general directions. Plane wave reflection at oblique incidence angles.

**TEXT BOOKS:**

1. W H Hayt, J A Buck Engineering Electromagnetics, 7th Edition TMH

2. Mathew NO Sadiku, Elements of Electromagnetics, Oxford University Press

3. G S N Raju, Electromagnetic Field Theory and transmission lines, 1st Edition, Pearson Education India.

**REFERENCE BOOKS:**

1. Joseph A Edminister, Theory and Problems of Electromagnetics, 2nd Edition, Schaum’s Outline Series, Mc-Graw Hill International

2. EC Jordan and KG Balmain, Electromagnetic Waves and Radiating Systems, PHI

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| **EE 216** | **DC MACHINES** | | **4** | **1** | **0** | **100** | **3** |

**UNIT – I**

**Magnetic Circuits:**  Introduction - simple magnetic circuit – magnetic circuits with air gap – Air-gap fringing fields – Magnetic equivalent circuit – properties of magnetic materials – Hysteresis and eddy current losses – permanent magnetic materials.

**Electro Mechanical Energy Conversions:** Energy in Magnetic system - field energy and mechanical force - mechanical energy. Torques in systems with permanent magnets

**UNIT – II**

**D.C. Machines:** Principles - constructional features - operation of DC generators and motors. Types of Windings – lap and wave.

Armature reaction and compensations - commutation and inter poles.

No load and load characteristics of all types of DC generators and their applications

**UNIT-III**

Parallel operation of D.C. generators - characteristics of DC Motors - applications - DC motor starters and their design - speed control of DC shunt series and compound motors

**UNIT – IV**

Losses efficiency and testing of DC machines - Swinburne’s - Hopkinson’s - retardation - Field Test etc., Principle of operation of Amplidyne and Metadyne

**Text Books:**

1. Electric Machinery by P.S. Bhimbra, Khanna Publications 7th edition

2. Electric Machines by I.J. Nagrath& D.P. Kothari, Tata Mc Graw – Hill Publishers

3. Electrical Machines by Samarjit Ghosh, Pearson 2nd edition, 2008

**REFERENCE Books:**

1. Theory & performance of Electric Machines, by J. B. Gupta, S.K. Kataria& Sons

2. Electric Machinery & Transformers by Irving L. Kosow , PHI

3. Performance and Design of D.C Machines – by Clayton & Hancock, BPB Publishers.

4. Electro mechanics – I (D.C. Machines) S. Kamakshaiah Right Publishers.

5. Electric Machinary-A.E. Fritzgerald, C. Kingsley &S. Umans, Mc Graw-Hill Companies, 6thediton 2003.

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| **EE 251** | **DC MACHINES LAB** | | **0** | **0** | **3** | **100** | **2** |

1. Open circuit characteristics of separately excited / self-excited D.C shunt generator

2. Load test on D.C Shunt Generator

3. Load test on D.C Compound Generator

4. Load test on D.C series generator

5. Swinburne’s Test

6. Speed control of DC shunt motor

7. Brake test on D.C Shunt Motor

8. Hopkinson’s test on D.C Machines

9. Retardation test on D.C. Machine

10. Brake test on D.C Series Motor

**Note:** Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations

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| **EE 252** | **NETWORKS LAB** | | **0** | **0** | **3** | **100** | **2** |

1. a) Verification of Kirchoff’s Laws

b) Parameters of a given Choke Coil

2. Verification of Thevenin’s Theorem

3. Verification of Superposition Theorem

4. Verification of Maximum power transfer theorem and reciprocity theorem

5. Frequency response of RL and RC circuits

6. Frequency response of RLC circuits

7. Time response of RL and RC circuits

8. Time response of RLC circuits

9. Simulation of RLC circuits using PSPICE

i) steady state analysis ii) transient analysis

10. Verification of Thevenin’s and Norton’s theorems using P-SPICE

11. Verification of Maximum power transfer theorem and superposition theorem using P-SPICE

**Note:** Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations

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| **EE 253** | **ELECTRONICS LAB-I** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Characteristics of PN Junction and Zener diode
2. Characteristics of Transistor in Common Emitter configuration
3. Verification of Transistor Self Bias Circuit
4. Characteristics of Junction Field Effect Transistor
5. Characteristics of Uni junction Transistor
6. Characteristics of Silicon Controlled Rectifier
7. Study of Half wave rectifier with and without filters
8. Study of Full wave rectifier with and without filters
9. Realization of Gates using Discrete Components and Universal Building Block
10. Design of Combinational Logic Circuits like half-adder, Half-subtractor and Full-subtractor
11. Design of Code converters, Multiplexers & Decoders
12. Verification of Truth Tables of Flip Flops using Gates
13. Design of Shift Register, Ring Counter and Johnson Counter using Flip Flops
14. Design of Asynchronous counter- Mod counter, Up counter, Down counter and Up/Down counter using Flip Flops
15. Design of Synchronous Counter- Mod Counter, Up counter, Down counter and Up/Down counter using Flip Flops.
16. Design of Sequence Generators using shift Registers and Multiplexers

**Note:** Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations.

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| **EE/EC/EI 221** | **MATHEMATICS - IV** | | **4** | **0** | **0** | **100** | **4** |

**UNIT – I**

Complex Analysis:

Introduction – Limits – Continuity – Derivative of a function - Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms - , Harmonic functions – harmonic conjugate - Orthogonal systems – Geometrical representation of w = f(z)- conformal mapping - Some standard transformations w = z + c, w = cz, w = 1/z Bilinear transformations.

**UNIT – II**

Complex Integration:

Cauchy’s integral theorem (without proof), Cauchy’s integral formula (without proof)- series of complex terms: Taylor’s series – Laurents series – Zeros of analytic function – singularities of analytic function.

**UNIT – III:**

Residues and poles:

Introduction – Definition of Residue - Calculation of Residues – Cauchy’s Residue theorem (without proof) - , Evaluation of real definite integrals: Integration around a unit circle, Integration around a semicircle.

**UNIT – IV**

Random Variables – continuous probability distributions, expectation, Variance, Normal distribution, normal approximation to binomial distribution – correlation – coefficient of correlation(direct Method), Lines of regression.

**TEXT BOOK:**

1. B S Grewal, Higher Engineering Mathematics, 43th Edition, Khanna Publishers, Delhi.

**REFERENCE BOOK:**

2. J.W. Brown and R.V.Churchil , Complex variables and applications – 8e- Mc Graw hills higher education.

3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International (P) Ltd.

4. N.P. Bali, A textbook of Engineering Mathematics, Laxmipublications .

5. Engineering Mathematics– I BYN.P. Bali, Satyanarayana Bhavanari and Indrani Kelker Laxmipublications, New Delhi.

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| **EE 222** | **ELECTRONIC CIRCUIT ANALYSIS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT I**

**SINGLE STAGE AMPLIFIERS:** Small Signal Low Frequency Amplifier Circuits: CE, CB, CC Amplifier Circuits, Small Signal Analysis of Junction Transistor: Analysis of CE, CB, CC using Hybrid Model, Analysis of CE Amplifier with Collector to Base Bias, Millers Theorem, Analysis of CE Amplifier with Emitter Resistance: Exact and Approximate Analysis.

**MULTI STAGE AMPLIFIERS:** Need for cascading, Methods of Inter stage Coupling, Gain, Selection of Configuration in cascading Amplifiers, RC Coupled CE-CE Amplifier, CE-CB Cascode Amplifier, CE-CC Amplifier, Effect of cascading on Bandwidth and Gain.

**UNIT II**

**FET AMPLIFIERS:** JFET Low Frequency small signal Model, Analysis of Common Source, Common Drain, Common Gate Amplifiers using small signal model.

**FREQUENCY RESPONSE**: Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers with Circuit Capacitors, Bipolar Transistor Frequency Response, The FET Frequency Response, High Frequency Response of Transistor Circuits

**UNIT III**

**POWER AMPLIFIERS**: Power Amplifiers, Power Transistors, Classification of Amplifiers: Class-A, Class B, Class C, Class AB Power Amplifiers.

**UNIT IV**

**FEEDBACK AMPLIFIERS**: Introduction to Feedback, Basic Feedback Concepts, Ideal Feedback Topologies, Voltage Amplifiers, Current Amplifiers, Transconductance Amplifiers, Trans resistance Amplifiers

**OSCILLATORS**: Barkausen Criterion, The Phase Shift Oscillator, Resonant Circuit Oscillator and Crystal Oscillator.

**TEXT BOOKS:**

1. Donald A. Neamen,” Electronic Circuits Analysis and Design”, 3rd

Edition, TMH, 2007.

1. Jacob Millman and Christos C. Halkias, “Integrated Electronics”, TMH, 1972

**REFERENCE BOOKS:**

3. Rashid –“Electronic Circuit Analysis”. Cengage Learning, 2013.

4. Uday A Bakshi-“ Electronic Circuit Analysis” 1st Edition, 2008, Technical

Publications.

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| **EE/EC/EI 223** | **DATA STRUCTURES USING C++** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Principles Of Object Oriented Programming:** Concepts, benefits of OOPS, Object oriented Languages, Applications of OOPs.

**Tokens, Expressions And Control Structures:** Introduction, Tokens, Keywords, Basic Data Types, User defined data types, Derived data types, Declaration of variables, Operators in C++, Types, Scope resolution operator, Member dereferencing operator, Memory management operator, Type cast operator.

**UNIT – II**

**Functions:**Function prototyping, Call by reference, Return by reference, Inline function, Function Overloading, Friend and Virtual functions.

**Classes And Objects:** Specifying a class, Defining member functions, Memory allocation for objects, Friendly functions, Pointer to members.

**Constructors And Destructors** – Introduction, Type conversions, Operator overloading and inheritance and virtual functions.

**UNIT – III**

**Linked Lists:** List operations and their implementation using arrays, Linked list operations and their implementations, Single linked, Double linked and Circular linked lists.

**Stacks:** Logical operations on stack, Stack implementations with arrays and linked lists, Stack applications.

**Queues:** Queue operations, Queue implementation with arrays and linked lists, Queue applications.

**UNIT – IV**

**Sorting Methods:** Insertion sort, Shell sort, Merge sort, Quick sort, Heap sort, Radix sort and their implementations.

**Searching Methods:** Binary Search, Hashing methods and applications.

**Trees:** Logical operations on Trees, Binary Tree Traversals, Binary Search Tree ADT,

**TEXT BOOKS:**

1. E Balaguruswamy, object oriented programming using C++ Programming ANSI C, PHI, 1993.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, The Benjamin &Cummings, Addison Wesley, 1997
3. Trembley and Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill, 1997.

**REFERENCES :**

1. Dital and Dital c+ programming
2. S Tanenbaum, Data Structures Using C, PHI, 1992.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 224** | **NETWORK ANALYSIS & SYNTHESIS** | | **4** | **1** | **0** | **100** | **4** |

## UNIT – I

**Poly phase systems:** Advantages of 3-phase systems – generation of 3-phase voltages - phase sequence - star & delta connections - interconnection of 3-phase sources and loads - voltage, current & power in star & delta connected systems - analysis of 3-phase balanced circuit - measurement of 3-phase power- 2 wattmeter method. Analysis of 3-phase unbalanced systems – star / delta transformation method - application of KVL and Millman’s method.

