Important Academic Rules
Scheme of Studies & Syllabus

B.Tech. Degree Programme
Electrical Engineering
(Effective from 2009-2010)

LINGAYA’S UNIVERSITY
choose to know
(u/s 3 of UGC Act 1956)
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ABBREVIATIONS/DEFINITIONS

- "AC" means, Academic Council of the University.
- "BOM" means, the Board of Management of the University.
- "BOS" means, the Board of Studies of the Department.
- "CAU/AUC-option" means change from Credit to Audit option / change from Audit to Credit option.
- "Class/Course Committee" means, the Class/Course Committee of a class/course.
- "Course" means, a specific subject usually identified by its course-number and course-title, with a specified syllabus / course-description, a set of references, taught by some teacher(s) / course-instructor(s) to a specific class (group of students) during a specific academic-semester / term.
- "Course Instructor" means, the teacher or the Course Instructor of a Course.
- "Curriculum" means the set of Course-Structure and Course-Contents.
- "DAA" means, the Dean of Academic Affairs.
- "DAAB" means Departmental Academic Appeals Board.
- "DEC/PEC" means Dissertation Evaluation Committee / Project Evaluation committee.
- "Department" means a group in the University devoted to a specific discipline also called a School. Department and School are used interchangeably.
- "DSA" means, Dean Student Affairs.
- "ETE" means End Term Examination.
- "Faculty Advisor/Class Counsellor" means, the Faculty Advisor or the Panel of Faculty Advisors, in a Parent Department, for a group (admission-batch) of students. Also known as Class Counsellor.
- "Grade Card" means the detailed performance record in a term/ programme.
- "He" means both genders “he” and “she”; similarly "his" and/or "him" includes "her" as well, in all the cases.
- "HOD" means, the Head of the Department.
- "MET" means Make-up End Term.
- "MLC" means Mandatory Learning Course.
- "MTE" means Mid Term Examination.
- "Parent Department" or "Degree Awarding Department" means, the department that offers the degree programme that a student undergoes.
- "Project Guide" means, the faculty who guides the Major Project of the student.
- "Regulations" means, set of Academic Regulations.
- "University" or “LU” means, Lingaya’s University, Faridabad.
- "VC" means, the Vice Chancellor, Lingaya’s University, Faridabad.
CODE OF CONDUCT AND ETHICS FOR STUDENTS

1. Wear decent dress respecting his/her modesty as well as that of others.
2. Expected to respect and show regard for teachers, staff and fellow students.
3. Inculcate civic sense and sensitivity for environment protection.
4. Not to resort to collection of funds for any use without written permission of VC.
5. To exhibit exemplary behaviour, discipline, diligences, and good conduct and are a role model to other students.
6. Not to indulge in offences of cognizable nature.
7. Not to practice casteism, communalism.
8. Not to indulge in any other conduct unbecoming of a professional student of the University.
9. Not to outrage the status, dignity and honour of any person.
10. Not to get involved in physical assault or threat, and use of physical force against any body.
11. Not to expose fellow students to ridicule and contempt that may affect their self esteem.
12. Not to form any kind of student’s Union, etc.
13. Not to take active or passive part in any form of strikes/protests.
14. To observe all safety precautions while working.
15. Not to disfigure/damage the University property, building, furniture, machinery, library books, fixtures, fittings, etc. (Damage / loss caused shall have to be made good by the students).
16. Use of mobile/video camera phones is strictly prohibited inside the examination halls, class rooms, laboratories and other working places. The University has the right to confiscate the mobile phones in case of any violation.
17. Not to indulge in ragging/teasing, smoking, gambling, use of drugs or intoxicants, drinking alcohol, rude behavior, and use of abusive language.
18. Not to resort to violence, unruly travel in buses, bullying, threatening and coercing others for undesirable act, such as preventing from attending classes, writing exam. / tests, etc etc.
19. All the students of the University shall be under the disciplinary control of the VC.
20. Students are deemed to be under the care and guidance of parents. It is obligatory for the former to appraise their progress (given by the CC) to the parents.
21. Fine, if ever imposed, is only to improve discipline and shall be paid promptly.
22. While on campus, students have to take care of their belongings and no responsibility for any loss or damage can be held by the University.
23. Every student shall produce the I-Card on demand, and if lost, get a duplicate issued.
24. The students must attend all lectures, tutorials and practical classes in a course punctually (The attendance will be counted course-wise).
25. To abide by the rules and regulations of the University stipulated from time to time.
IMPORTANT ACADEMIC RULES
B.Tech. Degree Programme (Regular)

GENERAL
- The Regulations may evolve and get revised/refined or updated or amended or modified or changed through approvals from the Academic Council from time to time, and shall be binding on all parties concerned, including the Students, Faculty, Staff, Departments, University Authorities and officers. Further, any legal disputes shall be limited to the legal jurisdiction determined by the location of the University and not that of any other parties.
- If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation etc., the matter will be reported to the AC, recommending revoking the admission of the candidate.
- The University reserves the right to cancel the admission of any student at any stage of his study or changed through approvals from the Academic Council from time to time, and shall be binding on all parties concerned, including the Students, Faculty, Staff, Departments, University Authorities and officers. Further, any legal disputes shall be limited to the legal jurisdiction determined by the location of the University and not that of any other parties.
- Medium of Instruction shall be English.

PROGRAMME
- The normal duration of the programme leading to B.Tech degree will be four years comprising twelve trimesters (or terms).
- The B.Tech. Degree programme consists of two modes i.e. (a) Project Mode and (b) with Internship.
- The total course package for a Regular B.Tech Degree Programme with Project Mode will typically consist of the following components.
  (i) General courses
  (ii) Basic Science and Mathematics
  (iii) Engineering Science and Technical Arts
  (iv) Core Courses
  (v) Elective Courses
    An Elective Course can be any of the following:
    a) Departmental Elective
    b) Open Elective
  (vi) Project/Internship (Supervised)
  (vii) Major Project/Internship (Supervised)
  (viii) Industrial Training
  (ix) Mandatory Learning Courses
- The Regular B. Tech. Degree Programme with internship will typically consist of all the components of the Regular Project Mode as above, however with different weightage to industrial training and core courses.
- The student has to opt for the Internship Scheme in the ninth term which will not be revoked in any circumstances. In the absence of exercising the option, it will be presumed that option is for Project Mode.
- A student having registered for internship scheme of a programme cannot opt out of that scheme.
- The minimum credit requirement for the B.Tech. Degree programme is 190. However, considering a case for award of honours the minimum credits will be 195.
- The project will be assigned in tenth term. It may be extended to Major Project. The Major Project shall comprise of Phase-I and Phase-II, spread over eleventh and twelfth terms respectively. Appropriate double-letter grade is awarded as per the evaluation scheme which will be considered for TGPA and CGPA calculations. It is recommended that an external expert from industry/academia may be a member of the evaluation team of four persons (two professors, external expert and respective project guide).
- MLC must be completed by a student at appropriate time or at his convenience. The 'S' grade is awarded for satisfactory completion of the course and 'N' grade is awarded for non-satisfactory completion of the course. In case 'N' grade is awarded, the student has to re-register for the same course if no alternative options are available. However, one can opt for other courses if provided with multiple options. The 'S' and 'N' grades do not carry grade-points and, hence, are not included in the TGPA and CGPA computations.
- Courses that come under this category are the following:
  (a) Environment Science and Ecology
  (b) Community Service Oriented Project
  (c) Professional Development Courses
- Students admitted to the University will be required to take suitable additional Courses in Mathematics (5-0-0) and or Communication Skills (3-0-0), if found deficient.

ASSOCIATION
- Every under graduate student of the University shall be associated with Parent Department (degree awarding department) offering the degree programme that the student undergoes throughout his study period, right from the very first day of admission into the programme. However, in the first year class he may report to the Dept. of Applied Science and Humanities for administrative/academic purpose.
- A student will be placed in GROUP-A/B/C for all the three terms in an academic year.
- The schedule of academic activities for a term, including the dates of registration, mid-term examinations (MTE), end-term examination (ETE), inter-term vacation, etc. shall be referred to as the Academic Calendar of the term, and announced at least two weeks before the closing date of the previous term.

PRE-REGISTRATION
- In order to facilitate proper planning of the academic activities of a term, it is essential for the students to declare their intent to register for a course well in advance, before the actual start of
the academic session, through the process of Pre-
Registration, which is mandatory for all those
students of second or subsequent term who
propose to deviate from recommended scheme of
studies.

- Pre-registration is an expression of intention of a
student to pursue particular course(s) in the next
term. It is information for planning for next term.
Every effort will be made to arrange for a course
opted by the student. However, it is not obligatory
on the part of the University to offer the course(s)
and no course may be offered if the number of
students opting for the course is less than 15 or 25
percent of the admission strength whichever is
less.

- If a student fails to pre-register, it will be presumed
that he will follow suggested normal scheme of
studies provided that he is progressing at a normal
pace. For remaining students the HOD of the
parent department will plan for courses as per the
convenience of the department.

REGISTRATION TO COURSES

- Every student after consulting his Faculty-Advisor
is required to register for the approved courses
with the HOD of parent department at the
commencement of each term on the days fixed for
such registration as notified in the academic
calendar.

- A student shall register for courses from amongst
the courses being offered in the term keeping in
mind the minimum and maximum credits allowed
for a degree and other requirements i.e. pre-
requisite if any, TGPA and CGPA after consulting
the Faculty Advisor. No registration will be valid
without the consent of HOD of the parent
department.

- A student will be permitted to register in the next
term as per the suggested normal scheme only if
he fulfills the following conditions:
  (a) Satisfied all the Academic Requirements to
      continue with the programme of studies
      without termination.
  (b) Cleared all University, library and hostel dues
      and fines (if any) of the previous term.
  (c) Paid all required advance payments of the
      University and hostel for the current term.
  (d) Not been debarred from registering on any
      specific ground by the University.

- The students will be permitted to register for
course(s) being offered in a term other than his
normal suggested scheme provided that the time
table permits.

- The registration in the critical cases will be done
as per the priority given below:
  (a) Fulfillment of minimum credit requirement for
      continuation,
  (b) The completion of programme in minimum
      period needed for degree, (Those who need
      to improve TGPA/CGPA)
  (c) The fulfillment of pre-requisite requirement of
      courses.

- Students who do not register on the day
announced for the purpose may be permitted
LATE REGISTRATION up to the notified day in
academic calendar on payment of late fee.

- REGISTRATION IN ABSENTIA will be allowed
only in exceptional cases with the approval of the
DAA after the recommendation of HOD through
the guardian of the student.

- Credits will be awarded in registered courses only.

CREDIT LIMITS

- A student of the B.Tech. degree programme must
register for a minimum of 10 credits, and up to a
maximum of 21 credits in a term. However, the
minimum / maximum credit limit can be relaxed by
the DAA on the recommendation of the HOD, only
under exceptional circumstances. The maximum
credits that a student can register in a Summer
Term are 8.

- Professional Development courses are one credit
courses each, with multiple options, to be
completed at student's convenience in each term.
Some of them may be mandatory and others two-
letter grade category. However, registration has to
be done for all courses.

CHANGE IN REGISTRATION

- A student has the option to ADD courses for
registration till the date specified for late
registration in the Academic Calendar.

- On recommendation of the Teaching Department
as well as the Parent Department, a student has
the option to DROP courses from registration until
two weeks after the commencement of the classes
in the term, as indicated in the Academic Calendar.

- A student can register for auditing a course, or a
course can be converted from credit to audit or
from audit to credit, with the consent of the Faculty
Advisor and Course Instructor within two weeks
after the commencement of the classes in the term
as indicated in the Academic Calendar. However,
CORE Courses shall not be available for audit.

ATTENDANCE REQUIREMENTS

- LU academic programmes are based primarily on
the formal teaching-learning process. Attendance
in classes, participating in classroom discussions
and participating in the continuous evaluation
process are the most essential requirements of
any academic programme.

- Attendance will be counted for each course, i.e.,
scheduled teaching days as per the academic
calendar.

- The attendance requirement for appearing in end
term examination shall be a minimum of 75% of
the classes scheduled in each course.

LEAVE OF ABSENCE

- The leave of absence must be authorized as per
regulations.

- A student short of attendance in a course (less
than needed after leave of absence and
condonation by VC) will be awarded 'FF' grade in
the course.

- All students must attend all lecture, tutorial and
practical classes in a course. The attendance will
be counted course wise.

- To account for approved leave of absence e.g.
representing the University in sports, games or
athletics; professional society activities, placement
ABSENCE DURING EXAMINATIONS

A student who has been absent during MTE due to illness and/or any exigencies may give a request for makeup examination within one week after the MTE to the HOD with necessary supporting documents in person. The HOD may consider such requests depending on the merits of the case, and after consultation with the Course Instructor, may permit the make-up examination for the student concerned. However, no make up examination will be permitted if the attendance in the course is less than 60% till the date of examination.

In case of absence from ETE of a course(s) on medical ground and/or other special circumstances, the student can apply for award of 'I' grade in the course(s) with necessary supporting documents and certifications by an authorized person to the HOD within one week after the ETE. The HOD may consider the request, depending on the merit of the case, and after consultation with the Course Instructor(s)/Faculty Advisor permit the MET Examination for the student concerned. The student may subsequently complete all course requirements within the date stipulated by BOS (which may possibly be extended till first week of term under special circumstances) and 'I' grade will then converted to an appropriate double-letter grade, as per Clause No: G5.9. All the details of such a decision with date of finalizing the grade shall be communicated to DAA. If such an application for the 'I' grade is not made by the student then a double-letter grade will be awarded based on his term performance.

COURSE CREDIT ASSIGNMENT

Every course comprises of specific Lecture-Tutorial-Practical (L-T-P) schedule. The credits for various courses are shown in the Scheme of Studies & Syllabus.

The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

The double-letter grade (AA, AB, BB, BC, CC, CD, DD, FF) indicates the level of academic achievement, assessed on a decimal (0-10) scale.

Letter-Grades and Grade-Points:

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<tr>
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<td>N</td>
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<td>Unsatisfactory</td>
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DESCRIPTION OF GRADES

An 'AA' grade stands for outstanding performance, relative to the class which may include performance with previous batches. The Course Instructor is supposed to take utmost care in awarding of this highest double-letter grade.

The 'DD' grade stands for marginal performance and is the minimum passing double-letter grade.

The 'FF' grade denotes very poor performance, i.e. failure in a course, and the Course Instructor is supposed to take utmost care while awarding this lowest double-letter grade.

A student, who obtains 'FF' grade in a core course, has to repeat (re-register) that core course, in subsequent terms/sessions whenever the course is offered, until a passing grade is obtained. However, for an elective course in which 'FF' grade has been obtained, the student may either repeat the same course, or register for any other elective course.

An 'I' grade denotes incomplete performance in any course due to absence at the ETE (see also Clause No: G7.4). When the 'I' grade is converted to a regular double letter grade, a penalty of ONE Grade-Point is imposed, by
B.Tech. Electrical Engineering (Regular)

awarding the double-letter grade that is immediately below the one that the student would have otherwise received except when the student has 95% attendance record in the subject concerned. For example, if on the basis of the performance including MET Examination, a student gets AB grade, he will be awarded BB grade if not under exception rule.

- 'U' grade is awarded in a course that the student opts to register for audit. It is not mandatory for the student to go through the entire regular process of evaluation in an audit course. However, the student has to go through some process of minimal level of evaluation and also the minimum attendance requirement, as stipulated by the Course Instructor and approved by the corresponding BOS, for getting the 'U' grade awarded in a course, failing which that course will not be listed in the Grade Card.

- A 'W' grade is awarded when the student withdraws from the course. Withdrawal from a course is permitted only under extremely exceptional circumstances (like medical emergencies, family tragedies and/or other unavoidable contingencies) and has to be recommended by the HOD and approved by the DAA. However, no withdrawal is permitted after the finalization of the grades in the term.

- 'S'/N' grades are awarded for the Mandatory Learning Courses. The 'S' grade denotes satisfactory performance and completion of a course. The 'N' grade is awarded for non-completion of course requirements and the student will have to register for the course until he obtains the 'S' grade.

FEEDBACK TO STUDENTS

- A student requires feedback on the progress of his learning. For this purpose, the Instructor will conduct at least two quizzes for a theory course in a term-one before MTE and the other thereafter. The quizzes will form a component of class work, the other components being tutorials, home assignments or any other mode.

- For a laboratory course, the continuous assessment’s feed back will be given through the laboratory records which are required to be submitted after performing the experiment in the next laboratory class.

- The continuous feedback on project/major project will be through project diary and interim report.

- For Internship stream, the continuous assessment and feedback is to be through seminars, professional diary and interim reports at the place of work.

EVALUATION

Theory Course:

- The double-letter grade awarded to a student in a course other than a practical course, i.e. it shall be denoted by L-T-0 course for which he has registered, shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to one MTE and ETE. The weightage of these components of continuous evaluation may be as follows:

  - End-term Examination : 50%
  - Mid-term Examinations : 30%
  - Quizzes, Tutorials, Assignments, etc. : 20%
  - Total : 100%

Laboratory Course:

- The double letter grade awarded to the student in a practical course i.e. 0-0-P course will be based on his performance in regular conduct of experiments, viva voce, laboratory report, quizzes etc., in addition to end term practical examination. The weightage of the components of continuous evaluation may be as follows:

  - Conduct of Experiments (as per syllabus) : 40%
  - Lab Record : 10%
  - Quizzes/Viva Voice : 20%
  - End-term Examination : 30%
  - Total : 100%

Project (Including Seminar):

- The double letter grade awarded to the student in Project (Includes Seminar) i.e. 0-0-P course will be based on his performance in technical work pertaining to the solution of a small size problem, project report, and presentation of work and defending it in a viva-voce. The weightage of the components of continuous evaluation may be as follows:

  - Technical Work : 50%
  - Report : 25%
  - Seminar, Presentation & Viva-voce : 25%
  - Total : 100%

Major Project:

- The double letter grade awarded to the student in Major Project Phase-I and Phase-II i.e. 0-0-P course will be based on his performance in technical work pertaining to the solution of a problem, project report, presentation and defending in a viva-voce. The weightage of the components of continuous evaluation may be as follows:

  - Technical Work : 50%
  - Report : 25%
  - Presentation & Viva-voce : 25%
  - Total : 100%

Internship:

- The Internship-II will be treated as Major Project for evaluation purpose. The double letter grade awarded to the student in Internship-II i.e. 0-0-P course will be based on his performance in technical work pertaining to the solution of a real-life problem, project report, presentation and defending in a viva-voce. The weightage of the components of continuous evaluation may be as follows:

  - Technical Work : 50%
  - Report : 25%
  - Presentation & Viva-voce : 25%
  - Total : 100%

The continuous assessment and feedback is to be through seminars, professional diary and entering report at the place of work.
**Seminar:**
- The double letter grade awarded to the student in Seminar i.e. 0-0-P course will be based on his performance in oral presentation with emphasis on technical contents, presentation and ability to answer questions. The weightage of the components of continuous evaluation may be as follows:
  - Technical Contents: 40%
  - Presentation: 30%
  - Questions and answers: 30%
  - Total: 100%

**Industrial/Field Training/Internship-I:**
- The double letter grade awarded to the student in Industrial/Field Training/Internship-I i.e. 0-0-P course will be based on Practical Training/Internship-I in an industry, professional organization/ research laboratory. The components of continuous evaluation with weightage may be as follows:
  - Training report: 40%
  - Presentation: 30%
  - Questions and answers: 30%
  - Total: 100%

**Professional Development:**
- There are 14 credits divided into 14 courses of one credit each. The evaluation process of these courses will be as per the nature, contents and delivery of these courses. Some of the common components of evaluation could be quizzes, viva-voce, practical test, group discussion, etc. Participation by students is to be given more weightage in Co-curricular courses.

**SCHEME OF EXAMINATION**
- The duration of examinations for a theory course will be 3 hours for ETE and 1½ hours for MTE.
- The pattern of question paper/examination will be as under:

**Theory Courses:**
- The University shall conduct the ETE for all theory courses being taught in the term.
  (a) There will be eight questions in all distributed over all the units in a course syllabus. The question paper will be in three parts with weightage 20 percent, 40 percent and 40 percent respectively.
  (b) Part-A will be short answer type with multiple parts covering all the units in the syllabus, which will be compulsory.
  (c) Part-B will have three questions from any three units, which will have long answers of derivation/descriptive type. Two questions are to be answered from this part.
  (d) Part-C will consist of four questions from the remaining four units and they will be of problem solving type in order to measure ability on comprehension/ analysis/ synthesis/ application. The relevant data will be made available. The student is required to solve two questions. However, for Part-C, the external examiner may select the questions from the question bank supplied by the University.
  (e) Students are allowed in the examination the use of single memory, non-programmable calculator. However, sharing of calculator is not permitted.

**Laboratory Courses:**
(a) The ETE in laboratory course will be conducted jointly by an external examiner (other than the instructor) and an internal examiner (the coordinator / instructor) jointly.
(b) The student will be given randomly an experiment to perform from within the list of experiments in the course.
(c) No change in the experiment will be permitted after the draw, if the student had performed the same in the class.

**Mid-Term Examination:**
- Question 1 is compulsory covering all topics taught till then. Question 2 and 3 will be essay type, out of which student will answer any one. Question 4 and 5 will be to measure the ability of analysis / comprehension / synthesis / application, out of which the student will answer any one.

**TRANSPARENCY**
- The answer books of all MTE and ETE will be shown to the students within three days of the last paper. It is the responsibility of the student to check this evaluation and affix his signature in confirmation.
- If the student finds some discrepancy, he should bring it to the notice of the Course Coordinator. The Course Coordinator will look into the complaint and remove the doubts of the student and proceed with the work of grading.
- The entire process of evaluation shall be transparent, and the Course Instructor shall explain to a student the marks he is awarded in various components of evaluation.

**RESULT**
- The final marks shall be displayed on the notice board for ONE day, (the date of which will be indicated in the Academic Calendar). A student can approach the Course Instructor(s) concerned for any clarification within TWO days of display. The process of evaluation shall be transparent and the students shall be made aware of all the factors included in the evaluation. In case of any correction, the Course Instructor shall have to incorporate the same before finalization of the grades.
- The Student's Grade Card shall contain the Letter-Grade for each registered course; along with the TGPA at the end of the term, and the CGPA at the completion of the programme.

**APPEAL FOR REVIEW OF GRADE**
- If a student is not satisfied with the award of the grade after the announcement of the grades, he may appeal on a Grievance Form duly filled in along with the fee receipt for this purpose to the HOD of the parent department within one week of the following term. The HOD will forward the form along with his recommendation based on the
records of the case to DAAB within the date specified in the Academic Calendar.