**UNIT-II**

**Network Functions:** Poles and Zeros - Network functions for the one port and two port - Poles and Zeros of network functions - Restrictions on pole and zero locations for driving point functions and transfer functions - Time domain behavior from the pole zero plot.network functions for the Two-Port bridged – T, Ladder and Lattice networks.

**Two port networks:** Open circuit impedance and short circuit admittance parameters, transmission (ABCD) and inverse transmission parameters, hybrid and inverse hybrid parameters, interrelation between them, image parameters, inter connection of 2-port networks.

**UNIT –III**

**Fourier Series:** Trigonometric and exponential Fourier series, representation of periodic function by Fourier series, Fourier transforms of simple functions, Applications to circuit analysis.

Fourier Transform of typical signals –inverse transforms-application of Fourier transform in circuit analysis-the relationship Fourier and Laplace transform.

Classification of signals and systems – stable-unstable systems-causal and noncasual systems- time variant and time invariant systems-convolution integral

**UNIT – IV**

**Filters**:Low pass, high pass & band pass filters - frequency response, constant K – and M filters.

**Network Synthesis:** Hurwitz polynomial – properties of positive real functions – sturm’s test – Synthesis of RC, RL & LC driving point impedances and RL, RC admittances – CAUER and FOSTER methods of Synthesis**.**

## Text Books:

1) Network analysis by M.E. Vanvalkenberg, 3rd Edition, 2006, Pearson Education

2) Engineering circuit analysis byW.H.Hayt&J.E.Kimmerly**,** 6th Edition,TMH, 2002

3) Circuits and Networks: Analysis and synthesis by A.Sudhakar andShyammohan, 3rd Edition, TMH, 2006

4) Circuits and Networks: Analysis, design and synthesis by M.S.Sukhija and T.K.Nagsarkar, Oxford press, 2010

**Reference Books**:

1) Electric Circuits by Edminister, Schaum’s series

2) Network analysis and synthesis by F.F. Kuo

3) Basic circuit analysis by Cunningham & J.A. Stuller

4) Theory and problems of Electric Networks by B.R. Gupta

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| **EE 225** | **GENERATION OF ELECTRICAL POWER** | | **4** | **0** | **0** | **100** | **4** |

**UNIT – I**

**Economical Aspects:** Economics of generation - factors affecting cost of generation - Definitions: load factor – diversity factor – plant use factor - reduction of cost by inter connected stations. Power factor considerations – causes of low power factor – methods of improving power factor – phase advancing and generation of reactive KVAR – most economical power factor for constant KW load and constant KVA type loads.

**Tariff:**  Characteristics of Tariff – types of Tariff.

## UNIT – II

**Choice of power stations and units:** Types of power stations – choice of generation - size of generator units – load duration curve – effect of variable load on plant operation and design.

**Thermal power stations:** Selection of site for thermal station – layout and salient features - boilers – economizers – condensers – coal handling – feed water treatment - steam turbines – turbo generators.

**Hydroelectric Stations:** Hydrology – hydrographs – mass curves – classification of hydroelectric plants - general arrangement and operation of hydroelectric plants and its function.

**UNIT – III**

**Nuclear Power Stations:** Principles of nuclear power station – basic factors in designing of reactors – pressurized water reactor – boiling water reactor – CANDU reactor – liquid metal cooled reactor – shielding and safety precautions.

**Gas Turbine Plants:** Layout of gas turbine plant – principle of operation – open cycle and closed cycle plants. Improvement of thermal efficiency of gas plant.

**Combined cycle Plants:** Introduction – stag combined cycle plant – combined cycle with nuclear gas turbine and fossil fuel fired steam turbine

**UNIT – IV**

**Solar Energy:** Basic of solar energy – solar constant – extra-terrestrial radiation – types of conversion systems – solar thermal power plants – solar pond - solar cell.

**Wind Energy:** Principles of wind power – types – wind turbine operation, types of wind generators

Tidal energy – Geo thermal Energy - Fuel cells.

## Text Books:

1. Elements of Electrical power station design by M.V.Deshpande Wheeler Publishing Co

2. Generation of Electric Power by B.R. Gupta S. Chand & Company Ltd

3. Non-conventional energy sources by G. D. Rai Khanna Publishers,New Delhi

4. Generation distribution and utilization of electrical energy by C.L.Wadhwa, New Age Internations (P) Limited, 2005

Reference Books:

1. Solar power Engineering by B.S.Magal TMH Publishing Company. Ltd., New Delhi

2. Power plant Technology by MML.Wakil TMH Publishing Company. Ltd., New Delhi

3. Electrical power systems theory and practice by M. N. Bandyopadhyay – PHI

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 226** | **AC MACHINES** | | **4** | **1** | **0** | **100** | **4** |

## UNIT – I

## Transformers:

Constructional features of transformers - EMF equation - no load and load phasor diagram - equivalent circuit of single phase transformers. Regulation – losses - efficiency and all day efficiency .Testing of transformers: OC & SC tests - Sumpner’s test etc.

## UNIT – II

Auto transformers - Tertiary transformer winding - 3 phase transformer windings and its connections. Open delta - Scott connected transformers - 3 phase to 2 phase conversion. Parallel operation of transformer and its load sharing. Tap changing - methods of cooling

## UNIT – III

## Poly Phase Induction Motors:

Rotating magnetic field in two phase & three phase systems - construction and operation of squirrel cage and slip ring 3-phase induction motors - torque equation and torque slip characteristics - equivalent circuit - Power losses – efficiency - testing of induction motors and circle diagrams.

## UNIT – IV

Types of starters - speed control of induction motors - Crawling and Cogging - Double cage rotors - Induction generators and their applications.

Single Phase Induction Motors:

Double field revolving theory - starting methods Split phase - capacitor start and run -shaded pole motors - characteristics and their applications - equivalent Circuit.

**Text Books:**

1. Electric Machinery by P.S. Bhimbra, Khanna Publications 7th edition

2. Electric Machines by I.J. Nagrath & D.P.Kothari, Tata Mc Graw Hill, 7th Edition.2005

**Reference Books:**

1. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2nd edition

2. Alternating Machines by A.F. Puchston, AG. Controad& Lloyd

3. Electrical Machinery & Transformers by Irving L. Kosow , PHI

4. Theory of performance of electrical machines by J.B. Gupta S.K. Khataria& Son’s Publications

5. Performance & Design of AC Machines by M.G. Say BPB Publishers

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| **EE 261** | **AC Machines Lab** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. OC & SC tests on single - phase transformer
2. Load test on single - phase transformer
3. Sumpner’s test on Transformers
4. Scott Connection of Transformers
5. Parallel Operation of Two Single - Phase Transformers
6. Load test on 3 - phase squirrel cage induction motor
7. Load test on 3 - phase slip ring induction motor
8. No load and Blocked rotor test on 3 - phase induction motor

10. Brake test on single - phase induction motor

11. Determination of Equivalent Circuit of Single - Phase Induction Motor

12. Parallel operation of 3 – phase transformers

13. Harmonic analysis of transformer

14. Separation of losses of 3-phase Induction motor

**Note:** Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations

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| **EE/EC/EI 262** | **DATA STRUCTURES LAB** | | **0** | **0** | **3** | **100** | **2** |

1. Over Loading Functions
2. Objects and Classes
3. Arrays
4. Overloading Operators
5. Inheritance
6. Virtual Functions
7. Linear list-Three programs.
8. Linear and Binary search.
9. Stacks - Two programs.
10. Queues - One program.
11. Linked Lists - Two programs.
12. Heap - One program.
13. Sorting - One program on (a) Quick sort (b) Heap sortt
14. Sorting - One program on (a) Radix sort (b) Merge sort.
15. Binary Tree-One program.
16. Tree Traversal-One program.

**NOTE:** A minimum of 10(Ten) programs, with One program from each Head, have to be performed and recorded by the candidate to attain eligibility for University Practical Examination.

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| **EE263** | **ENGLISH COMMUNICATION SKILL& SOFT SKILLS LAB (AUDIT)** | | **0** | **0** | **3** | **-** | **0** |

**Syllabus:**

Module-1: Phonetics

1. Introduction to vowels and consonants
2. Introduction to Accent, Intonation and Rhythm

Module-2: Presentation Skills

1. Debate
2. Paper Presentation:

i) Identification of source material

ii) Arrangement of Collected Data

1. Extempore

Module-3: Employability Skills

1. Resume Preparation

i) Identification of information

ii) Arrangement of collected data

1. Group Discussions
2. Interview Skills

i) Dress code

ii) Behavioral Skills

Module-4: Telephonic Skills

a) Formal &Informal interaction

b) Receiving Messages & Complaints

Module-5: Soft Skills

1. Voluntary & Involuntary Body Language
2. Self-Esteem
3. Creative Thinking
4. Team Management

Module-6: Interpersonal and Intrapersonal Skills

a) Motivation

b) Stress Management

c) Negotiation Skill

d) Effective Listening

**NOTE:** 12 Lab Activities are minimum in Record (125 pages single side book) with contents: Name of the Activity, Source, Skill Improved.

**Minimum Requirements:**

The Communication and Soft Skills Lab shall need two labs. One is Communication Skills Lab with LAN facilitated 60 multimedia systems and English language software suggested by the concern faculty. The other, Conversational Skills Lab with 6 to 10 round tables, 60 movable chairs and audio-visual Devices with LCD Projector.

**Suggested Software:**

* Cambridge Advanced Learners’ English Dictionary with CD.
* Clarity Pronunciation Power
* The Rosetta Stone English Library
* Dorling Kindersley series of Grammar, Punctuation, Composition etc.
* English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
* Language in Use, Foundation Books Pvt. Ltd with CD.
* Mastering English in Vocabulary, Grammar, Spellings, Composition
* Telephoning in English
* A Practical Course in Spoken English with CD by J.K. Gangal, PHI Publications.
* Communicate to Conquer: A Handbook of Group Discussions and Job Interviews with CD, PHI Publications.

**Reference Books:** Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems) :

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. Speaking English Effectively by Krishna Mohan & NP Singh (Macmillan)
5. A Practical Course in English Pronunciation, (with two Audio cassettes) by J. Sethi, KamleshSadanand& D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
6. A text book of English Phonetics for Indian Students by T.Balasubramanian (Macmillan)
7. English Skills for Technical Students, WBSCTE with British Council, OL
8. Soft Skills: Know Yourself & Know the World, Dr.K.Alex, S.Chand Publications
9. The ACE of Soft Skills: Attitude, communication and Etiquette for Success, by Pearson Publications.

Converston Developing Soft Skills,4thEdition,pearson Publication.

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| **EE/EC 311** | **LINEAR CONTROL SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Introduction:** Basic concept of simple control system – open loop – closed loopcontrol systems. Effect of feedback on overall gain – stability sensitivity and external noise.

Types of feedback control systems – Liner time invariant, time variant systems and nonlinear control systems

**Mathematical models and Transfer functions of Physical systems:** Differentialequations – impulse response and transfer functions – translational and rotational mechanical systems. Transfer functions and open loop and closed loop systems. Block diagram representation of control systems – block diagram algebra – signal flow graph – Mason’s gain formula

**Components of control systems:** DC servo motor – AC servo motor – synchrotransmitter & receiver

**UNIT – II**

**Time domain analysis:** Standard test signals – step, ramp, parabolic and impulseresponse function – characteristic polynomial and characteristic equations of feedback systems – transient response of first order and second order systems to standard test signals. Time domain specifications - steady state response – steady state error and error constants. Effect of adding poles and zeros on over shoot, rise time, band width – dominant poles of transfer functions.