- The fee for such an appeal will be decided from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student without interest.
- VC shall have power to quash the result of a candidate after it has been declared, if
  (a) He is disqualified for malpractice in the examination;
  (b) A mistake is found in his result;
  (c) He is found ineligible to appear in the examination.

**AWARD OF DIVISIONS**

- The overall performance of a student will be indicated by two indices:
  (i) **TGPA** which is the Term Grade Point Average
  (ii) **CGPA** which is the Cumulative Grade Point Average

**TGPA for a term is computed as follows:**

\[
TGPA = \frac{\sum C_i G_i}{\sum C_i}
\]

Where,
- \(C_i\) denotes credits assigned to \(i^{th}\) course with double-letter grade, and
- \(G_i\) denotes the grade point equivalent to the letter grade obtained by the student in \(i^{th}\) course with double-letter grade, including all ‘FF’ grades in that term.

**CGPA is computed as follows:**

\[
CGPA = \frac{\sum C_i G_i}{\sum C_i}
\]

Where,
- \(C_i\) denotes credits assigned to \(i^{th}\) course with double-letter grade, and
- \(G_i\) denotes the grade point equivalent to the letter grade obtained by the student in \(i^{th}\) course for all courses with double-letter grades, including all ‘FF’ grades in all terms at the end of the programme.

For CGPA calculation, the following grades are to be counted:
- (i) Grades in all core courses,
- (ii) The best grades in the remaining eligible courses to fulfill the minimum credits requirement for a programme.

- The degree will be awarded only upon compliance of all the laid down requirements for programme as under:
  (i) There shall be University requirement of earning a minimum credits for a degree, satisfactory completion of MLCs and other activities as per the course structure.
  (ii) There shall be a minimum earned credit requirement on all Departmental Core courses, Elective courses and Major Project as specified by BOS.
  (iii) There shall be a maximum duration for complying with the degree requirement.
  (iv) The candidate will be placed in First Division with Honours/First Division with Distinction/First Division/Second Division which will be mentioned on the degree certificate as under:

<table>
<thead>
<tr>
<th>DIVISION</th>
<th>CONDITIONS TO BE FULLFILLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Division with Honours</td>
<td>CGPA ≥ 8.5</td>
</tr>
<tr>
<td>First Division with Distinction</td>
<td>CGPA ≥ 8.5</td>
</tr>
<tr>
<td>First Division</td>
<td>CGPA ≥ 6.75</td>
</tr>
<tr>
<td>Second Division</td>
<td>CGPA ≥ 5.0 but &lt; 6.75</td>
</tr>
</tbody>
</table>

**Note:**
Although, there is no direct conversion from grades to marks, however, for comparison purposes percentage of marks may be assumed to be CGPA multiplied by nine.

**B. TECH. DEGREE REQUIREMENTS**

- The requirements of the award of B.Tech. Degree programme are as follows:
  (a) **University Requirements:**
    (i) Minimum Earned Credit Requirement for Degree is 190 for regular programme. However, the credits required for consideration for honours degree will be 195.
    (ii) Satisfactory completion of all MLCs.
  (b) **Programme Requirements:**
    Minimum Earned Credit Requirements on all Core Courses, Elective Courses and Major Project/Internship as specified by the BOS.
  (c) The CGPA at the end of programme is at least 5.0.
  (d) The Maximum duration for a student for complying with the Degree Requirement is SEVEN years from date of first registration for first Term.

**GRADE IMPROVEMENT**

- A student may be allowed to improve the TGPA in an appropriate term, if his TGPA falls below 5.0. Similarly, any student may be allowed to improve performance in any course provided the course is being floated and available.

**TERMINATION FROM THE PROGRAMME**

- A student shall be required to leave the University without the award of the Degree, under one or more of the following circumstances:
  (1) If a student fails to earn the minimum credits specified below:

<table>
<thead>
<tr>
<th>CHECK POINT</th>
<th>CREDIT THRESHOLD**</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of FIRST year</td>
<td>20*</td>
</tr>
<tr>
<td>End of SECOND year</td>
<td>50*</td>
</tr>
<tr>
<td>End of THIRD year</td>
<td>85</td>
</tr>
<tr>
<td>End of FOURTH year</td>
<td>125</td>
</tr>
</tbody>
</table>

* A student may be given one more chance to cover the shortfall in the threshold during the following summer term as follows:
  (i) if a student earns 12 credits or more but less than 20 at the end of first year.
  (ii) if a student earns 42 or more credits but less than 50 at the end of second year.
In case he fails to clear the threshold even after the summer term he has to leave the course.

** If at any stage, a student fails to cross the threshold with a TGPA of minimum 5.0 in any term, he will be treated as critical case and will be advised to improve the grades.

— The period of temporary withdrawal is not to be counted for the above credit threshold.

(2) If a student is absent for more than 4 (four) weeks at a stretch in a term without sanctioned leave.

(3) Based on disciplinary action by the AC, on the recommendation of the appropriate Committee.

Note:
Under any circumstances of termination, the conditions specified in permanent withdrawal shall also apply.

WITHDRAWAL FROM PROGRAMME

Temporarily:
- A student who has been admitted to a degree programme of the University may be permitted to withdraw temporarily, for a period of one term or more, on the grounds of prolonged illness or grave calamity in the family, etc., provided:
  
(i) He applies to the University stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian

(ii) There are no outstanding dues or demands, from the Departments/ University / Hostels / Library and any other centers;

(iii) Scholarship holders are bound by the appropriate Rules applicable to them.

(iv) The decision of the VC of the University regarding withdrawal of a student is final and binding.

- Normally, a student will be permitted only one such temporary withdrawal during his tenure as a student and this withdrawal will not be counted for computing the duration of study.

Permanently:
- Any student who withdraws permanently admission before the closing date of admission for the academic session is eligible for the refund of fee as per the University rules. Once the admission for the year is closed, the following conditions govern withdrawal of admission:
  
- A student who wants to leave the University for good, will be permitted to do so (and take Transfer Certificate from the University, if needed), only after clearing all the dues for the remaining duration of the course.
  
- A student who has received any scholarship, stipend or other form of assistance from the University shall repay all such amounts, in addition, to clearing all the dues for the remaining duration of the course.
  
- The decision of the VC regarding all aspects of withdrawal of a student shall be final and binding.

****
Department of Electrical Engineering

DEGREE OBJECTIVE

The Bachelor of Electrical Engineering program fosters the personal and professional growth of its students, resulting in competent and effective contributors to engineering technology and society as a whole. The program provides a path for transfer of students to applied engineering positions. The Electrical Engineering program is designed to provide its graduates with a solid educational foundation on which they can build successful and sustainable careers in electrical engineering or a related field.

An in-depth knowledge of electrical engineering enables our graduates to contribute in their area of expertise. The graduated electrical engineering student will have:

1. A knowledge of the electrical engineering fundamental topics in circuits, fields, and digital logic.
2. A knowledge of advanced topics in mathematics including vector calculus, transform calculus, complex variables and probability and statistics.
3. The ability to specify, design, analyze and test an electrical system to meet a set of desired goals, within the context of a broader system application.
4. Specialized knowledge in one or more of the topical areas of electrical engineering: controls, electrical machines, digital systems, power system.
5. Understand the importance of lifelong learning, ethics and professional responsibilities of an engineering practitioner or researcher.

DEGREE OBJECTIVES

1. Graduates will successfully function in applied engineering positions in industry.
2. Graduates will be positively valued by industry because of strong problem-solving skills including analysis, simulation, design, laboratory experimentation and project teamwork.
3. Graduates will be proficient in oral and written communication, especially in conveying technical information.
4. Graduates will have knowledge of professional and ethical responsibilities as applied to both engineering technology and society as a whole.
5. Graduates will have the broad education and awareness of contemporary issues necessary to recognize the societal and global impact of their professional endeavors.
6. Graduates will have the ability and awareness of the need to keep their skills up-to-date through both formal and informal lifelong learning.
### CATEGORY-WISE LIST OF COURSES

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<td>Economics</td>
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<td>2. BA-226</td>
<td>Principles of Management</td>
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<tr>
<td>3. CE-101</td>
<td>Environmental Science &amp; Ecology</td>
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<td>4. EN-101</td>
<td>Communication Skills</td>
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<td>5. EN-151</td>
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<td>Basic Science &amp; Mathematics including Computer (BSM)</td>
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<td>6. MA-102</td>
<td>Applied Mathematics-II</td>
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<td>7. MA-202</td>
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<td>1. EC-204</td>
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<td>7. ME-152</td>
<td>Workshop Practice</td>
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<td>6. EE-206</td>
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<td>7. EE-302</td>
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<td>8. EE-304</td>
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<td>4. EL-206</td>
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<td>15. EL-307</td>
<td>Power System Operation and Control</td>
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<td>16. EL-308</td>
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<td>21. EL-357</td>
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<td>BA-272</td>
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<td>PH-473</td>
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**Professional Development (PD) – Gen.**

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<td>PD-191</td>
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**Mandatory Learning Course (MLC)**

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**Additions/Bridge Course**

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# Scheme of Studies

## B. Tech. Degree Programme (Regular)

(Common to all Branches)

### 1st Year

#### TERM – I

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### PRACTICAL/DRAWING/DESIGN

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**Note:** A student will be placed in GROUP A/B/C for all the three terms in an academic year.

**GROUP** | **TOTAL CONTACT HOURS** | **TOTAL CREDITS**
---|------------------------|----------------
A | 20-2-8 (30) | 18
B | 15-3-10 (28) | 17
C | 15-2-12 (29) | 17

**FINAL EVALUATION IN GRADES**

(L-T-P-Cr) – Lectures-Tutorials-Practicals-Credits

CW - Class Work

MTE – Mid-Term Exam

ETE – End-Term Exam

* One credit to be earned in Term-III through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of first year.

** One hour for explanation/demonstration.

*** CE-101 is a Mandatory Learning Course.
# Scheme of Studies

## B. Tech. Degree Programme (Regular)
**(Common to all Branches)**

### 1st Year

#### TERM – II

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**Note:** A student will be placed in GROUP A/B/C for all the three terms in an academic year.

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**FINAL EVALUATION IN GRADES**

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* One credit to be earned in Term-III through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of first year.

** One hour for explanation/demonstration.

*** CE-101 is a Mandatory Learning Course.
### Scheme of Studies

**B. Tech. Degree Programme (Regular)**
*(Common to all Branches)*

#### 1st Year

**TERM – III**

### THEORY

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**Note:** A student will be placed in GROUP A/B/C for all the three terms in an academic year.

**GROUP**

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<th>TOTAL CONTACT HOURS</th>
<th>TOTAL CREDITS</th>
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**FINAL EVALUATION IN GRADES**

(L-T-P-Cr) – Lectures-Tutorials-Practicals-Credits
CW – Class Work
MTE – Mid-Term Exam
ETE – End-Term Exam

* One credit to be earned in Term-III through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of first year.

** One hour for explanation/demonstration.

*** CE-101 is a Mandatory Learning Course.
# Department of Electrical Engineering

## Scheme of Studies

### B. Tech. Degree Programme (Regular)

#### 2nd Year

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**20-2-8 (30)**

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**20-2-6 (28)**

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**20-3-6 (29)**

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**FINAL EVALUATION IN GRADES**

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits

* One credit to be earned in Term-VI through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of second year.