**Stability analysis in the complex plane:** Absolute, relative, conditional, boundedinput –bounded output, zero input stability, conditions for stability, Routh –Hurwitz criterion.

**UNIT - III**

**Frequency domain analysis:** Introduction – correlation between time and frequencyresponses – polar plots – Bode plots – Nyquist stability criterion – Nyquist plots. Assessment of relative stability using Nyquist criterion – closed loop frequency response.

**UNIT – IV**

**Root locus Technique:** Introduction – construction of root loci Introduction to Compensation Techniques

**State space analysis:** Concepts of state, state variables and state models –diagonalisation – solution of state equations – state models for LTI systems. Concepts of controllability and Observability.

**TEXT BOOKS:**

1. B.C. Kuo, Automatic control systems, 7th edition, PHI.
2. I.J.Nagrath & M Gopal, Control Systems Engineering, 3rd edition, New Age International.
3. K. Ogata, Modern Control Engineering, 3rd edition, PHI.

**REFERENCE BOOKS**:

1. Schaum Series, Feedback and Control Systems, TMH
2. M.Gopal, Control Systems Principles and Design, TMH
3. John Van de Vegta, Feedback Control Systems, 3rd edition, Prentice Hall,1993.

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| **EE/EC 312** | **LINEAR ICS & APPLICATIONS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Operational Amplifiers:** Operational amplifier and block diagram representation,op-amp with negative feedback. Block diagram representation of feedback configurations, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier with one op-amp, input offset voltage, input bias current, input offset current, total output offset voltage, frequency response of op-amp, stability, slew rate.

**Op-Amp Applications**: The summing amplifier, Differential and instrumentationamplifiers, Voltage to current and current to voltage conversion, The Op-amp with complex impedances, Differentiators and integrators, Non Linear Op Amp circuits, Precision rectifiers.

**UNIT – II**

**Oscillators**: Oscillator principles, Oscillator types, Frequency stability, Phase shiftoscillator, Wein bridge oscillator, Quadrature oscillator, Square-wave generator, Triangular wave generator, Saw tooth wave generator, Voltage controlled oscillator.

**Comparators**: Introduction to comparator, Basic comparator, Zero-crossingdetector, Schmitt Trigger, Comparator characteristics, Limitations of Op-Amps as comparators, Voltage limiters.

**UNIT – III**

**Clippers, Clampers & Converters**: Positive and negative clippers, Positive andnegative clampers, Absolute value output circuit, Peak detector, Sample and hold circuit. D/A conversion fundamentals, Weighted resistor summing D/A Converter, R-2R Ladder D/A converter, A/D conversion: Ramp converters, Successive Approximation A/D converters, Dual slope converters, Parallel A/D converters. Tracking A/D converters.

**UNIT – IV**

**Applications Of Special ICs**: The 555 timer, 555 as Monostable and Astable Multivibrator and applications. Phase Locked Loops, Operating principles, Monolithic PLLs, 565 PLL applications, A 723 Voltage Regulator and its design.

**Active Filters**: Active LP and HP filters, Band pass filters: Wideband, Narrow Bandpass filters, Band stop filters, State variable filters, All pass filters.

**TEXT BOOKS:**

1. Rama Kant A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th Edition, PHI/ Pearson Education, 2003.
2. D.Roy and Choudhury, Shail B.Jain, Linear Integrated Circuits, 2nd Edition, New Age International, 2003.
3. Denton J Dailey, Operational Amplifiers and Linear Integrated Circuit Theory and Applications,

**REFERENCE BOOK**:

1. J.Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, PHI, 2003.

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| **EE/EC 313** | **PULSE CIRCUITS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Linear Wave Shaping:** Responses of RC-high pass circuit and low pass circuits tosinusoidal, step, pulse, square, ramp and exponential inputs, Criteria for good differentiation and integration, Uncompensated and compensated attenuators, Ringing circuit.

**UNIT – II**

**Non-Linear Wave Shaping:** Clipping circuits with diodes, Multi-diode circuits,Transient and steady state response of a diode clamping circuit, Clamping circuit theorem, Practical clamping circuits, Transistor as switch, Design of Transistor switch, Transistor Switching Times

**UNIT – III**

**Multivibrators (using BJTs):** Bistable Multivibrator: Fixed bias and self-biastransistor binary, Commutating capacitors, Non-saturated binary, Direct coupled binary, Unsymmetrical and symmetrical triggering of binary, Schmitt Trigger circuit, Collector Coupled Monostable and Astable Multivibrators-operation & design

**UNIT –IV**

**Sweep Circuits:** Voltage sweep circuits, Deviation from linearity expressed aserrors, Exponential and Constant current charging voltage sweep circuits, Principles of Miller and Bootstrap Sweep circuits, Simple current sweep circuit, Need for a trapezoidal waveform for linearity correction, its generation and application.

**TEXT BOOKS:**

1. J Millman and H Taub, Pulse, Digital and Switching Circuits, TMH, 2003
2. David A Bell, Solid State Pulse Circuits, 4th Edition, PHI, 2003

3. Mothiki S. Prakash Rao, Pulse Digital & Switching Waveforms, 2nd Edition, TMH

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| **EE 314** | **PROFESSIONLA ETHICS AND HUMAN VALUES** | | **4** | **1** | **0** | **100** | **0** |

**UNIT – I**

**Human Values:** Morals, Values and Ethics – Integrity – Work Ethic – ServiceLearning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – honesty –Courage – Valuing Time – Co-operation – Commitment – Empathy – Self – Confidence – Character – Spirituality.

**UNIT – II**

**Engineering Ethics:** Senses of ‘Engineering Ethics’ – Variety of model issues –Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Theories about right action – Self-interest – customs and Religion – Uses of Ethical Theories.

**UNIT – III**

**Engineering as Social Experimentation:** Engineering as Experimentation –Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**Safety, Responsibility and Rights:** Safety and Risk-Assessment of Safety andRisk – risk Benefit analysis and reducing risk.

Collegiality and Loyalty – Respect for Authority – Collective Bargaining - Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – employee Rights – Intellectual Property Rights (IIPR) – Discrimination.

**UNIT – IV**

**Global Issues:** Multinational Corporations – Environmental Ethics – ComputerEthics – Weapons Development – Engineers as Managers – consulting Engineering

– Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Ethics like ASME, ASCE, IEEE, Institution of engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

**TEXT BOOKS**:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York 1996.
2. Govindarajan. M, Natarajan. S, Senthilkumar. V.S, “Engineering Ethics”, Prentice Hall of Inida, 2004.

**REFERENCE BOOKS**:

1. Charles D Fleddermann, “engineering Ethics”, Prentice Hall, New Jersey, 2004 (Indian Reprint).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics Concepts and Cases”, Thompson Learning, United States, 2000 (Indian Reprint now available).
3. John R Boatright, “ethics and the Conduct of Business”, Pearson Educaiton, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “fundamentals of ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

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| **EE 315** | **TRANSMISSION & DISTRIBUTION** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Transmission line parameters:** Expressions for inductance and capacitance ofsingle phase and 3-phase lines of symmetrical and transposed configurations - concept of self GMD (GMR) and mutual GMD - double circuit lines and bundled conductors - effect of ground on capacitance - line charging KVAR calculations. Inductive interference

**UNIT – II**

**Transmission line theory:** Short, medium and long lines - regulation and efficiency Pie, T and rigorous methods of solution - ABCD constants - sending and receiving end power angle equations and power circle diagrams. Surge impedance loading - Ferranti effect.

**Travelling wave Phenomenon:** Travelling waves on transmission lines, attenuationof travelling waves

**Protection against traveling waves:** Rod gaps - sphere gaps - different types ofarrestors and surge absorbers, Insulation Co-ordination.

**UNIT – III**

**Insulators:** Types of insulators - voltage distribution in a string of suspensioninsulators.

**Grading of insulators:** Failure of insulator and testing, arcing horns.

**Underground Cables:** Types of cables - laying of cables - insulation resistance -electric stress and capacitance of single core cable - use of inter sheath - capacitance grading - capacitance of three core belted type cable - stress in a three core cable - sheath effects - currents in bonded sheaths - electrical equivalent of sheath circuit - thermal characteristics of cables

**UNIT – IV**

**AC Distribution:** calculation of voltage regulation in case of non-uniform and uniformly distributed loads on feeders - feeders fed at one end and both ends - ring feeders without and with interconnections.

**Substation Practice:** Classification of substations - indoor and outdoor substations -busbar arrangements – single busbar - sectionalized single busbar - main and transfer busbar system - sectionalized double busbar system - ring mains - group switching. Substation layout showing the location of PT’s and CT’s - lightening arrestors, earth switches, isolators, circuit breakers and auxiliaries.

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**TEXT BOOKS:**

1. Elements of Power system analysis by W.D. Stevenson TMH 4th Edition

2. Electrical power systems by C.L. Wadhwa, New age International (P) Limited 3rd edition

3. Electric power transmission and distribution by Sivanagaraju and Satyanarayana, Pearson Education

**REFERENCE BOOKS:**

1. Transmission and Distribution by H. Cotton B. I. Publishers, New Delhi, 1998

2. Electric Power Generation, Transmission & Distribution by S.N. Singh, PHI, 2003

3. Modern power system analysis by D.P. Kothari & I.J. Nagrath McGraw Hill

3rdedition,2003

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| **EE 316** | **SYNCHRONOUS AND SPECIAL MACHINES** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Synchronous Generators:** Construction - e.m.f. equation with sinusoidal flux -winding factors - harmonics in generated voltage and their suppression - armature reaction - synchronous impedance - vector diagram - load characteristics - methods of determining regulation – direct load - EMF, MMF, ZPF and ASA.

**UNIT – II**

Blondel two reaction method for salient pole machine - phasor diagram - slip test - regulation of salient pole machines - parallel operation - synchronizing with infinite bus bars - synchronizing power - effect of variation of excitation and mechanical input on parallel operation - load sharing – losses and efficiency.

**UNIT – III**

**Synchronous Motor:** Theory of operation - starting methods - phasor diagrams -variation of current and power factor with excitation - minimum and maximum power for a given excitation and power circles - V and inverted V curves - hunting and its prevention – synchronous condenser and its applications.

**UNIT – IV**

**Single Phase Series (Universal) motors:** Principle of operation and characteristicof AC series motors - Repulsion motors and its applications.

**Single phase Synchronous motors:** Basic concepts and principle of operation andcharacteristics of reluctance motor and hysteresis motor

**Stepper Motor**: Variable reluctance stepper motor - permanent magnet steppermotor - principle of operation of linear induction motor and its applications.

Principle of operation of Brushless DC Motor.