** PD-292 is a Mandatory Learning Course.
### 3rd Year

#### TERM – VII

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<td>Power Electronics</td>
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**20-2-8 (30)**

#### TERM – VIII

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**20-3-6 (29)**

#### TERM – IX

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**20-2-6 (28)**

### SUMMER TERM – INDUSTRY TRAINING/FIELD TRAINING/INTERNSHIP

**FINAL EVALUATION IN GRADES**

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits

* One credit to be earned in Term-IX through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of 3rd year.

**PD-393 is a Mandatory Learning Course.**
Department of Electrical Engineering  
Scheme of Studies  
B. Tech. Degree Programme (Regular)  
(PROJECT MODE)

4th Year

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FINAL EVALUATION IN GRADES  
(L-T-P-Cr) – Lectures-Tutorials-Practicals-Credits  
# CSOP is a mandatory learning course.  
* One credit to be earned in Term-XII through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of 4th year.  
** To be evaluated based on the work done during Summer Term after Term-IX.  
*** Marks of Major Project Phase-I to be added to marks of Major Project Phase-II for award of final grade.  
**** To be based on Major Project Phase-I.  
***** To be based on Major Project Phase-II.
# Final Evaluation in Grades

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits

- # CSOP is a mandatory learning course.
- * One credit to be earned in Term-XII through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of 4th year.
- ** To be evaluated based on the work done during Summer Term after Term-IX.
- *** To be based on Internship-II and to be given in the beginning of Term-XII.
- **** To be based on Internship Documentation.
## List of Dept. Electives

### Dept. Elective - I

<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EL-421</td>
<td>Renewable Energy Sources and Energy Conservation</td>
<td>5-0-0</td>
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<tr>
<td>2</td>
<td>EL-422</td>
<td>HVDC Transmission</td>
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<tr>
<td>3</td>
<td>EL-423</td>
<td>High Voltage Engineering</td>
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### Dept. Elective - II

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<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>EE-433</td>
<td>Industrial Process Control</td>
<td>5-0-0</td>
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<tr>
<td>2</td>
<td>EC-461</td>
<td>Bio-Medical Instrumentation</td>
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<td>3</td>
<td>CS-402</td>
<td>Artificial Intelligence</td>
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### Dept. Elective - III

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<tbody>
<tr>
<td>1</td>
<td>EL-441</td>
<td>Advanced Power Apparatus</td>
<td>5-0-0</td>
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<tr>
<td>2</td>
<td>EL-442</td>
<td>Power Management</td>
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<td>3</td>
<td>EL-443</td>
<td>Electrical Power Quality</td>
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### Dept. Elective - IV

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<th>Course Code</th>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>EL-461</td>
<td>Computer Applications to Electrical Engineering</td>
<td>5-0-0</td>
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<tr>
<td>2</td>
<td>EL-462</td>
<td>FACTS</td>
<td>5-0-0</td>
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<tr>
<td>3</td>
<td>EL-463</td>
<td>Optimization Techniques</td>
<td>5-0-0</td>
</tr>
</tbody>
</table>
IMPORTANT NOTES

1. Laboratory Courses are being offered as distinct courses (0-0-2) without being mixed with lecture components.
2. Conduct of Lab Courses:
   a. At least ten experiments/programmes/exercises are to be performed in a term.
   b. It is expected that more experiments/programmes/exercises are designed and set as per the scope of the syllabus, which may be added to the above list.
   c. One or more than one experiments/programmes/exercises may be performed in one lab period in order to utilize the time properly.
   d. The scheme of operation is to be approved by HOD.
3. Students admitted through Lateral Entry Scheme will be required to take a Bridge Course on Mathematics (5-0-0) as an Audit Course.
4. Assessment of Industrial/Field Training and Internship-I will be based upon certificate of Industry/Field training obtained by the student, report, seminar and viva-voce examination. A student who is awarded ‘FF’ Grade is required to repeat Industry/Field training.
5. The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have expertise.
6. For open elective, all students will be permitted to opt for any one elective run by another department. However, the departments will offer only those elective for which they have expertise. Further, the students will not be allowed to opt for any course under this category, which has already been done. An open elective opted during the end of tenth term, allotted list of which will be displayed on notice board and taught in the eleventh term.
7. The choice of students for the Internship stream shall not be a binding for the department to offer.
8. Elective-II is not required to be done by the students pursuing the degree through Internship Mode.
9. Students are allowed in the examination the use of single memory, non-programmable calculator. However, sharing of calculator is not permitted.
10. The B. Tech. degree programmes in Electrical Engineering, Electronics & Communication Engineering and Electrical & Electronics Engineering constitute one group for the purpose of deciding core courses as these all are based on electrical sciences.
11. For the students admitted in 2009-10 the sequence of PD Courses is given in the table below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Professional Development (PD) – Gen.</th>
<th>0-0-2</th>
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<tbody>
<tr>
<td><strong>1st Year</strong></td>
<td>PD-251 MATLAB</td>
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<tr>
<td></td>
<td>PD-191 Co-curricular Activities</td>
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<td>PD-292 Effective Communication</td>
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<td></td>
<td>PD-393 Advanced Professional Development</td>
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<td>PD-151N* Basics of Computer Fundamentals</td>
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<tr>
<td><strong>2nd Year</strong></td>
<td>PD-291 Co-curricular Activities</td>
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<td>PD-192 Personality Skills</td>
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<td></td>
<td>PD-193 Entrepreneurial &amp; Professional Skills</td>
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<td></td>
<td>PD-356 Bio Electronics Instrumentation</td>
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<tr>
<td><strong>3rd Year</strong></td>
<td>PD-391 Co-curricular Activities</td>
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<td></td>
<td>PD-392 Problem Solving Skills</td>
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<td></td>
<td>PD-293 Intra &amp; Inter-personal Skills</td>
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<td></td>
<td>PD-456 Robotics and Automation</td>
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<tr>
<td><strong>4th Year</strong></td>
<td>PD-491 Co-curricular Activities</td>
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</tbody>
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* The contents for PD-151N are the same as for PD-151.
DETAILED SYLLABUS
GEN., BSM, ESTA, DEPT. CORE & ELECTIVE

<table>
<thead>
<tr>
<th>BA-225</th>
<th>ECONOMICS</th>
<th>L T P</th>
<th>Cr</th>
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</tbody>
</table>

**OBJECTIVE**
The purpose of this course is to
- Acquaint the students in the basic economic concepts and their operational significance and
- Stimulate him to think systematically and objectively about contemporary economic problems.

1. **INTRODUCTION:** Definition of economics; difference between micro and macro economics; central problems of economy including PP curve; factors of production
2. **UTILITY:** concept and measurement of utility; Law of Diminishing Marginal Utility (DMU); derivation of Law of Demand from Law of DMU; Law of Equimarginal Utility (EMU) – its practical applications
3. **DEMAND:** What is demand and supply; shift in demand and extension of demand; law of demand and law of supply; demand function; demand schedule; elasticity of demand; measurement of elasticity of demand; factors affecting elasticity of demand; role of demand and supply in price determination and effect of changes in demand and supply on prices
4. **PRODUCTION FUNCTIONS:** Meaning of production and production functions; Law of Variable Proportion; returns to scale, internal and external economies and diseconomies of scale.
5. **COSTS:** Various concepts of costs: fixed cost, variable cost, average cost, marginal cost, opportunity cost; shape of average cost, marginal cost, total cost etc. in short run and long run.
6. **MARKET STRUCTURES:** What is market; main features of perfect competition; monopoly; oligopoly; monopolistic competition.
7. **MACRO ECONOMICS:** Macro economics: brief concepts of GDP, GNP, NI, per capita income; inflation; privatization; globalization (merits & demerits); elementary concepts of VAT, WTO, GATT and TRIPS

**TEXT BOOK**
Hirshey M., "Managerial Economics", Thomson Learning, 2007

**REFERENCE BOOKS**

<table>
<thead>
<tr>
<th>BA-226</th>
<th>PRINCIPLES OF MANAGEMENT</th>
<th>L T P</th>
<th>Cr</th>
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<tbody>
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</table>

**OBJECTIVE**
To acquaint the students with various concepts of management which will be very basic to appreciate the subject.

1. **INTRODUCTION:** Meaning of management, definitions of management, characteristics of management, management vs. administration; management: art, science and profession; importance of management; Fayol’s principles of management; the management functions; interrelationship of managerial functions.
2. **FORMS:** Forms of organizational structure (line, line & staff, functional); delegation of authority; centralization & decentralization.
3. **GROUPS:** Formal & informal groups; stages in team development, empowerment concept, significance; changing nature of managerial work; outsourcing.
4. **CORPORATE SOCIAL RESPONSIBILITY:** Corporate social responsibility – meaning; responsibility towards different stakeholders; ethics in management – meaning; factors effecting ethical choices.
5. **STAFFING:** Nature and significance of staffing; human resource management - functions of human resource management; human resource planning; process of human resource planning; recruitment, selection; promotion-seniority vs. merit.
6. **MARKETING MANAGEMENT:** Marketing management – definition of marketing, marketing concept, objectives and functions of marketing; marketing mix (basics of 4Ps of marketing); difference between goods and services; steps of personal selling.
7. **FINANCIAL MANAGEMENT:** Introduction of financial management; objectives of financial management; functions and importance of financial management; brief introduction to the concept of capital structure and various sources of finance.

**TEXT BOOK**

**REFERENCE BOOKS**
1. **THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:** Basic definitions related to environment: Scope, vis-à-vis environmental science and environmental engineering; Causes of environmental degradation, atmospheric composition and associated spheres, habitat and climate; objective, goals and principles involved in environmental education, environmental awareness, environmental ethics, environmental organization and their involvement.

2. **NATURAL RESOURCES:** Renewable and non-renewable resources; forest resources, over-exploitation, and deforestation / afforestation; water resources, impact of over-utilization of surface and ground water, floods, drought, conflicts over water, dams; mineral resources: derivation of mines, environmental effects of extracting and using mineral resources; Food resources, modern agriculture and its impact, problem associated with fertilizer and pesticide, water logging, salinity; energy resources, renewable, non-renewable energy sources, solar energy, wind energy, hydro energy, biomass energy, geothermal energy, nuclear energy and its associated hazards; land as a resource, land degradation, man induced landslides, soil erosion and desertification.

3. **ECOSYSTEMS:** Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids; characteristic features, structure and function of the following ecosystem - forest ecosystem, grassland ecosystem desert ecosystem and aquatic ecosystems.

4. **BIODIVERSITY AND ITS CONSERVATION:** Bio-geographical classification of India; biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity; value of biodiversity-consumptive use, productive use, social, ethical aesthetic and option values; threats to biodiversity; conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

5. **ENVIRONMENTAL POLLUTION:** Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, solid waste management, e-waste management; disaster management – floods, earthquake, cyclone and landslides.


7. **HUMAN POPULATION AND THE ENVIRONMENT:** Population growth, population explosion – family welfare programmes; role of information technology in environment and human health; case studies, Chipko movement, Saradar Sarovar dam, mining and quarrying in Udaipur, salinity and water logging in Punjab, Haryana and Rajasthan, Bhopal gas tragedy, Chernobyl nuclear disaster, arsenic pollution in ground water.

**TEXT BOOK**

**REFERENCE BOOKS**
1. PHASE RULE: Terminology of phases; components and degree of freedom; derivation of Gibbs phase rule equation; one component system (water system); application of reduced / condensed phase rule; two component system; eutectic (Pb-Ag) system; congruent (Zn-Mg) system; Incongruent system (Na-K) system; merits and demerits of phase rule.

2. THERMODYNAMICS: Entropy; entropy change for an ideal gas; free energy and its physical significance; variation of free energy with temperature and pressure; work function and its significance; relation between Gibb’s free energy and work function; second law of thermodynamics; Gibbs Helmholtz equation; Its application and significance; chemical potential; Gibbs Duhem equation; Clausius Clapeyron equation and its application.

3. WATER AND ITS TREATMENT: Specification of water for different uses; hardness of water; equivalent of calcium carbonate; units of hardness; disadvantages of hard water and determination of hardness; alkalinity of water and its determination; related numericals; scale and sludge formation in boilers and its prevention; caustic embrittlement; water softening; Zeolite process; Ion exchange process and mixed bed demineralization; disinfection of water; desalination; reverse osmosis; electrodialysis.

4. CORROSION AND ITS PREVENTION: Introduction; classification; dry and wet corrosion; electrochemistry theory of corrosion; galvanic, potting and waterline corrosion; differential aeration corrosion; stress corrosion; factors affecting corrosion; preventive measures; material selection; proper designing; barrier protection; sacrificial protection; cathodic; anodic protection.

5. LUBRICATION AND LUBRICANTS: Friction; mechanism of lubrication; classification of lubricants; additives of lubricants; synthetic lubricants; properties of lubricants; consistency; drop point; fire and flash point; cloud point; pour point; viscosity; viscosity index; iodine no.; aniline drop point; saponification no.; steam emulsion no.; viscosity; viscosity index; Iodine no.; aniline drop point; fire and flash point; cloud point; pour point; viscosity; viscosity index; chemical potential; Gibbs Duhem equation; Clausius Clapeyron equation and its application.

6. PHOTOCHEMISTRY: Photochemical and dark reactions; laws of photochemistry; quantum efficiency; classification of photochemical reactions on the basis of their quantum efficiencies; non-radiative processes (ISC and IC); fluorescence; phosphorescence (Jablonski diagram); chemiluminescence; photosensitization; technology based on photochemical processes.

7. BIOMOLECULES: Structure; function; diversity and distribution; general composition of living matter. carbohydrates; monosaccharides and their inter-relationship; structure of sugars; glucose; fructose; maltose; lactose, sucrose; stereoisomerism and optical isomerism of sugars; ring structure and tautomeric form and mutarotation; lipids: definitions; classification of lipids; fatty acids; glycerol; building block of lipid; proteins and amino acid; classification and formulae; proteinous and non-proteinous; essential and non-essential amino-acids; primary, secondary, tertiary, quaternary structure of proteins; N and C terminal determination.

TEXT BOOK

REFERENCE BOOKS

CH-151 APPLIED CHEMISTRY LAB

LIST OF EXPERIMENTS
1. Determination of Ca++ and Mg++ hardness of water using EDTA solution.
2. Determination of alkalinity of water sample.
3. Find the melting and eutectic point for a two component system by using method of cooling curve.
4. Determination of viscosity of lubricant by Red Wood viscometer (No. 1 & No. 2).
5. Prepare Phenol-formaldehyde and Urea formaldehyde resin.
6. Find out Saponification number of oil.
7. Determination of concentration of KMnO4 solution spectrophotometrically.
8. Determination of strength of HCl solution by titrating it against NaOH solution conductometrically.
9. Determination of drop point of given lubricant using drop point apparatus.
10. Estimate the sugar (Glucose) using Fehling solution method.
11. Determine flash point and fire point of oil by Pensky - Marten’s flash point apparatus.
12. Determine amount of sodium and potassium in a given water sample by flame photometer.

REFERENCE BOOKS
OBJECTIVE
To provide sound conceptual understanding of the fundamental concepts of computing hardware, software, networking and services; build programming logic and developing skills in problem solving using C/C++; introduce the concept of object orientation and on how to handle data in different forms; emphasize the concepts and constructs rather than on language features.

1. AN OVERVIEW OF COMPUTER SYSTEM:
Anatomy of a digital computer; memory units; main and auxiliary storage devices; input devices; output devices; classification of computers; computer hardware; computer software; data representation – bits and bytes and operations of data; radix number system – decimal, binary, octal, hexadecimal numbers and their inter-conversions; representation of information inside the computers.

2. OPERATING SYSTEM BASICS:
The user interface; running programs; managing files; introduction to PC operating systems: Unix/Linux, DOS, MacOS and Windows, file system; file formats.

3. INTERNET BASICS:
Introduction to computer networks; what is internet and WWW; basic WWW concepts; surfing the web; web multimedia; internet applications and features.

4. PROGRAMMING LANGUAGES:
Machine level language; assembly level language; high level language; system software: assembler, compiler, interpreters, linker and loader, and their inter-relationship, debuggers, IDE; programming fundamentals – problem definition, algorithms, flow charts and their symbols.

5. C PROGRAMMING LANGUAGE CONSTRUCTS:
An overview of C; expressions – data types, identifiers names, variables, type qualifiers, storage class specifiers, operators, type conversion in expression, type casting; console I/O: I/O functions; the C standard library; problem solving process algorithm: pseudo code and flowchart; statements – true and false in C, selection statements, iteration statements, jump statements, expression statements and block statements; arrays – single dimensions arrays, generating a pointer to an array, passing 1D array to functions; string: 2D arrays, multidimensional array, indexing pointers, array initialization, variable-length array.

6. DATA HANDLING:
Pointers – Pointer variables, pointer operators, pointer expressions, pointers and arrays, multiple indirection, initializing pointers, C’s dynamic allocation functions, restrict-qualified pointers, problems with pointers; functions: the general form of a function, scope of a function, function arguments, argc and argv — arguments to main(), the return statement, purpose of main(), recursion, function prototypes, the "implicit int" rule; structures, unions, enumerations, and typedef – structures, arrays of structures, passing structures to functions, structure pointers, arrays and structures within structures, unions, bit-fields, enumerations, using sizeof to ensure portability, typedef; important differences between C and C++.

7. ADVANCED DATA HANDLING:
Basic file I/O – C vs. C++ File I/O, standard C Vs. Unix file I/O streams and files, file system basics, fread() and fwrite(), fseek() and random-access, sprintf() and fscanf(); the preprocessor and comments – the preprocessor, conditional compilation directives, using defined, the # and ## preprocessor operators, predefined macro names, comments.

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES

LIST OF EXPERIMENTS/EXERCISES
1. Basic/Simple logic building
2. Handling mathematical data
3. Use of control structures
4. Use of Function
5. Handling mathematical problems
6. Array and Pointer
7. Searching and Sorting
8. String Manipulation
9. Use of Structure and Union
10. File handling

Note: Write and run at least three programmes for each topic.

REFERENCE BOOKS

REFERENCES

WEB REFERENCES

OBJECTIVE
To introduce about artificial intelligence approaches to problem solving, various issues involved and application areas

PRE-REQUISITES
Knowledge of neural networks, data structures

INTRODUCTION TO AI AND SEARCH TECHNIQUES: Foundation and history of AI; data, information and knowledge; AI problems and techniques – AI programming languages, problem space representation with examples; blind search strategies, breadth first search, depth first search, heuristic search techniques: hill climbing: best first search, A * algorithm AO* algorithm, Means-ends analysis.

KNOWLEDGE REPRESENTATION ISSUES: predicate logic; logic programming; constraint propagation; representing knowledge using rules.

REASONING UNDER UNCERTAINTY: Reasoning under uncertainty, non monotonic reasoning; review of probability; Bayes’ probabilistic interferences and Dempster Shafer theory; heuristic methods; symbolic reasoning under uncertainty; statistical reasoning, fuzzy reasoning.

PLANNING & GAME PLAYING: Minimax search procedure; goal stack planning; non linear planning, hierarchical planning, planning in situational calculus; representation for planning; partial order planning algorithm.

LEARNING: Basic concepts; rote learning, learning by taking advices, learning by problem solving, learning from examples, discovery as learning, learning by analogy; explanation based learning; neural nets; genetic algorithms.

OTHER KNOWLEDGE STRUCTURES: semantic nets, partitioned nets, parallel implementation of semantic nets; frames, common sense reasoning and thematic role frames; architecture of knowledge based system; rule based systems; forward and backward chaining; frame based systems.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE: Principles of natural language processing; rule based systems architecture; expert systems, knowledge acquisition concepts; AI application to robotics, and current trends in intelligent systems; parallel and distributed AI; psychological modeling, parallelism in reasoning systems, distributed reasoning systems and algorithms

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES
operation: Characteristics and control by SCR and TRIAC Introduction to op-amp; UJT: Introduction; Basic theory of operation characteristics and structure; Complementary and programmable UJT relaxation oscillator.

**TEXT BOOK**


**REFERENCE BOOKS**


### ELECTRICITY AND MAGNETISM

- **INTRODUCTION:** Vector Relation in rectangular; Cylindrical; Spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient; Divergence and curl; Gauss’s Divergence and Stoke’s theorems.
- **ELECTROSTATICS - I:** Electric field intensity; flux density and polarization; Electric field due to various charge configurations. Potential functions and displacement vector.
- **ELECTROSTATICS-II:** Gauss’s law; Poisson’s and Laplace’s equation and their solution in rectangular coordinates; Uniqueness theorem; Capacitance and electrostatics energy; methods of electrostatics images; boundary conditions.
- **MAGNETOSTATICS – II:** Magnetic field vector; Magnetic field intensity; flux density and magnetization.
- **MAGNETOSTATICS – II:** Bio-Savart’s law; Ampere’s law; Magnetic vector potential; Energy stored in magnetic field; Boundary conditions; Analogy between electric and magnetic field.
- **TIME VARYING FIELDS:** Faraday’s law; Displacement currents and equation of continuity. Maxwell’s equations; Uniform plane wave in free space; Reflections; refraction and polarization of UPW; surface impedance; standing wave ratio. Poynting theorem and power considerations.
- **ELECTROMAGNETIC FIELDS:** EM wave in Dielectrics; Conductors and Magnetic Materials and Skin effect.

### OBJECTIVE

To provide a sound understanding of the fundamental concepts of electromagnetic field theory; explaining various basic laws governing it; and its application to communications.

1. **INTRODUCTION:** Vector Relation in rectangular; Cylindrical; Spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient; Divergence and curl; Gauss’s Divergence and Stoke’s theorems.
2. **ELECTROSTATICS - I:** Electric field intensity; flux density and polarization; Electric field due to various charge configurations. Potential functions and displacement vector.
3. **ELECTROSTATICS-II:** Gauss’s law; Poisson’s and Laplace’s equation and their solution in rectangular coordinates; Uniqueness theorem; Capacitance and electrostatics energy; methods of electrostatics images; boundary conditions.
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7. **ELECTROMAGNETIC FIELDS:** EM wave in Dielectrics; Conductors and Magnetic Materials and Skin effect.

### TEXT BOOK


### REFERENCES


### OBJECTIVE

Modern world deals with digital conditioning of various signals. Digitally manipulating signals or using digital circuits have a lot of advantages in terms of accuracy etc. This subject introduces concept of basic digital electronics: gates; combinational and sequential circuits and their designing.