**Text Books:**

1. Electric Machinery by P.S. Bhimbra, Khanna Publications 7th edition
2. Electric Machines – by I.J. Nagrath & D.P. Kothari, Tata Mc Graw-Hill Publishers, 3rd Edition 2004.
3. Generalized theory of Electric Machines by P.S. Bimbra Dhanpat Rai and sons, 2000

**Reference books:**

1. Alternating current Machines by A.F. Puchatein, T.C. Lloyd and A.G. Conarad Asia publishing house, 1962
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd Edition.
3. Principles of Electrical machines and power electronics by P.C. Sen John Wiley & Sons 2003

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| **EE 351** | **AC MACHINES LAB-II** | | **0** | **0** | **3** | **100** | **2** |

1. Electric Machinery – by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 6th edition, 2003

**List of Experiments:**

1. Load test on alternator – for UPF, Inductive and capacitive loads
2. Regulation of alternator by synchronous impedance and MMF methods
3. Regulation of alternator by ZPF & ASA methods
4. Synchronization of alternator with infinite bus – P and Q control
5. Parallel operation of two synchronous machines
6. V and inverted V curves of synchronous motor
7. Synchronous motor performance with constant excitation
8. Separation of losses in single – phase transformer by v/f method
9. Measurement of Xd and Xq of a three phase alternator by slip test
10. Load test on Universal motor
11. Measurement of Xd” and Xq” of a three phase alternator
12. Load test on 1 synchronous reluctance motor
13. Power factor correction using synchronous motor
14. Load test on synchronous hysteresis motor
15. Load test on 1 repulsion motor

**Note:** Minimum of ten experiments have to be performed and recorded by thecandidate to attain eligibility for University Examinations

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 352** | **PULSE AND ELECTRONIC CIRCUITS LAB** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Two stage RC coupled Amplifier
2. Design of voltage shunt feedback amplifier and determination of voltage gain, input impedance and output impedance with and without feedback
3. Class B push pull amplifier
4. Complementary symmetry amplifier
5. Design of RC phase shift oscillator
6. Design of LC oscillator
7. Design of series voltage regulator
8. Linear wave shaping
9. Non-linear wave shaping
10. Bistable multivibrator
11. Monostable multivibrator
12. Astable multivibrator
13. Schmitt trigger
14. UJT relaxation oscillator
15. Blocking oscillator

**Note:** Minimum of ten experiments have to be performed and recorded by thecandidate to attain eligibility for University Examinations

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 353** | **CONTROL SYSTEM LAB** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Time response of second order systems
2. Characteristics of synchros.
3. Effect of feedback on D.C servomotor.
4. Transfer function of D.C motor
5. Effect of P, PD, PID controller on a second order system
6. Simulation of transfer functions using operational amplifier
7. Lag and lead compensation – Magnitude and phase plot
8. Transfer function of D.C generator
9. Temperature controller using PID
10. Characteristics of magnetic amplifier
11. Characteristics of A.C servo motor
12. Stepper motor control
13. D.C. position control
14. P, PI, PD, PID control using Op-Amps.
15. Frequency response of first and second order systems.

**Note:** Minimum of ten experiments have to be performed and recorded by thecandidate to attain eligibility for University Examinations

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| **EE 321** | **ELECTRICAL MEASUREMENTS AND INSTRUMENTATION** | | **4** | **1** | **0** | **100** | **3** |

**UNIT - I**

**Instruments:** Classification of instruments – Construction and principle of operationof Permanent magnet moving coil - moving iron – dynamometer – induction type of instruments. Measurement of current, voltage, power, energy and reactive power in single phase and three phase circuits.

**UNIT – II**

Construction and principle of operation of Power factor meters – frequency meters and synchroscope.

**Magnetic Measurements:** Ballistic galvanometer –- B-H loop – flux meter –measurement of permeability.

**Oscilloscope:** Basic operation – deflection mechanism – time base circuits -vertical amplifiers - alternate and chop modes - applications.

**UNIT – III**

**Instrument Transformers:** CTs, PTs principle of operation – errors - testing.

**Bridges:** Measurement of inductance, capacitance and resistance by bridgemethods - Maxwell’s - Anderson’s - Wien’s - Schering’s - Heaviside’s - Campbell’s - Kelvin’s double bridge. Measurement of high resistance by Price’s guard wire, loss of charge methods.

**UNIT – IV**

**Digital Instruments:** Principle of operation of DVM’s – display devices LEDs andLCDs

**Transducers:** Principles - LVDT – frequency and power transducers

**Measurement of Non electrical quantities with electrical transducers:** Velocity,acceleration, Force, Torque, flow, temperature thermistor – thermo couple, displacement & strain.

Data recorders, data acquisition systems.

**Text Books:**

1. Electrical & Electronic Measurement & Instruments by A.K.Shawney Dhanpat Rai & Co 17th edition 2000.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing, 1999.

**Reference books:**

1. Electrical Measurements – by Buckingham and Price, Prentice – Hall, 1961
2. Electrical Measurements by Harris John Wiley
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.

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| **EE/EC 322** | **MICROPROCESSORS AND MICROCONTROLLER** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Microprocessor**: introduction to microcomputers and microprocessors, introductionand architecture of 8086 family, addressing modes, instruction description and assembler directives of 8086 microprocessors.

**UNIT – II**

**8086 programming and system connections**: Program development steps, writingprograms for use with an assembler, assembly language program development tools, writing and using procedures and assembler macros.

An example of minimum mode system, addressing memory and ports in microcomputer system. 8086 interrupts and interrupt responses.

**UNIT – III**

**Digital Interfacing**: Programmable parallel ports, handshake IO, interfaceMicroprocessor to keyboards.

**Analog interfacing**: DAC principle of operation, specifications and different types ofDAC's and interfacing.

**Programmable devices**: Introduction to Programmable peripheral devices 8255,8254, 8259, 8251, DMA data transfer, RS232 communication standard.

**UNIT – IV**

**Introduction**:- Introduction to microcontrollers, comparing microprocessors and

microcontrollers, Architecture:- Architecture of 8051, pin configuration of 8051 microcontroller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts.

**Programming & interfacing 8051**:- Addressing modes of 8051 microcontroller,Instruction set of 8051 microcontroller, simple programs using 8051 microcontroller.

**TEXT BOOKS:**

1. Duglus V. Hall, Microprocessor and Interfacing, Revised 2nd Edition, TMH,2006.
2. Kenneth J. Ayala, The 8051 Microcontroller Architecture Programming and Applications, 2nd Edition, Penram International Publishers (I), 1996.

**REFERENCE BOOKS:**

1. John Uffenbeck, The 80X86 Family, Design, Programming and Interfacing, 3rd Edition, Pearson Education, 2002.
2. Barry Bray, the intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium processors, architecture, programming, and interfacing, 6th Edition, PHI edition.
3. Mohammed Ari Mazidi and Janci Gillispie, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.

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| **EE/EC 323** | **DIGITAL SIGNAL PROCESSING** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Discrete Signals and Systems**: Introduction to digital signal processing, Advantages and applications, Discrete time signals, LTI system: Stability and causality, Frequency domain representation of discrete time signals and systems

**Z-Transforms**: Z-transforms, Region of convergence, Z-transform theorems andproperties, Parseval’s relation, Relation between Z-transform and Fourier transform of a sequence, Inverse Z transform using Cauchy’s integration theorem, Partial fraction method, Long division method, Solution of differential equations using one sided Z-transform, Frequency response of a stable system.

**UNIT – II**

**DFT And FFT**: Discrete Fourier Series, Properties of DFS, Discrete FourierTransform, Properties of DFT, Linear convolution using DFT, Computations for evaluating DFT, Decimation in time FFT algorithms, Decimation in frequency FFT algorithm, Computation of inverse DFT.

**UNIT – III**

**IIR Filter Design Techniques**: Introduction, Properties of IIR filters, Design of DigitalButterworth and Chebyshev filters using bilinear transformation, Impulse invariance transformation methods. Design of digital filters using frequency transformation method.

**UNIT – IV**

**FIR Filter Design Techniques**: Introduction to characteristics of linear phase FIRfilters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning window, Hamming window, Generalised Hamming window, Bartlett triangular window, Comparison of IIR and FIR filters.

**Realisation Of Digital Filters**: Direct, Canonic, Cascade, Parallel and Ladderrealizations

**TEXT BOOKS:**

1. Lonnie C Ludeman, Fundamentals of Digital Signal Processing, John Wiley & Sons, 2003.
2. S K Mitra, Digital Signal Processing: A Computer Based Approach, 2nd Edition, TMH.
3. Alan V Oppenheim and Ronald W Schafer, Digital Signal Processing, Pearson Education/PHI, 2004.
4. P.Ramesh Babu, Digital Signal Processing, 2nd Edition, Scitech Publications, 2004.

**REFERENCE BOOKS:**

1. Johnny R. Johnson, Introduction to Digital Signal Processing, PHI, 2001.
2. Andreas Antoniou, Digital Signal Processing,TMH, 2006.

3.John G.Proakis, Dimitris G Manolakis, digital Signal Processing: Principles, Algorithms and Applications, Pearson Education / PHI, 2003

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| **EE 324** | **POWER SYSTEM ANALYSIS & STABILITY** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Representation of power systems:** One line diagram - Impedance and Reactancediagrams – per unit quantities - changing the base - selection of base - per-unit impedances of three winding transformers - Advantages of per-unit computations.

Y Bus formation by inspection method.

**UNIT – II**

**Load Flows:**

Introduction – nonlinear equations - solutiontechniques using Gauss iterative, Gauss Seidal and Newton Raphson (rectangular and polar) methods using bus admittance matrix - acceleration of convergence - development of flow charts for load flow problems - comparison of different load flow methods. Data preparation for load flow program

**UNIT – III**

**Symmetrical Faults:** Transients in RL series circuit - short-circuit currents andreactances of synchronous machines - internal voltages of loaded machines under transient conditions - selection of circuit breakers

**Symmetrical components and Networks:** Introduction – operator ‘a’ – resolution ofthree unbalanced phasors into symmetrical components - power in terms of symmetrical components.

Unsymmetrical series impedance - sequence impedances and sequence networks of unloaded generators , circuit elements. Positive negative and zero sequence networks.

**Unsymmetrical Faults:** Single line to ground - line to line and double line to groundfaults on an unloaded alternator. Unsymmetrical faults on power systems - single line to ground line to line and double line to ground faults. Interpretation of the interconnected sequence networks.

**UNIT – IV**

**Power system stability:** Introduction – steady state stability, Transient stability,Review of machine swing equation - Equal area criterion of stability – applications. Step by step solution of the swing curve - factors affecting steady state and transient stabilities.

**Text Books:**

1. Elements of power system analysis by W D Stevenson Jr Fourth Edition TMH International student edition
2. Modern power system analysis by D.P. Kothari and I.J. Nagrath , TMH 3rd edition
3. Electrical power systems by C.L. Wadhwa, New age International (P) Limited
4. Power system analysis by TK Nagsarkar and Sukhija, Oxford press

**Reference Books:**

1. Power system stability by Kimbark Vol – I Willey Publications , Inc
2. Power system stability and control by P. Kundur , TMH
3. A. R. Bergen and V. Vittal; “Power System Analysis”, Pearson Publication.

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| **EE 325** | **POWER ELECTRONICS** | | **4** | **0** | **0** | **100** | **4** |

**UNIT-I**

**Power devices:** SCR - Theory of operation of SCR - Two transistor model of SCR -Characteristics and ratings - SCR turn on and turn off methods - Firing circuits R, RC, UJT and Ramp comparator Firing circuits - Protection of SCR - Series and parallel operation of SCRs - P-N-P-N devices - SCS, LASER, DIAC, TRIAC, IGBT, MOSFET and their characteristics – ratings - TRIAC triggering and turn off methods - Introduction to digital firing schemes.