1. **FUNDAMENTALS OF DIGITAL TECHNIQUES:** Digital signal; logic gates; AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR; Boolean algebra. Review of Number systems. Binary codes: BCD; Excess-3; Gray; EBCDIC; ASCII; Error detection and correction codes.
2. **COMBINATIONAL DESIGN USING GATES:** Design using gates; Karnaugh map and Quine Mcluskey methods of simplification.
3. **COMBINATIONAL DESIGN USING MSI DEVICES:** Multiplexers and Demultiplexers and their use as logic elements; Decoders; Adders/Subtractors; BCD arithmetic circuits; Encoders; Decoders/Drivers for display devices.
4. **SEQUENTIAL CIRCUITS:** Flip Flops : S-R; J-K; T; D; master-slave; edge triggered; shift registers; sequence generators; Counters; Asynchronous and Synchronous Ring counters and Johnson Counter; Design of Synchronous and Asynchronous sequential circuits.
5. **DIGITAL LOGIC FAMILIES:** Switching mode operation of p-n junction; bipolar and MOS. devices. Bipolar logic families:RTL; DTL; DCTL; HTL; TTL; ECL; MOS; and CMOS logic families. Tristate logic; Interfacing of CMOS and TTL families.
6. **A/D AND D/A CONVERTERS:** Sample and hold circuit; weighted resistor and R -2 R ladder D/A Converters; specifications for D/A converters. A/D converters : successive approximation; counting type.
7. **PROGRAMMABLE LOGIC DEVICES:** ROM; PLA; PAL; PEEL; GAL; FPGA and CPLDs.

### TEXT BOOK


### REFERENCES


LIST OF EXPERIMENTS
1. To study V-I characteristics of diode; and its use as a capacitance.
2. Study of the characteristics of transistor in Common Base configuration.
3. Study of the characteristics of transistor in Common Emitter configuration.
4. Study of V-I characteristics of a photo-voltaic cell.
5. Study of characteristics of MOSFET/JFET in CS configuration.
6. To plot characteristics of thyristor.
7. To plot characteristics of UJT.
8. To plot characteristics of diac and Triac.
9. Introduction to Orcad PSPICE Software.
10. Simulation of semiconductor device circuits using Orcad PSPICE.

REFERENCE BOOKS

LIST OF EXPERIMENTS
1. Study of TTL gates – AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR.
2. Design and realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer and Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R; J-K; T and D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design and verify the operation of 3-bit synchronous counter.
8. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops and drive a seven-segment display using the same.
9. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops and drive a seven-segment display using the same.
10. To design and realize a sequence generator for a given sequence using J-K flip-flops.
11. Study of CMOS NAND and NOR gates and interfacing between TTL and CMOS gates.
12. Design a 4-bit shift-register and verify its operation. Verify the operation of a ring counter and a Johnson counter.

TEXT BOOK

REFERENCE BOOKS
2. V. Alon., Oppenhelm, “Digital Signal Processing”, Prentice Hall of India

<table>
<thead>
<tr>
<th>EC-359</th>
<th>DIGITAL SIGNAL PROCESSING LAB</th>
<th>L T P</th>
<th>Cr</th>
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LIST OF EXPERIMENTS
Perform the experiments using MATLAB:

1. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
2. To develop program for discrete convolution.
3. To develop program for discrete correlation.
4. To understand stability test.
5. To understand sampling theorem.
6. To design analog filter (low-pass, high pass, band-pass, band-stop).
7. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
8. To design FIR filters using windows technique.
9. To design a program to compare direct realization values of IIR digital filter.
10. To develop a program for computing parallel realization values of IIR digital filter.
11. To develop a program for computing cascade realization values of IIR digital filter.
12. To develop a program for computing inverse Z-transform of a rational transfer function.

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<th>BIOMEDICAL INSTRUMENTATION</th>
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OBJECTIVE
The course aims to give a complete exposure of various recording mechanisms and parameter measured for diagnostic application, electrodes used in biopotential recording, bioamplifiers, instrument concerned with measuring the blood flow volume and to select and properly use the optimal instrument for measurement in biological research.

1. INTRODUCTION TO BIO MEDICAL INSTRUMENTATION: System in terms of range; linearity; hysteresis; frequency response; accuracy; signal to noise ratio; stability insolation simplicity;physiological system of Biometrics; basic design; specifications of biomedical instrumentation body; biochemical system; cardiovascular system; respiratory system; nervous system. Source of bioelectric potential resting and action potential and propagation of action potential.
2. ELECTRODES AND TRANSDUCERS: Microelectrodes; skin surface electrode; needle electrode; electrodes and lead for EG; ECG; EMG. Transducer for biomedical applications; factors governing the selection of Transducer; pressure; temperature; flow; ultrasonic transducer.
3. BIO SIGNAL AMPLIFIERS AND SIGNAL PROCESSING: Signal conditioner; amplifier used in biomedical instrumentation; requirement of amplifier; input isolation; DC amplifier; power amplifier; differential amplifier carrier amplifier; instrumentation amplifier. Introduction to biomedical digital signal processing and biomedical telemetry.
4. ELECTROPHYSIOLOGY AND CELL STRUCTURE: Bioelectric signal generated by muscles of heart; neuronal activity of brain; muscle activity; block study of ECG; EEG and EMG. Electrodes and leads for ECG; EEG and EMG.
5. CARDIOVASCULAR INSTRUMENTATION: Measurement of blood pressure; blood flow; and heart sound; cardiology; Phonocardiography; vector cardiography; Echocardiography pacemaker; defibrillators; ventilators.
6. IMAGING SYSTEMS: Ultrasonic imaging system; basic pulse – echo system; block study of a mode scan equipment; multidimensional transducer system; X – Ray machine; CT Scanner; nuclear imaging systems.
7. PATIENT CARE MONITORING: Elements of intensive care unit; diagnosis; calibration and reparable of patient monitoring equipment; instrumentation for monitoring patient; pacemakers; defibrillators and computer patient monitoring system.

TEXT BOOK

REFERENCE BOOKS

<table>
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base load and peak load power plants; plant capacity factor; plant use factor.

2. **THERMAL POWER, HYDRO POWER, NUCLEAR POWER STATIONS**: Selection of site for thermal power plants; thermodynamic cycle for steam flow; Rankine cycle; actual Rankine cycle; reheating cycle; regenerative cycle qualitative treatment; general layout & main components of thermal power station (in brief). Available hydropower; selection of site for hydroelectric power stations; their classifications; layout and main components (in brief); Nuclear power plants – fission energy; general layout and main components (in brief); waste disposal; types of nuclear reactors (in brief); general lay out and main components (in brief); waste disposal; types of nuclear radiations & their effect.

3. **CIRCUIT PARAMETERS OF TRANSMISSION LINES**: Review of calculations of resistance, inductance, capacitance of a single conductor, multi conductor, single phase and three phase transmission lines; transposition; double circuit lines; skin and proximity effect; current carrying capacity and use of Tables.

4. **ANALYSIS OF TRANSMISSION LINES**: Classification; generalized ABCD constants; representation & steady state analysis of short and medium lines; regulation and efficiency; nominal–T and pi circuits; Long line: current –voltage relationship, hyperbolic solution; surge impedance; Surge impedance loading; lumped circuit equivalent representation; Ferranti effect; power flow through a transmission line; reactive power generation / absorption of a line; power transfer capability; shunt and series compensation (in brief).

5. **CORONA AND RADIO INTERFERENCE**: Electric stress between parallel conductors; disruptive and visual critical voltage; corona power loss; factors effecting corona; effects of corona. Radio interference-electromagnetic effect; electrostatic effect; reduction of interference.

6. **INSULATORS**: Overhead line insulators –types and materials; voltage distribution calculations; different methods of equalizing voltage drops across insulators of string; string efficiency.

7. **INSULATED CABLES**: Cable conductor, insulating, sheathing and armouring materials; single core and three core belted cables, gas and oil pressure cables (qualitative treatment); insulation resistance and capacitance calculations; capacitive and intersheath grading; sheath and di-electric loss; thermal rating of cables.

**TEXT BOOK**


**REFERENCE BOOKS**


**EE-302 POWER SYSTEM ENGINEERING –II**

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**OBJECTIVE**

Electrical power is an energy transportation system. A large variety of equipment is necessary to economically and efficiently distribute electrical power. Practical, reliable and safe distribution depends on protective devices to sense fault conditions and disconnect malfunctioning equipment. The course is designed for exhaustive study of faults, circuit interrupters, protective relays and system protection.

1. **SYSTEM REPRESENTATION AND FAULT ANALYSIS**: Single line representation; per unit system; modeling of transformer, load & synchronous machine; nature and causes of faults; fault analysis – symmetrical faults on a synchronous machine at no load and full load; calculations for current limiting reactors – their use, construction and location.

2. **SYMMETRICAL COMPONENTS**: Unbalanced faults-symmetrical component transformation; phase shift in star-delta transformation; sequence impedances. Unsymmetrical faults using symmetrical components – sequence networks and their inter-connection for shunt types of faults.

3. **CIRCUIT INTERRUPTERS**:

   (a) **Fuses**: Types; ratings; the mechanism of fuse performance – characteristics and discrimination; construction and characteristics of HRC fuses.

   (b) **Circuit Breakers**: Theory of formation and extinction of arcs, arc control devices and arc quenching media; inductive and capacitive current interruption; current chopping; resistive switching; recovery and restriking voltage and rate of rise of restriking voltage and factors affecting them; air blast circuit breakers; oil circuit breakers; SF6 circuit breakers; rating of circuit breakers; automatic switch.

4. **PROTECTIVE RELAYS**: General introduction; classification of relays, basic requirements of protective relaying; methods of discrimination; universal torque equation; construction features of electromagnetics relays – attracted armature, induction (disc and cup) type.

5. **RELAY APPLICATION & CHARACTERISTICS**: Over current, instantaneous over current, IDMT, directional and differential relays; distance relays - plain impedance, mho, reactance, offset mho, transmission line & feeder protection and carrier current protection.

6. **APPARATUS PROTECTION**: Transformer, generator, Transformer generator unit protection & motor protection; Neutral grounding.

7. **STATIC & DIGITAL RELAYS**: Basic principle of static relaying, phase & amplitude comparators, introduction to digital relays-basic principle; applications of microprocessors and computer-recent trends.

**TEXT BOOK**

### OBJECTIVE
Due to lack of technology, electric drives historically were designed to provide crude power without consideration of performance. Advances in industrial manufacturing led to a need for more sophisticated drives which stimulated the development of the subject. With the development of power electronics devices & circuits, virtually any type of power source can now be used with any type of electric motor. The course contents are designed to develop fundamentals of drives systems & their control using static devices.

1. **ELECTRIC DRIVES**: Basic components of an electric drive system-power source; converters; controllers; types of industrial loads; load torque components; torque speed characteristics of electric motors; classification, choice of electric drive machines; status of ac and dc drives.
2. **DYNAMICS OF ELECTRIC DRIVES**: Fundamental torque equations; equivalent values of drives parameters; joint speed-torque characteristic of electric motors and mechanical loads; bi-directional electric drive systems; four-quadrant electric drives systems.
3. **ESTIMATION OF MOTOR POWER RATING**: Heating and cooling; determination of motor rating-continuous; short time and intermittent duty rating; use of load diagrams; load equation and determination of MOI of the flywheel.
4. **SOLID STATE SWITCHING CIRCUITS**: Review of three phase half wave; ac/dc converters for resistive and inductive loads; three phase full wave ac/dc converter; pulse width modulation (PWM) energy recovery systems; current source inverter.
5. **SEMI-CONDUCTOR CONTROLLED DC MOTOR DRIVES**: Starting; acceleration control; braking of DC drive; converter fed DC drive & chopper fed DC drive.
6. **SEMI-CONDUCTOR CONTROLLED INDUCTION MOTOR DRIVES**: Starting; acceleration control; braking; static control techniques – stator frequency control; stator voltage control; rotor resistance control; static Scherbius system & static Kramer system; vector control.
7. **PMBLDC & PMSAC Drives**: permanent magnet brush less DC drive; permanent magnet sine fed drives; switched reluctance machine drive.