**UNIT-II**

**Converters:** Principles of phase controlled converter operation - single phase halfwave converters - single phase semi converter and single phase full converters with R, RL types of load - single phase dual converter - three phase half wave converters - three phase full wave converters - three phase dual converter with R, L loads - effects of source and load inductance - pulse width modulation control for PF improvement.

**UNIT-III**

**Inverters:** Principle of inverter operation - single phase inverters- series, parallelinverters - Mc Murray Bedford half bridge inverters - three phase inverters (120,180 modes of operation) - voltage source inverters - current source inverters - pulse width modulated inverters.

**UNIT-IV**

**Choppers:** Principle of choppers - step up and step down choppers - differentclasses of chopper circuits and their analysis - Speed control of DC motors.

**Cyclo converters:** Principle and operation of single - phase and three phase cycloconverters and applications.

**TEXT BOOKS:**

1. Power Electronics, circuits, devices and applications by M.H. Rashid Pearson 3rd edition, 2005
2. Power Electronics by M.D.Singh and Khanchandani TMH, 2nd Edition

**REFERENCE BOOKS:**

1. Power Electronics by P.S. Bhimbra Khanna publications, 3rd Edition 2006
2. Power Electronics by W. Launder 2ndedition,1993
3. Industrial Electronics & Robotics by Shaler & C.Menamee
4. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, 2nd edition 2006

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| **EE 361** | **MICROPROCESSORS AND MICROCONTROLLERS LAB** | | **0** | **0** | **3** | **100** | **2** |

**Experiments Based on ALP (8086)**

1. Programs on Data Transfer Instructions.
2. Programs on Arithmetic and Logical Instructions.
3. Programs on Branch Instructions.
4. Programs on Subroutines.
5. Sorting of an Array.
6. Programs on Interrupts (Software and Hardware).
7. 8086 Programs using DOS and BIOS Interrupts.

**Experiments Based on Interfacing & Microcontroller (8051)**

1. DAC Interface-Waveform generations.
2. Stepper Motor Control.
3. Keyboard Interface / LCD Interface.
4. Data Transfer between two PCs using RS.232 C Serial Port
5. Programs on Data Transfer Instructions using 8051 Microcontroller.
6. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
7. Applications with Microcontroller 8051.

**NOTE:** A minimum of 10(Ten) experiments, have to be Performed and recorded bythe candidate to attain eligibility for University Practical Examination.

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| **EE 362** | **POWER ELECTRONICS LAB** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Static characteristics of SCR, Triac
2. Characteristics of MOSFET & IGBT
3. Gate triggering methods for SCR’s (R, R-C, UJT)
4. Single phase fully controlled rectifier with R, RL & RLE load (with or without feedback diode)
5. Characteristics of Jone’s chopper
6. Voltage commutated DC chopper
7. Characteristics of single – phase modified series inverter
8. Characteristics of single - phase parallel inverter with R & RL loads
9. Characteristics of single - phase cyclo-converter (Center tapped or Bridge)
10. Study of single - phase full wave McMurray Bedford inverter
11. Single phase dual converter with R & RL loads (Circulating and non circulating modes)
12. Three phase fully/half controlled rectifier with R, RL and RLE loads
13. Speed control of Universal motor
14. Characteristics of PWM converter
15. Characteristics of Morgan’s chopper
16. Characteristics of PWM inverter
17. Converter based DC motor control
18. Inverter based Induction motor control

**Note:** Minimum of ten experiments have to be performed and recorded by thecandidate to attain eligibility for University Examinations

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| **EE 363** | **ELECTRICAL MEASUREMENTS LAB** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Calibration and testing of single – phase energy meter
2. Kelvin’s Double Bridge – Measurement of resistance – Determination of tolerance
3. Schering Bridge – capacitance measurement and tan  measurement
4. Anderson Bridge – inductance measurement
5. Measurement of 3-phase active and reactive power in three phase circuits.
6. Measurement of 3-phase power using 3-Voltmeter and 3- Ammeter methods
7. Measurement of frequency using CRO.
8. Measurement of strain using strain gauge.
9. Tracing of B-H curve using CRO.
10. LVDT characteristics, calibration and displacement measurement.
11. Energy meter calibration by phantom loading.
12. Frequency measurement by Wein’s Bridge
13. Measurement of earth resistance by earth resistance tester & fall of potential method
14. Measurement medium resistance using Wheatstone Bridge
15. Testing of current transformer.
16. Measurement of dielectric strength of transformer oil by transfer oil testing kit
17. Fault identification and location in underground cables

**Note:** Minimum of ten experiments have to be performed and recorded by thecandidate to attain eligibility for University Examinations.

**Elective – I**

EE326/1: Massive Open Online Courses.

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| **EE/EC/EI 411** | **INDUSTRIAL MANAGEMENT** | | **4** | **0** | **0** | **100** | **3** |

**UNIT – I**  
**General Management:** Principles of scientific management - Brief treatment of managerial functions.  
**FORMS OF BUSINESS ORGANISATION:** Salient features of sole proprietorship. Partnership - Joint Stock Company – private limited and public limited companies.  
**UNIT – II**  
**Financial Management:** Concept of interest - compound interest - equivalent cash flow diagram  
**Economic Evaluation Of Alternatives:** Basic methods - the annual equivalent  
method - present worth method - future worth method.  
**Depreciation:** Purpose - types of depreciation - common methods of depreciation -The straight line method - declining balance method - the sum of the years digits method.  
**UNIT – III**  
**Personnel Management:** Functions of Personnel Management – Human Resources Planning - Brief treatment of Recruitment – Selection – Placement – Performance Appraisal - Career Development - Training and Development - Compensation. Staff role of Personnel Department - Organization for the Personnel Function. Goals and Plans of the Organization. Motivation and Leadership - Theories of motivation and styles of Leadership.  
**UNIT – IV**  
**Material Management:** Purchasing – Objective - Source Selection – Procurement Methods - Inventory Management –EOQ, EPQ, ABC Analysis.  
**Marketing Management:** Functions of Marketing - Product life cycle - Channels of distribution - Advertising & Sales promotion - Market Research.

**TEXT BOOKS:**  
1. KK Ahuja, Industrial Management, Vol. I & II, Dhanpat Rai, 1978.  
2. E.Paul Degarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan

Publishing Co, 1979

**REFERENCE BOOKS:**  
1. Philip Kotler, Marketing Management, 11th Ed, Pearson Education, 2004.  
2. P. Gopalakrishnan, Hand Book of Materials Management, PHI, 1999  
3. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH, 2004

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| **EE 412** | **POWER SYSTEM OPERATION AND CONTROL** | | **4** | **0** | **0** | **100** | **4** |

**UNIT – I**

**Economic operation of power systems:** Economic dispatch in thermal power station: Heat rate curves - cost curves - incremental fuel and production costs -economic distribution of load between units without consideration to line losses. Transmission line losses as a function of plant generation - calculation of loss coefficients - optimum generation allocation between thermal plants. Optimal unit commitment-Dynamic programing

**UNIT – II**

Load frequency control: Importance of keeping voltage and frequency constant in a power system - Load frequency control (LFC) single area case - the P-δ loop: Schematic of load frequency and AVR of a synchronous generator – mathematical modeling of generator, loads, prime mover and speed governor for LFC & corresponding block diagram representation - LFC block diagram of an isolated power system - steady state analysis - dynamic response. LFC for two area systems - automatic generation control (AGC) scheme – AGC in a single area and two area systems - block diagram representation.

**UNIT – III**

**Power flow control:** Control of power into a network-specification of bus voltage-capacitor anks-control by transformers.

**Reactive power control in synchronous generators:** The role of excitation system- exciter, generator and sensor models - simplified AVR block diagram -steady state response for a step change in terminal voltage.

**UNIT – IV**

**Real time control of power system:** Computer control of power systems-Energy control center-various levels

**State Estimation**: power system state estimation- weighted least square estimation- Maximum likelihood concepts-matrix formulations.

**Contingency analysis:** Adding and removing of lines-Piece wise solution of interconnected power system-Analysis of single contingencies-Analysis of multiple contingencies contingency analysis by D.C model.

**TEXT BOOKS:**

1) Modern power system analysis by D.P. Kothari & I.J. Nagrath McGraw Hill 3rdedition,2003

2) Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Comapany Ltd., Second edition 1983

3) Electrical power systems by C.L. Wadhwa, New age International (P) Limited

4) Understanding FACTS by Naran G. Hingorani, L. Gyugyi, 1st edition, 2001,Standard Publishers Distributors

**Reference Books**:

1) Elements of power system analysis by W D Stevenson Jr Fourth Edition TMH International student edition

2) Economic operation of interconnected systems by L.K.Kirchmeyer Wiley Eastern Ltd

3) Power system analysis by H. Saadat , McGraw Hill, 2nd edition

4) Power System Analysis Operation and Control by A Chakrabarti, Sunita Halder, PHI, 2007

5) Computer modeling of Electrical power systems by J.Arrillaga, N. A. Watson, second Edition2003, John Wiley & Sons, Ltd.

6) Power system control- technology by Torsten Cegrell, Prentice Hall international series in systems & control engineering

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| **EE 413** | **COMPUTER APPLICATIONS TO POWER SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**

**Incidence & Network Matrices:** Element-node incidence matrix – reduced incidence matrix or bus incidence matrix - basic loop incidence matrix – augmented loop incidence matrix - basic cut set incidence matrix - augmented cut set incidence matrix - branch path incidence matrix - concept of primitive network – primitive impedance and admittance matrices with and without mutual coupling – network performance equations - formation of network matrices using singular & non-singular transformation.

**UNIT – II**

**Algorithm for formation of network matrices & short circuit studies:**

Formation of bus admittance and bus impedance matrices and respective algorithms - modifications of bus impedance and admittance matrices for changes in the networks with and without mutual coupling - representation of three phase network elements for balanced and unbalanced systems - short circuit calculations for symmetrical and unsymmetrical faults using bus impedance matrix. Data preparation for short circuit program.

**UNIT – III**

**Load Flow studies**: Review of power flow methods - acceleration of convergence –Fast decoupled method-development of flow charts for load flow problems - comparison of Different load flow methods. Data preparation for load flow program

**UNIT – IV**

**Formulation of Transient Stability Problem:** Representing synchronous machine by constant voltage behind transient reactance (d- axis) and network by steady state equations - alternating solution approach for transient stability solving algebraic equations and differential equations alternately - numerical stability aspects of different integration schemes - combined solution approach. Flow chart for digital simulation of transient stability problem. Development of state equation (linearised version) for steady state stability of power systems with single machine connected to infinite bus using swing equation for the machine and incorporating excitation (IEEE, 1981) turbine and speed governor controls.

**Text Books:**

1. Computer methods in Power System Analysis by Stagg, G.W. & El-Abiad TMH

2. Computer Techniques in Power System Analysis by M.A. Pai , TMH 2005

3. Power System Stability & Control by P. Kundur , TMH 1998

4. Advanced Power System Analysis and Dynamics by L.P. Singh Wiley Eastern Ltd., New

Delhi 3rd edition 1993

**Reference Books:**

1. Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Comapany

Ltd., Second edition 1983

2. Control and stability of Power Systems by Anderson & Fouad, Iowa state university press

3. Modern power system analysis by Nagrath & Kothari TMH 3rd edition

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| **EE 414** | **SWITCHGEAR & PROTECTION** | | **4** | **0** | **0** | **100** | **4** |

**UNIT-I**

**Need for protection**: evolution of protective relays- zone of protection-primary and back-up protection – essential qualities of protection – classification of protective relays- basic relay terminology construction and operating principles of electromechanical relays, static relays and numerical relays.

**Over current protection:** Time-current characteristics- over current protection schemes- directional relay- protection of parallel feeders and ring mains – earth fault and phase fault protection.

**Differential protection:** basic differential protection- percentage differential relay- stability limit and stability ratio – settings of percentage differential relay.

**UNIT-II**

**Distance protection**: Introduction – impedance relay- reactance relay – effect of arc resistance, line length and power swings on the performance of distance relays- reach of distance relays- choice of characteristics for different zones of protection.

**Pilot relaying schemes:** carrier current protection- Phase comparison carrier current protection, carrier aided distance protection- carrier transfer and intertripping scheme, carrier blocking scheme.

**Numerical protection**: numerical relay – data acquisition systems- numerical distance protection -- numerical over current protection -- numerical differential protection.

**UNIT-III**

**Protection of Generators, Transformers and Bus zone:**

Generator Protection: Stator protection, Rotor protection and other Miscellaneous Protections.

Transformer Protection: Types of faults, Percentage differential protection, over heating Protection, Protection against Magnetising Inrush current, Buchholz relay, Rate of rise of pressure relay, over current relays, Earth fault relays and other Miscellaneous Protections.

Bus zone Protection: Differential current protection, High impedance relay scheme.

**UNIT-IV**

**Circuit breakers:** introduction-fault clearing time of a circuit breaker-arc voltage-arc interruption-restriking voltage and recovery voltage-resistance switching-current chopping-interruption of capacitive current.

Classification of circuit breakers-air break circuit breakers, oil circuit breakers- air blast circuit breakers – sf circuit breakers – vacuum circuit breakers- selection of circuit breakers – rating of circuit breakers

**TEXT BOOKS:**  
1. Power System Protection and Switchgear by B.Ram, D N Vishwakarma– Tata Mc-Graw Hill

Pub, 2nd edition.  
2. Electrical power systems by C.L. Wadhwa, New age International (P) Limited  
3. Fundamentals of Power System Protection by Y.G. Paithankar & S.R.Bhide, PHI, 2003

**REFERENCE BOOKS:**  
1. Power system protection Static relays by T.S. Madhava Rao TMH 2nd edition 1981  
2. The Art and Science of protective relaying by Mason Wiley Eastern Ltd  
3. Power system protection and switchgear by B. Ravindranath, Chander Willy Eastern Ltd 1992  
4. Switchgear and protection by Sunil S. Rao Khanna Publications

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| **EE 415** | **NEW AND RENEWABLE ENERGY SOURCES** | | **4** | **0** | **0** | **100** | **4** |

**UNIT-I**

**Renewable Energy Technologies:**

Basic principles of Energy conversion: Heat Energy Conversion Principles – Mechanical Energy Principles – Solar Radiation Conversion: Photovoltaic Conversion – Photo Electro Chemical Conversion – Solar Thermal Conversion – Fuel Cells – Basic Principles of Hydrogen – Oxygen fuel cell – factory effecting the Power output – Maximum Power output Bio Energy Conversion Process – Combustion and composting of Bio- Mass – Production of heat by bio-mass – Bio-logical Conversion into gaseous into liquid bio-fuels.

**UNIT-II**

**Introduction to Solar Cells:**

P-N Junction Under illumination: solar cell – generation of photo voltage – light generated current – I-V equation of solar cell – solar cell characteristics. Upper limits of cell parameters – short circuit current – open circuit voltage - Fill factor - efficiency –losses in solar cells – model of solar cell – effect of series –shunt Resistance on efficiency – effect solar radiation on efficiency -effect of temperature on efficiency – basic design aspects of solar cells.

**UNIT-III**

**Thin film solar cell technologies**:

Generic advantages of twin film technologies - materials for thin film technologies – thin film de position techniques – Common features thin film technologies.

**Solar Photo Voltaic modules:**

Solar PV modules from solar cells – series and parallel connection of cells – mismatch in series and parallel connection. Design and structure of PV modules: number of solar cells in a module – wattage of modules – fabrication of PV modules. PV module power output- I-V equation of P.V modules – ratings of P.V modules- I-V and Power curves of module. DC – DC convertors used in Solar systems – maximum power point tracking algorithms.

**UNIT-IV:**

**WIND ENERGY SYSTEMS:**

**Generation schemes with variable speed turbines:** classification of schemes – operating area –Induction Generators-Doubly fed Induction generators-Equivalent circuits-Reactive power and harmonics-Double output system with VSI-Variable voltage, variable frequency generation-circuit model and steady state operation and characteristics- effect of wind generator on the network. Wind speed measurements-Wind speed statistics-site and turbine selection.

**TEXT BOOKS:**  
1. Renewable Energy by Bent Sorensen, Academic Press, 4th edition.

2. Solar Photovoltaic fundamentals, Technology and applications, Chetan Singh Solanki, PHI Publications, 2nd edition

3. Wind Electrical Systems by S. N Bhadra, D. Kastha and S Banerjee, Oxford press publications

**REFERENCE BOOKS:**  
1. Power plant technology by EL-Wakil, Mc Graw-Hill  
2. Non-Conventional Energy Sources by G.D.Rai, Khanna Pub.

3. Renewable Energy Sources by John Twidell & Toney Weir : E&F.N. Spon

4. Renewable Energy Sources: Their impact on global warming and pollution by Abbasi & Abbasi –PHI

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| **EE 416/1** | **RENEWABLE ENERGY SOURCES** | | **4** | **0** | **0** | **100** | **3** |

**UNIT-I**  
**Principle of Renewable Energy:** Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth -primary supply to end use - Spaghetti & Pie diagrams - energy planning – energy efficiency and management.  
**UNIT-II**  
**Solar Radiation:** Extra-terrestrial solar radiation - terrestrial solar radiation – solar thermal conversion - solar thermal central receiver systems - photovoltaic energy conversion - solar cells – 4 models.  
**UNIT-III**  
**Wind energy:** Planetary and local winds - vertical axis and horizontal axis wind mills - principles of wind power - maximum power - actual power - wind turbine operation - electrical generator.  
**UNIT-IV**  
**Energy from Oceans:** Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction – tides - simple single pool tidal system.  
**Geothermal energy:** Origin and types - Bio fuels – classification – direct combustion for heat and electricity generator - anaerotic digestion for biogas – biogas digester - power generation.

**TEXT BOOKS:**  
1.Renewable Energy Sources by John Twidell & Toney Weir : E&F.N. Spon  
2. Renewable Energy Sources: Their impact on global warming and pollution by Abbasi & Abbasi –PHI

**REFERENCE BOOKS:**  
1. Power plant technology by EL-Wakil, Mc Graw-Hill  
2. Non-Conventional Energy Sources by G.D.Rai, Khanna Pub.

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| **EE 416/2** | **UTILIZATION OF ELECTRICAL POWER** | | **4** | **0** | **0** | **100** | **3** |

**UNIT – I**  
**Electric Traction:** Introduction- Systems of electric traction- comparison between DC and AC systems in electric traction - mechanics of train movement- speed-time curves- effect of speed-acceleration and distance on schedule- Power and energy output from driving axles- specific energy output- collectors - introduction to electric braking – comparison of electric and mechanic braking.  
**UNIT – II**  
**Electric Heating:** Introduction; Modes of heat transfer - Stefan’s law –classification of electric heating methods- design of heating element - Construction and working of different types of induction furnaces - resistance furnace - Dielectric heating – arc furnaces .  
**UNIT – III**  
**Welding:** Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding - comparison (Excluding electronic controls)- requirements of good weld-ultra sonic-electron beam-laser beam welding.  
**UNIT – IV**  
**Illumination:** Introduction- terms used in illumination-laws of illumination-Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps – comparison between filament and fluorescent lamps-square law methods of calculation – Factory lighting - flood lighting and street lighting-design of lighting schemes-introduction to Compact Fluorescent Lamps.  
**Storage batteries:** Applications-rating-classification-dry cell and wet cells-primary and secondary cells-charging and discharging of lead acid cells, trickle charging methods of charging lead acid batteries-over discharging-common troubles with lead acid batteries and remedies-Nickel cadmium batteries.

**Text Books:**  
1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U. S. Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 2001.  
2. Utilization Electric Power and electric traction by J.B.Gupta, publishers-Katson books  
3. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers.

**Reference Books**:  
1. Generation, Transmission & Utilization Electric Power by A.T. Starr London, Pitman. 1953  
2. Art and Science of Utilization of Electrical Energy by Partab H Dhanpat Rai and Sons, New Delhi. Second edition

3. Electrical Technology, volume-1 by B.L.Thereja, S.Chand &co publishers

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| **EE 451** | **COMPUTER APPLICATIONS TO ELECTRICAL SYSTEMS LAB -1** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**  
1. Simulation of a single-phase full-bridge converter with different loads  
2. Simulation of static characteristics of SCR  
3. Simulation of a resonant pulse commutation circuit and buck chopper  
4. Simulation of an AC voltage controller with various loads  
5. Simulation of single-phase inverter with PWM control  
6. Modeling of transformer  
7. Transfer function analysis of a given circuit  
8. State model representation of transfer functions  
9. Plotting of Bode, Nyquist and root-locus plots for transfer functions  
10. Steady state and Transient analysis of RLC circuits  
11. Develop a program for Ybus by inspection  
12. Develop a program for Zbus using Zbus building algorithm

13. Simulation of loop and Nodal analysis of linear circuits.

14. Develop a program to find ABCD parameters of a transmission line.

15. Write a program to find efficiency and regulation of a transmission line

Note: A minimum of 10 experiments are to be completed.

Simulation is to be carried out with the following software PSPICE/ MATLAB/ MiPower/ PSIM/ PSCAD/ EMTP.

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| **EE 452** | **POWER SYSTEMS LAB** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**  
1. Characteristics of over current relay & Earth fault relay  
2. Characteristics of over voltage / under voltage relay  
3. Characteristics of differential relay  
4. Characteristics of definite time reverse power relay  
5. Characteristics of negative sequence relay  
6. Sequence impedances of alternator  
7. Harmonic analysis using power network analyzer  
8. Characteristics of distance relays  
9. Power factor correction of induction motor  
10.Determination of Transmission line parameters  
11.Regulation and efficiency of transmission line including Ferranti effect  
12.Reactive power control by tap changing transformers  
13.Sequence impedances of transformer  
14.Grading of Insulators  
15.Short circuit studies using DC network analyzer  
16.Compensation of transmission line model using Facts devices  
17.H.V. testing of Insulators  
18.High voltage testing of cables

**Note:** Minimum of ten experiments have to be performed and recorded by the  
candidate to attain eligibility for University Examinations

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| **EE 421** | **INDUSTRAIL DRIVES** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Introduction:** Electric drives - advantages of electric drive - Type of electric drives -components of electric drives - Status of dc and ac drives.  
**Dynamics of Electric Drives:** Fundamental torque equations - Speed torque conventions and multi quadrant operation - Equivalent values of drive parameters -Components of load torques - some common load torques - Nature and classification of load torques  
**Control of Electric Drives:** Modes of operation - Speed control and drive classification - closed-loop control of drives.  
**UNIT - II**  
**DC motor Drives:** DC motors and their performance – Starting - methods of braking - speed control -Methods of armature voltage control - Transformer and uncontrolled rectifier control.  
**Controlled Rectifier fed DC Drives:** Single phase fully and half controlled rectifier control of separately excited dc motor - Three phase fully and half controlled rectifier control of separately excited dc motor - Dual converter control of separately excited dc motor - comparison of conventional and static Ward-Leonard schemes – Rectifier control of dc series motor.  
**Chopper fed DC Drives:** Control of separately excited dc motors - Chopper control of series motor.  
**UNIT – III**  
**Induction motor drives:** Three phase induction motors - Operation with unbalanced source voltages and single phasing - Operation with unbalanced rotor impedances –Starting – braking - transient analysis - Speed control - pole amplitude modulation -stator voltage control - Variable frequency control from voltage and current sources -Eddy current drives - rotor resistance control - slip power recovery - Variable speed constant frequency generation.  
**UNIT – IV**  
**Synchronous motor drives:** Synchronous motors - Operation and fixed frequency supply - Synchronous variable speed drives - braking of synchronous motor. Switched reluctance motor drives - brush less dc motors - stepper motors – variable reluctance motor.