### REFERENCE BOOKS

### TEXT BOOK
REFERENCE BOOKS

LIST OF EXPERIMENTS
1. Symmetrical fault level measurement on a D.C Network analyzer.
2. Unsymmetrical fault level measurement on a D.C Network analyzer for various types of faults.
3. To find ABCD parameters of a model of transmission line.
4. To draw the operating characteristics of IDMT relay.
5. To observe the Ferranti effect in a model of transmission line
6. To draw the operating characteristics of differential relay.
7. Testing of transformer oil.
8. To study the voltage distribution in an analogue model of a string insulator and to compute the string efficiency.
10. To study circuit breakers.
11. To study Bucholtz relay.
12. To study plain impedance relay and plot it’s tripping characteristics.

LIST OF EXPERIMENTS
1. Speed control of dc motor using dc chopper.
2. Speed control of dc motor using single –phase converter.
3. Speed control of dc motor using 3-phase converter.
6. CSI fed induction motor drive.
7. Speed control of single –phase induction motor using ac regulator.
10. Static rotor resistance control method.

OBJECTIVE
The programmable logic controller represents a key factor in industrial automation. Its use permits flexible adaptation to varying processes as well as rapid fault finding and error elimination. Today, Industrial environment is steered with the latest technological advancements in computers and communication. Programmable Logic Controllers (PLC) based automation is its outcome. This subject is useful to understand the concept of automation used in industry.

1. INTRODUCTION: Programmable Logic Controller; advantages of PLCs Over Relay System; input output Section – Fixed input output, Modular input output Modules, Analog input output Modules.
2. PROCESSOR UNIT: Processor; Memory types; Guarding against Electro Static Discharge; Peripherals; Memory Organization.
3. PROGRAMMING DEVICES: Programming Devices; Dedicated Desktop Programmes; Hard Held Programmes; Computer Programmes
4. LADDER DIAGRAM & PLC PROGRAMMING: Ladder Diagram Rules; Writing Diagram; Ladder Diagram; Basic Stop / START Circuit; Digital Logic gates; Sequenced Motor Starting; Relay Type Instruction; Programming a PLC; PLC Peripherals; Network Limitation; Program Scanning
5. Program Control Instructions: Master Control Relay Instructions; Latching Relay instruction; immediate input output instruction; Jump and Label Instruction.
6. PROGRAMMING TIMER & COUNTERS: Pneumatic Timers; Cascading Timers; Allen Bradley PLCs Counters; Combining Timer & Counters.
7. SCADA: Introduction; Concept of Automatic Scada; Architecture of Scada; Hierarchical of Supervisory Control & Data Acquisition System; Technology Available; Data Acquisition Unit; Remote Technical Unit.

TEXT BOOK
REFERENCE BOOK

OBJECTIVE
Process control is a very important subject for control engineers. Knowledge of process dynamics, mathematical modeling and analysis of the same is absolutely required for the control engineers. The content of the course has been designed to give the students a basic understanding of industrial process, dynamics of the process, characterizing the process dynamics. The objective has been set to enable them to design industrial controller using various control methods.

1. INTRODUCTION TO PROCESS DYNAMICS: Process definition; characteristics of process dynamics; process models; first order process; second order process; dynamics of first and second order process; feedback control; two position control; multi position control; PID control; feed forward control; multi variable control.
2. TRANSDUCERS: Characteristic of transducers; classification; displacement / motion transducers; temperature transducer; pressure transducers; liquid level transducers.
3. DIGITAL CONTROL: Direct digital control-introduction, structure, software; distributed digital control-introduction, requirements of distributed process control system, system architecture, configuration.
4. PROGRAMMABLE CONTROLLERS: Introduction; principles of operation; architecture; configuration; software; applications.
5. DISPLAY SYSTEMS: Introduction; display parameters; displays in process control environment.
6. ADVANCED CONTROL STRATEGIES: Feed forward control; ratio control; time-delay compensation; cascade control; override control; control of non-linear process; stabilizing process control.
7. INTELLIGENT CONTROLLERS: Introduction; model based controllers; predictive controller; expert system based controller; fuzzy controller; neural controllers; neuro-fuzzy controller.

TEXT BOOK

REFERENCE BOOKS

EL-101 ELECTRICAL ENGINEERING L T P Cr
5 1 0 4

OBJECTIVE
To provide basic knowledge and understanding of fundamental concepts of Electrical Technology, explaining various basic laws governing the circuit configurations and evaluation and its applications to electrical circuits.

1. DC NETWORKS: EMF, potential difference; current, resistance; Ohm’s law; effect of temperature on resistance; source conversion; KCL, KVL; mesh analysis; nodal analysis; network theorems – superposition, Thévenin’s, Norton, reciprocity, maximum power transfer theorem; star-delta conversion.
2. SINGLE PHASE AC CIRCUIT: Generation of AC voltages, frequency, cycle, period, instantaneous, Peak, RMS and average value, peak factor, form factor, phase and phase difference, polar, rectangular, exponential and trigonometric representation of phasors; R, L and C components, behavior of these components in A.C. circuits, series and parallel A.C. circuits and their phasor diagrams, concept of impedance and admittance, power and power factor, Complex power; resonance-Series and parallel resonance, Q factor; bandwidth.
3. THREE PHASE CIRCUITS: Phase and line voltages and currents, balanced star and delta circuits; phasor diagram, power equation, measurement of three phase power by two wattmeter method; comparison of single phase, three phase and DC system and their relative advantages.
4. MAGNETIC CIRCUITS: Magnetic effect of electric current; concept of MMF, flux, flux density, reluctance, permeability; B-H curve; hysteresis loop, hysteresis and eddy current loss; comparison of electrical and magnetic circuits.
5. TRANSFORMER: Construction, principle, working of ideal and practical transformer; equivalent circuit, phasor diagram; OC and SC tests, regulation and efficiency; autotransformer.
MACHINES: Construction and principle of operation of three phase induction motor, concept of slip and its importance.
7. MEASURING INSTRUMENTS: Voltmeter; ammeter; wattmeter; energy meter.

TEXT BOOK
Gupta, J.B. “Electrical Technology”, Katson Publication
REFERENCE BOOKS
1. Theraja, B.L. "Electrical Technology Vol I & II", S. Chand Publications, 2005

Objective
Providing sound knowledge about the need of measurement of various electrical quantities and the various means and instruments required to accurately measure them, also to explain the constructional features and principles of operation of various electrical and electronics instruments.

PRE-REQUISITE
Basic concepts and knowledge of Electronics and Electrical Engineering.

1. MEASURING SYSTEM FUNDAMENTALS:
   Classification of Instruments (Absolute and Secondary; Indicating, Recording and Integrating Instruments, Based Upon principle of operation); Block diagram and description of block of generalized instrument; 3 forces in electromechanical Indicating Instrument (Deflecting, Controlling and Damping forces); Comparison between gravity and spring controls; comparison of damping methods and their suitability; Bearing supports, Pivot-less support, scale information, Instrument cases (covers).

2. MEASURING INSTRUMENTS:
   Construction, operating principle, torque equation, shape of scale, use as ammeter or as voltmeter (Extension of ranges), Use on AC / DC or both; Advantages and disadvantages, errors (Both on AC / DC) of PMMC types; Electrodyamics type; Moving Iron Type (Attraction, Repulsion and Combined type); Hot wire type and Induction type; Electrostatic type instruments; Electrodyamics and Induction type wattmeters; Single phase induction type energy meters; compensation and creep in energy meters.

3. POWER FACTORS & FREQUENCY METERS:
   Construction, operation principle torque equation, advantages and disadvantages of single phase power factor meter (Electro dynamic and moving from types); Electrical resonances type, Ferro dynamic and electro dynamic type frequency meter.

4. A.C. BRIDGES:
   Classification of resistances, resistance – Measurements by Wheat Stone Bridge, Kelvin’s double bridge method and their limitation General Balance Equation, Circuit Diagram, Phasor Diagram, Advantage and Disadvantages, Application of Maxwell’s Inductance, Inductance – Capacitance, Hay’s, Anderson’s, Owen’s, De-Sauty’s, Schering and Wein’s Bridges, Shielding and Earthing.

5. GENERATION AND ANALYSIS OF WAVEFORMS:
   Block Diagram of pulse-generator; Signal generators; Function Generators; Wave analyzer; Distortion Analyzers; Spectrum analyzer; Harmonic Analyzer; Power Analyzer.

6. ELECTRONIC MEASUREMENT:
   Electronic Voltmeter; Multimeter; Wattmeter; Energy meter; Time; Frequency and phase measurements using CRO; Spectrum and wave Analyzer; Digital Counter; Frequency meter; storage oscilloscope.

7. INSTRUMENTATION:
   Transducers; classification and selection of transducers; strain Gauges; Inductive and Capacitive transducer; Piezo-electric and Hall-Effect transducer; Thermistors and hermo couples; Photo-Diode and Photo-transistors; Encoder type digital transducer; Signal conditioning, Telemetry and Data Acquisition system.
TEXT BOOK

REFERENCE BOOKS

REFERENCE BOOKS

TEXTBOOK

PRE-REQUISITES
Basic concepts of electrical engg.

OBJECTIVE
Explain the basic concepts regarding the difference in behavior of different materials used in electrical and electronics industry, explaining the various properties of different materials and their application to devices, equipments and systems selection of proper materials for given application.

EL-202 ELECTRICAL ENGINEERING MATERIALS L-T-P Cr
5-0-0 3

OBJECTIVE
Explain the basic theorems applied on ac circuits and the transient behaviour of various circuits, Network functions and synthesis along with various filters and their characteristics.

EL-203 NETWORK ANALYSIS & SYNTHESIS L-T-P Cr
5-1-0 4

OBJECTIVE
Explain the basic concepts of electrical engg.

PRE-REQUISITES
Basic concepts of electrical engg.

7. **NETWORK SYNTHESIS**: Positive real functions; synthesis of one port and two port networks; elementary ideas of active networks.

**TEXT BOOK**


**REFERENCE BOOKS**


**OBJECTIVE**

Providing a basic knowledge and understanding of the fundamental concepts of Analog Electronics and AE Circuits, explaining various basic laws governing the circuit configurations and evaluation and its applications to electrical circuits of various electronics systems.

**PRE-REQUISITE**

Knowledge of Basic Electronics Engineering and Electrical Technology.

1. **TRANSISTOR BIASING AND WORKING AT LOW FREQUENCIES**: Bipolar junction transistor construction and types; three modes of configuration in a BJT; concept of biasing, Need of biasing, collector to base bias, self bias, emitter bias, Need of bias compensation, thermistor and sensistor compensation; hybrid model of transistor; calculation of h parameters in three modes of configuration.

2. **TRANSISTOR AT HIGH FREQUENCIES**: Hybrid pi model; CE short circuit current gain; frequency response; cut off frequency; gain bandwidth product.

3. **FIELD EFFECT TRANSISTOR**: JFET, MOSFET, types of MOSFET – enhancement and Depletion mode, V MOSFET; Biasing of FET; application of FET as a voltage variable resistor (VVR).

4. **POWER AMPLIFIERS AND FEEDBACK**: Amplifier, classification of amplifier, distortion in amplifiers, R – C coupled amplifiers; low frequency response of R – C coupled Amplifier; cascade of Amplifiers, Class A, Class B and Class C Amplifier; push pull amplifier; Feed back concept in an amplifier and negative feedback in amplifiers; current series feedback, current shunt feedback, voltage shunt feedback.