**Text Books:**  
1. Fundamentals of Electric drives by G.K. Dubey, Narosa, 2001

**Reference Books:**  
1. Power Semiconductor controlled drives by G.K. Dubey , PH,1989  
2. Power semiconductor drives by S.B. Dewan, G.R. Selmon & Straughen ,John Wiley, 1984  
3. Thyristorised power controllers by GK Dubey SR Doradla, New Age  
4. Electric drives by Nisit K De and P.K. Sen, PHI 2006

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 422** | **UTILIZATION OF ELECTRICAL ENERGY** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Motor Power Rating and selection:** General considerations in selecting motor power ratings - Selection of motor capacity for continuous duty - Equivalent current -torque and power methods - Selection of capacity for short time and intermittent periodic duty - Heating and cooling of motors - Load equalization - fly wheel and its applications in load equalization. Electric braking advantages - plugging - rheostatic and regenerative braking applied to DC motors.  
**UNIT – II**  
**Electric Traction:** Systems of electric traction - transmission of drive – mechanics of train movement, speed-time curves, effect of speed, acceleration and distance on schedule, Power and energy output from driving axles, specific energy output, series – parallel method of speed control shunt bridge transition – collectors – different types of electric braking - reverse current - rheostatic and regenerative braking. Counter current braking and reversal of shunt motors.  
**UNIT – III**  
**Electric Heating:** Elementary principles of heat transfer - Stefan’s law – electric furnaces - resistance furnace - design of heating element - losses and efficiency - Construction and working of different types of induction furnaces - Dielectric heating - arc furnaces - control equipment.  
**Welding:** Types of welding - resistance and arc welding - Characteristics of Carbon and metallic arc welding - comparison (Excluding electronic controls)  
**UNIT – IV**  
**Illumination:** Light production by excitation - Gas discharge lamps – Fluorescent lamps - Ultra violet lamps - Arc lamps - Filament lamps - Polar curves - Effect of voltage variation - Lighting calculations solid angle and square law methods of calculation - Factory lighting - flood lighting and street lighting.

**Text Books:**  
1. Art and Science of Utilization of Electrical Energy by Partab H Dhanpat Rai and Sons, New

Delhi. Second edition  
2. Utilization Electric Power by Openshaw Taylor Orient Longman,1986  
3. Generation distribution and utilization of electrical energy by CL Wadhwa, New Age 2005

**Reference Books**:  
1. Generation, Transmission & Utilization Electric Power by A.T. Starr London, Pitman. 1953  
2. Controllers for Electric Motors by James and Markie  
3. Electric Drives by M. Chillikin Mir Publishers, Russia 1986  
4. Web sites: bee-india.org, eia.doe.gov, [www.irfca.org](http://www.irfca.org).

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| **EE 423/1** | **HVDC TRANSMISSION** | | **4** | **1** | **0** | **100** | **4** |

**UNIT-I**  
**General considerations of AC and DC transmission:** Introduction – economic advantages of DC over AC transmission - types of DC links - brief description of the layout of a bipolar HVDC link - technical advantages of DC over AC transmission - application of DC transmission system - planning and modern trends in DC transmission - brief summary of the technical details of HVDC projects in India.  
**UNIT-II**  
**Converter Circuits:** Properties of converter circuits - different kinds of arrangements - choice of converter configuration analysis of bridge converters with grid control with and without overlap angle -complete characteristics of 6 pulse and 12 pulse converters - operation as an inverter - converter parameters and characteristics - values of transformer secondary currents - converter equations.  
**Protection:** Converter faults - short circuit current - arc back currents - short circuit currents in rectifier and inverter - protection against over currents - DC smoothing reactors,- bypass valves - DC circuit breakers. protection against over voltages –surge arresters.  
**UNIT-III**  
**Converter and HVDC system Control:**  
Principles of DC link control - converter control characteristics - firing angle control - current and extinction angle control - effect of source inductance – starting and stopping of DC link - the four operating modes of the DC link – CG, AC, AG, CV - power control - sources of reactive power - reactive power requirements in steady state - reactive power control. Introduction to HVDC simulator.  
**UNIT-IV**  
**Power Flow Analysis in AC/DC systems:** Modeling of DC links - solution of DC load flow .  
**Harmonics and Filters:** Generation of harmonics - characteristic and uncharacteristic harmonics - adverse effects of harmonics - calculation of voltage and current harmonics. The impedance loci; Methods of reducing the harmonics –AC tuned and high pass filters - DC filters - telephonic interference.

**TEXT BOOKS:**  
1. HVDC power transmissions systems: Technology and system interactions by K.R. Padiyar New

age International (P) Ltd.  
2. HVDC transmission by J. Arrillaga, Peter Peregrinus

**REFERENCE BOOKS:**  
1. Direct Current transmission by E.W.Kimbark, John Wiley  
2. Power Transmission by Direct Current by E.Uhlmann, Springer-Verlag  
3. HVDC power converters and systems by B.J.Cory and Mc Donald  
4. EHVAC and HVDC transmission engineering and practice by S. Rao  
5. HVDC transmission by Adamson and Hingorani

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| **EE 423/2** | **ELECTRICAL DISTRIBUTION SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Distribution systems planning and automation:** Planning and forecast techniques - Present and future role of computers in distribution system planning –automation - Methods of improvement - Load characteristics – Definitions load growth – tariffs - Diversified demand method.  
**UNIT – II**  
**Distribution transformers:** Types - Regulation and Efficiency - Use of monograms for obtaining efficiency - distribution factors – KW KVA Method of determining regulation.  
**Deign of sub transmission lines and distribution substations:** Introduction – sub transmission systems - distribution substation – Substation bus schemes -description and comparison of switching schemes – substation location and rating -Application of network flow techniques in rural distribution networks to determine optimum location of sub-station.  
**UNIT – III**  
**Design considerations on primary systems:** Introduction - types of feeders - voltage levels - Radial type feeders - feeders with uniformly distributed load and nonuniformly distributed loads.  
**Design considerations of secondary systems:** Introduction - secondary voltage levels - Secondary banking - existing systems improvement.  
**Distribution system Protection:** Basic definitions - over current protection devices -fuses, automatic circuit reclosures, automatic line sectionalizers - objectives of distribution system protection - coordination of protective devices - Fuse to Fuse coordination, Fuse to circuit breaker coordination, Reclosure to circuit breaker coordination.  
**UNIT-IV**  
**Voltage drop and power loss calculations:** Three phase primary lines - non 3 phase primary lines - 4 wire multi grounded primary lines - copper loss – Distribution feeder costs - loss reduction and voltage improvement in rural distribution networks.  
**Applications of Capacitors to distribution systems:** Effect of series and shunt capacitors - Power factor correction - economic justification for capacitors – a computerized method to determine the economic power factor - Procedure to determine the best and optimum capacitor location  
**Distribution System Voltage Regulation:** Basic definitions - Quality of service - voltage control - line drop compensation.

**TEXT BOOKS**:  
1. Electric Power Distribution System Engg. by Turan Gonen, MGH  
2. Electrical Distribution Systems by Dr. V. Kamaraju, Right Publishers  
3. Electrical Power Distribution Automation by Sivanagaraju & Sankar, Dhanpatrai & Sons

**REFERENCE BOOK**:  
1. Electric Power Distribution by A.S. Pabla, TMH, 4th Ed., 1997

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| **EE 423/3** | **DIGITAL CONTROL SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**SAMPLING AND Z-PLANE ANALYSIS**  
Introduction, sample and hold operations, Sampling theorem, Reconstruction of original sampled signal to continuous-time signal.  
**REVIEW OF Z-TRANSFORMS:**  
Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane: Primary strips and Complementary Strips.  
**UNIT – II**  
**State Space Analysis:** State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it’s Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations. Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability  
conditions for Pulse Transfer Function.  
**UNIT – III**  
**Stability Analysis:** Stability Analysis of closed loop systems in the Z-Plane. Jury stablility test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems.  
**Design Of Discrete Time Control System By Conventional Methods:** Design of digital control based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers. Design digital control through deadbeat response method.  
**UNIT – IV**  
**State Feedback Controllers And Observers:** Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman’s formula. State Observers – Full order and Reduced order observers.  
**Linear Quadratic Regulators**: Min/Max principle, Linear Quadratic Regulators

**TEXT BOOKS:**  
1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.  
2. Digital Control and State Variable Methods by M.Gopal, TMH  
3. Discrete-Time Control systems - K. Ogata, Pearson Education

**REFERENCE BOOKS:**  
1. Digital Control Engineering, M. Gopal Wiley Eastern  
2. Modern control engineering by K.Ogata, PHI

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| **EE 423/4** | **COMPUTER ORGANIZATION** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Register Transfer And Micro operations**: Register Transfer Language, Register Transfer, Bus and memory Transfers, Arithmetic Micro-operations, Logic Micro operations, Shift Micro operations, Arithmetic logic shift unit  
**Basic Computer Organisation And Design:** Instruction codes, Computer Registers, Computer Instructions, Timing and control, Instruction cycle, Memory Reference Instruction, Input-output and Interrupt, Design of basic computer, Design of accumulator logic.  
**UNIT – II**  
**Micro Programmed Control:** Control Memory, Address Sequencing, Micro program example, design of control unit.  
**Central Processing Unit :** General register organization, stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, Reduced Instruction set computer (RISC).  
**Pipe Line And Vector Processing**: Parallel processing, pipelining, Arithmetic pipeline, RISC pipeline, vector processing, Array Processing.  
**UNIT – III**  
**Computer Arithmetic**: Addition and Subtraction, multiplication Algorithms, Division Algorithms, Floating-point Arithmetic operations.  
**Input -Output Operations :** Peripheral Devices, Input-output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor, Serial communication.  
**UNIT - IV**  
**Memory Organisation:** Memory hierarchy, Main memory, Auxiliary memory, Associate Memory, Virtual Memory, Memory management hardware.  
**Multiprocessors:** Characteristics of multiprocessors, Interconnection Structures, Interprocessor Arbitation, Interprocessor communication and synchronization, cache coherence.

**TEXT BOOKS:**  
1. Computer systems Architecture - by Morris M. ano (chapters: 4,5,7 to 13) (3rd edition).

**REFERENCE BOOKS:**  
1. Computer Architecture and organisation - by John P Hayes (2nd Ed.)  
2. Computer Organization - by V. Carl Hamacher et.al. (2nd ed.)

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| **EE 423/5** | **COMPUTER NETWORKS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Introduction:** Uses of Computer networks, Network Hardware, Network Software, Reference Models (OSI and TCP/IP only).  
**Physical Layer:** Introduction to Guided Transmission Media, Wireless Transmission  
**UNIT – II**  
**Data Link Layer:** Data Link Layer design issues, Error detection and correction, Elementary Data link Protocols, Sliding window protocols.  
**Medium Access Control Sublayer:** The channel Allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband wireless, Bluetooth, Data Link Layer Switching.  
**UNT – III**  
**Network Layer:** Network layer Design Issues, Routing Algorithms – (The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts.) Congestion Control Algorithms, Quality of Service - (Requirements, Techniques for Achieving Good Quality of Service), Internetworking, The Network layer in the internet- (The IP Protocol, IP Address, Internet Control Protocols, OSPF, BGP).  
**UNIT – IV**  
**Transport Layer:** Elements of Transport Protocols, TCP, UDP,RTP.  
**Application Layer:** DNS, Electronic Mail, The World Wide Web (Architectural Overview only) Multimedia.

**TEXT BOOKS:**  
1. A.S Tanenbaum, Computer Networks, 4th Edition, PHI, 2003  
2. Behrouz A. Foruzan, Data communication and Networking, 4th Edition,TMH, 2004.

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| **EE 424/1** | **FACTS CONTROLLER** | | **4** | **1** | **0** | **100** | **4** |

**UNIT-I**  
**FACTS Concept and General system Considerations**: Power Flow in AC system - definitions on FACTS - Basic types of FACTS Controllers. Converters for Static Compensation - Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM) - GTO Inverters - Multi-Pulse Converters and Interface Magnetics - Transformer Connections for 6 and 12 pulse operation.  
**UNIT-II**  
**Static Shunt Compensators**: SVC and STATCOM - Operation and Control of TSC, TCR, STATCOM - Comparison between SVC and STATCOM - STATCOM for transient and dynamic stability enhancement.  
**UNIT-III**  
**Static Series Compensation**: GCSC, TSSC, TCSC and SSSC - Operation and Control - External System Control for series Compensators - SSR and its damping - Static Voltage and Phase Angle Regulators - TCVR and TCPAR - Operation and Control.  
**UNIT-IV**  
**UPFC and IPFC**: The unified Power Flow Controller – Operation - Comparison with other FACTS devices - control of P and Q - Dynamic Performance - Special Purpose FACTS controllers - Interline Power flow Controller - Operation and Control.

**TEXT BOOKS:**  
1. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, 2000 by N.G. Hingorani & L.Gyugyi  
2. Reactive Power Control in Electric Systems by T.J.E. Miller , John Wiley & sons

**REFERENCE BOOKS**:  
1. FACTS controllers in power transmission and distribution by Padiyar KR, New Age  
2. Power Electronics, circuits, devices and applications by M.H. Rashid Pearson 3rd edition, 2005  
3. Journal & Conference papers from IEEE

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| **EE 424/2** | **EHV AC TRANSMISSION** | | **4** | **1** | **0** | **100** | **4** |

**UNIT- I**  
**E.H.V. A.C. Transmission**: line trends and preliminary aspects, standard transmission voltages – power handling capacities and line losses – mechanical aspects.  
**Calculation of Line Resistance and Inductance:** resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell’s coefficient matrix.  
**UNIT- II**  
**Line Capacitance Calculation :** capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and diagonalization. Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings.  
**UNIT - III**  
Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula. Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling  
waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.  
**UNIT -IV**  
**Power Frequency Voltage Control** : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines Static reactive compensating systems : Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

**TEXT BOOKS :**  
1. Extra High Voltage AC Transmission Engineering – Rakosh Das Begamudre, Wiley Eastem ltd., New Delhi – 1987.  
2. EHV Transmission line reference book – Edision Electric Institute (GEC) 1986.

**REFERENCE BOOKS:**  
1. EHV AC/ DC Transmission engineering and practice by S.Rao, Khanna publications

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| **EE 424/3** | **DATABASE MANAGEMENT SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT-I**  
Databases and Database users, Database systems, concepts and Architecture  
Data Modeling using the Entity-Relationship model  
**UNIT-II**  
The Relational Data Model, Relational constraints, and the Relational Algebra SQL-The Relational Database standard. ER and EER – to – Relational mappings, and other relational languages.  
**UNIT-III**  
Functional Dependencies and Normalizations for Relational, Database Relational Database Design Algorithms and Further Dependencies, Database system Architectures and the system catalog  
**UNIT-IV**  
Transactions Processing Concepts, Concurrency Control Techniques

**TEXT BOOK:**  
1. Fundamentals of Database Systems, 3rd edition by Elmasri and Navathe, Addison Wesley, Pearson Education, Inc. 2000.

**REFERENCE BOOKS:**  
1. An introduction to Database Systems by Bipin C. Desai, West Publishing Company, 2000  
2. An introduction to Database Systems, 6th Edition, Addison Wesley Longman Inc.,1999

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| **EE 424/4** | **EMBEDDED SYSTEMS & VLSI** | | **4** | **1** | **0** | **100** | **4** |

**UNIT-I**  
**Introduction**: Embedded systems overview - design challenge – processor technology - IC technology - Design technology - Tradeoffs.  
**Single purpose Processors**: RT Level combinational logic - sequential logic (RTLEVEL) - optimizing custom single purpose processors.  
**General purpose processors**: Basic architecture - operation – pipelining - programmer’s view - development environment - application specific instrumentation– set processors (ASITPS) – Micro controllers and Digital signal processors.  
**UNIT-II**  
**MOS & BIMOS Technology**: An introduction to MOS technology – BIMOS technology - Basic electrical properties of MOS & BIMOS circuits - MOS and BIMOS circuit design processors - Basic circuit concepts - sheet resistance – area capacitances of layers - the delay unit - scaling of MOS circuits - scaling models - scaling factors for device parameters.  
**UNIT-III**  
**Sub-system design and layout:** Architectural issues - switch logic - Gate logic - examples of structured design (combinational logic) - Memory registers and aspects of system timing - system timing considerations - commonly used storage / memory elements.  
**Semiconductor integrated circuit design:** PLA – FPGAS – CPLDS -standard cells  
- programmable array logic - design approach.  
**UNIT-IV**  
**Design Technology:** Introduction to automation – synthesis - the parallel evolution of compilation and synthesis - logic synthesis - RT synthesis - behavioral synthesis - system synthesis and Hardware/Software code design – verification - Hardware/Software co-simulation - reuse of intellectual property coder.

**TEXT BOOKS:**  
1.Embedded system Design – A unified Hardware/ Software introduction by Frank Vahid, Tony

D.Givargis  
2. Introduction to Embedded systems by Raj kamal, TMH, 2002  
3. Basic VLSI Design systems and circuits by Douglas A.Pucknell, Kamaran Eshraghian, PHI  
4. Application of specific integrated circuits by Michael John Sebastian Smith, Addison Wesley

**REFERENCE BOOKS:**  
1. Embedded Microcomputer systems by Jonathan W. Valvano, Brooks/ cole, Thompson learning  
2. Modern VLSI Design by Wayne Wolf, Pearson Education

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| **EE 424/5** | **ANN AND FUZZY SYSTEMS** | | **4** | **1** | **0** | **100** | **4** |

**UNIT – I**  
**Artificial Neural Network:** Concept – evolution – basic models – Notation and terminology – training  
**Supervised learning Network:** Introduction – Perceptron networks – Adaptive linear neuron – Multiple adaptive linear neurons – Back propagation network – radial basis network  
**UNIT–II**  
**Associative Memory Networks:** Training algorithms for pattern association – Auto associative memory network – Bidirectional associative memory – Hopfield networks – Iterative auto associative memory networks – Temporal associative memory network  
**Unsupervised learning networks:** Fixed weight competitive nets – Kohenen self-organizing feature maps – learning vector quantization – counter propagation networks – Adaptive resonance theory network.  
**UNIT- III**  
**Fuzzy logic:** Classical sets – fuzzy sets – classical relations – fuzzy relations – tolerance and equivalence relations – Membership functions – fuzzification – Membership value assignments – Defuzzification – Fuzzy arithmetic – Fuzzy measures – Fuzzy rule base and approximate reasoning – fuzzy decision making.  
**UNIT – IV**  
**Hybrid fuzzy neural networks:** Hybrid system – fuzzy logic in learning algorithms - fuzzy neurons – Neural networks as pre-processors, post processors, tuners – FNN architecture based on back propagation – ANFIS

**TEXT BOOK:**  
1. Principles of soft computing by S.N.Sivanandam, S.N.Deepa, John Wiley India –2007  
2. Fuzzy logic and Neural networks: Basic concepts and applications by Chennakesava R

Alavala, New Age International (P) Ltd., 2008  
3. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan

and Pai – PHI Publication.

**REFERENCE BOOKS:**  
1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education,2002.  
2. Neural Networks – Simon Hakins , Pearson Education  
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI  
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 461** | **COMPUTER APPLICATIONS TO ELECTRICAL SYSTEMS LAB-II** | | **0** | **0** | **3** | **100** | **2** |

**LIST OF EXPERIMENTS:**

1. Short circuit studies in power systems  
2. Transient stability analysis of power systems  
3. Relay co-ordination in power systems  
4. Simulation of two area system  
5. Develop a program for Load flow analysis by Gauss - Seidel method  
6. Develop a program for load flow analysis by Newton - Raphson method  
7. Develop program for load flow analysis by FDLP method.

8. Simulation of solar cell and develop its equivalent circuit.

9. Simulation of PV module to obtain I-V characteristics and power output

10. Simulation of slip power control scheme with DC voltage link.

11. Simulation of Reactive power compensation of DFIG

12. Simulation of single/multiple contingencies in power systems.

13. Write a program for transient stability analysis of multi machine power system.

14. Write a program for MPPT for PV panel using P & O Algorithm.

15. Write a program for MPPT for PV panel using PSO Algorithm.

Note: A minimum of 10 experiments are to be completed.

Simulation is to be carried out with the following software PSPICE/ MATLAB/ MiPower/ PSIM/ PSCAD/ EMTP.

**Elective – II (Open)**  (Note: Offered to other Branches)

EE416/1: Renewable Energy Sources

EE416/2: Utilization of Electrical Energy

**Elective-III**

EE423/1: HVDC Transmission

EE423/2: Electrical Distribution Systems

EE423/3: Digital Control Systems

EE423/4: Computer Organization

**Elective – IV**

EE424/1: FACTS Controllers

EE424/2:EHV AC Transmission

EE424/3: Database Management Systems

EE424/4: Embedded Systems & VLSI

EE425/4: ANN and Fuzzy Systems

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|  |  |  | **L** | **T** | **P** | **M** | **C** |
| **EE 462** | **PROJECT WORK** | | **0** | **0** | **12** | **200** | **10** |

**The Project Report has to be submitted at the end of the semester and marks will be awarded based on the Viva-voce examination.**