5. **DIFFERENTIAL AMPLIFIER**: Operational amplifier; Ideal and practical op-amp; inverting and non inverting amplifier; emitter coupled differential amplifier; transfer characteristics of differential amplifier; offset error of voltage and current; common mode rejection ratio (CMRR).

6. **LINEAR AND NON-LINEAR APPLICATIONS OF OP-AMP**: Scale changer; phase shifter; adder; voltage to current converter; current to voltage converter; DC Voltage follower; Bridge amplifier; AC coupled amplifier and AC voltage follower; Integrator; comparators; logarithmic amplifier; anti-log amplifier; waveform generator and sweep generator multivibrators.

7. **PHASE LOCKED LOOP AND IC TIMER 555**: Operating principle and operation of PLL; IC timer 555; Applications of PLL and IC timer 555.

**TEXT BOOK**


**REFERENCE BOOKS**


**OBJECTIVE**

Providing the knowledge to the students about various types of conventional and non-conventional electrical power plants and explain the concepts regarding their layout and their operations at different load conditions and also the economically considerations in electrical power generation.

**PRE-REQUISITES**

Knowledge and concepts of Electrical Technology.

1. **INTRODUCTION**: Energy sources, their availability electrical energy demand and growth in India; general state of the energy system; global Energy scenario.

2. **POWER PLANT ECONOMICS**: Types of load; chronological load curves; load duration curve; mass curve; max. Demand; demand factor; load factor; capacity factor; utilization factor; diversity factors; base load and peak load power plants; Capital cost of plants; annual fixed and operating costs of plants; generation cost and degradation; effect of load factor on unit energy cost; role of load diversity in power system economics; off peak energy utilization; energy cost reduction.

3. **TARIFFS**: Objectives of tariffs; general tariff form; flat demand rate; straight meter rate; block meter rate; two part tariffs; power factor dependant tariffs; three parts tariffs; spot (time differentiated) pricing.

4. **CONVENTIONAL ENERGY SOURCES**: Selection of site; capacity calculations; detailed description and use of different parts; schematic diagram and
working of thermal, hydro electric, nuclear power, diesel power and gas turbine power plant.
5. NON-CONVENTIONAL ENERGY SOURCES: Study of wind, solar, tidal, geo-thermal bio-gas sources of energy, fuel cell, magneto hydro dynamic generation system; power crisis; future energy demand; role of private sector in energy management.
6. POWER FACTOR IMPROVEMENT: Causes and effect of low power factor; advantages of power factor improvement; PF improvement using shunt capacitors and synchronous condensers; calculation of most economic pf when (a) kw demand is constant (b) KVA demand is constant.
7. POLLUTION AND ITS CONTROL: Air and water pollution by thermal power plants and its control; acid rains; thermal pollution by thermal and nuclear power plants; radio-active pollution of environment by nuclear power plants; noise pollution and noise control; methods suggested to reduce the pollution.

TEXT BOOK

REFERENCE BOOKS

EL-206 ELECTRICAL MACHINES-I

OBJECTIVE
Providing sound knowledge about the principles of operation of various electrical machines, their constructional features, and their behavior and characteristics under various condition of operation.

PRE-REQUISITES
Basic of knowledge of Electrical Technology and Circuits.

1. INTRODUCTION TO ELECTRO-MECHANICAL ENERGY CONVERSION: Basic principles, concept and laws of magnetic circuits; energy in single and multiple excited magnetic systems; basic differential equations of electromechanical energy conversion devices; equations for force and torque in single and multiple excited magnetic systems; reluctance torque.
2. SINGLE PHASE TRANSFORMERS: Basic principle; basic theory of an ideal transformer; construction of transformers i.e. core, winding, tank, conservator, Breather, cooling methods, buchholz relay; equivalent circuit; phase diagram; per unit representation of parameters; regulation; losses and efficiency; transformer tests i.e. open circuit, short ckt. and sumner’s test; separation of iron losses; nature of magnetizing circuit; plotting of B – H curve; inrush current; harmonics; parallel operation of 1 –Φ transformer and load sharing; auto transformer: Principle; construction; comparison with 2 – winding transformer; application of autotransformer.
3. THREE PHASE TRANSFORMER: Construction of three winding transformer; various types of connections; their comparative features; zig-zag connection; phase conversion - 3Φ to 1Φ; 3Φ to 2Φ; 3Φ to 6Φ and 3Φ to 12Φ.
4. SPECIAL TYPE TRANSFORMERS: Tap changing transformer; phase shifting transformer; pulse transformer; isolation transformer; welding transformer; rectifier transformer; high frequency transformer.
5. D.C. GENERATORS: Elementary DC machine; emf equation; Principle and construction of D. C. Generator; lap and wave winding; methods of Excitation of D. C. Generators; Armature Reaction; Commutation in D. C. Machines; Compensating windings; characteristics of D. C. Generators; Parallel operation of Generators.
6. D. C. MOTORS: Construction, principle and operation of D.C motors; back emf concept; torque equation; power balance equation; Characteristics of different types of DC motors, losses in DC motors, efficiency, testing: Swinburne’s, & Hopkinson’s, and retardation test.
7. CONTROL OF DC MOTORS: Necessity of starter; 3 point and 4 point starters. Speed control; flux Control; armature resistance and armature voltage control. Electrical Braking: Methods of electrical braking i.e. dynamic, regenerative and plugging.

TEXT BOOK

REFERENCE BOOKS
To calibrate an energy meter with the help of a standard wattmeter and a stop watch.

To measure power and p.f. by 3-ammeter and 3-voltmeter method.

To measure power and p.f in 3-phase circuit by 2-wattmeter method.

To measure capacitance by De Sauty’s bridge.

To measure inductance by Maxwell’s bridge.

To measure frequency by Wien’s bridge.

To measure the power with the help of C.T and P.T.

Measurement of distance by capacitive pick-up.

Measurement of temperature using thermo-couple.

To measure low resistance by Kelvin’s double bridge.

To measure high resistance by loss of charge method.

REFERENCE BOOKS

LIST OF EXPERIMENTS
1. Transient response of RC circuit.
2. Transient response of RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify “Z” parameters of a two port network.
5. To calculate and verify “Y” parameters of a two port network.
6. To determine equivalent parameter of parallel connections of two port network.
7. To plot the frequency response of low pass filter and determine half-power frequency.
8. To plot the frequency response of high pass filters and determine the half-power frequency.
9. To plot the frequency response of band-pass filters and determines the band-width.
10. To calculate and verify “ABCD” parameters of a two port network.
11. To synthesize a network of a given network function and verify its response.
12. Introduction of P-Spice

REFERENCE BOOKS

OBJECTIVE
Providing sound knowledge about the various control system techniques required for the operation and accurate controls of industrial processes and other strategies for complicated processes and efficient control.

PRE-REQUISITES
Knowledge of Mathematics and Electrical Engineering

1. INTRODUCTION TO CONTROL PROBLEM:
Industrial control examples; Transfer function
models of mechanical; electrical; thermal and hydraulic systems; systems with dead-time, system response; control hardware and models; potentiometers; synchros; LVDT; dc and ac servomotors; tacho-generators; electrohydraulic valves; hydraulic servomotors; electropneumatic valves; pneumatic actuators; closed-loop systems. Block diagram and signal flow graph analysis; transfer function.

2. BASIC CHARACTERISTICS OF FEEDBACK CONTROL SYSTEM: Stability; steady-state accuracy; transient accuracy; disturbance rejection; insensitivity and robustness. Basic modes of feedback control: proportional; integral and derivative. Feed-forward and multi-loop control configurations.

3. TIME DOMAIN ANALYSIS: Introduction; standard input signals; response of 1st and 2nd order systems; time domain specifications i.e.; rise time; peak time; delay time; peak overshoot; settling time; steady state error etc.; different types of feedback systems; steady state errors for unit ramp; unit step and unit parabolic inputs; effects of addition of zeros to the system.

4. STABILITY ANALYSIS: Introduction; concept of stability; conditions for stable system; asymptotic; relative and marginal stability; Routh-Hurwitz criterion for stability and various difficulties with Routh-Hurwitz criterion.

5. ROOT LOCUS TECHNIQUE: Introduction; concepts of root locus; construction of root loci and various rules pertaining to locus diagram development.

6. FREQUENCY DOMAIN ANALYSIS AND STABILITY: Introduction; relation between time and frequency response for 2nd order system; Bode plot; construction procedure for bode plot; gain cross over and phase cross over frequency; gain margin and phase margin; Nyquist plot and Nyquist stability criterion.

7. STATE-VARIABLE ANALYSIS: Concept of state; state variable; state model; state models for linear continuous time functions; diagonalization of transfer function; solution of state equations; concept of controllability and Observability.

TEXTBOOK
Naggrath and Gopal, “Control System Engineering” , New Age International, 2005

REFERENCE BOOKS

EL-302 POWER ELECTRONICS

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OBJECTIVE
Providing a sound understanding of the fundamental concepts of power electronics devices their characteristic, operation, control and applications.

PRE-REQUISITES
Knowledge of basic electronics electrical and electronics circuits.

1. POWER ELECTRONIC DEVICES: Role of Power Electronics; Classification of power electronic devices; construction; characteristics and applications of power transistor; power MOSFET; IGBT;GTO; SCR; triac; diac; Two transistor analogy for turning ON-OFF SCR; turn ON mechanism; different methods of turning ON-OFF SCR; turn OFF mechanism; thyristor firing circuits.

2. OPERATION & PROTECTION OF SCR: Series parallel operation of SCRs; firing cts. for series and parallel operation; static and dynamic equalising cts.; equalisation of current in parallel connected SCRs; string efficiency; derating factor; Devices used in control circuits; protection of SCRs against dv/dt; dv/dt; radio freq. interference; over voltage; over current.

3. DIFFERENT TYPES OF SCR RECTIFIERS: Principle of phase control; half wave controlled rectifier; half controlled bridge and fully controlled bridge rectifier for resistive and RL load; derivation for output voltage and current; effect of free wheeling diode; single phase dual converters. Three phase half controlled bridge and fully controlled bridge rectifier.

4. INVERTER CIRCUITS: Basic circuits for forced commutation; series inverter; improved series inverter; parallel inverter; out put voltage and waveform control; principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode; single phase transistorized bridge inverter.

5. DC CHOPPER: Basic principles of chopper; time ratio control and current limit control techniques; voltage commutated chopper circuit.; Jones chopper; step-up chopper; step-down chopper ;Regulated DC Power supplies and SMPS

6. AC VOLTAGE REGULATORS: Types of regulators; equation of load current; calculation of extinction angle; out put voltage equation; harmonics in load voltage. Synchronous tap changers. Three phase voltage regulators. Basic principle of cyclo-converters; single phase to single phase and three phase cyclo-converter; Load commutated and force commutated cyclo-converters

7. APPLICATION OF POWER ELECTRONICS: Static circuit breakers; fan speed regulator; principle of soft start circuits. Zero Voltage Switch; UPS; and Induction heating; static VAR Control

TEXT BOOK
Rashid.M.H. “Power Electronics Circuits Devices and Application” Prentice Hall of India, 2000

REFERENCE BOOKS
OBJECTIVE
Providing sound knowledge about the various control system techniques required for the operation and accurate controls of Industrial processes and other strategies for complicated processes and efficient control.

PRE-REQUISITES
Knowledge of mathematics and control system-I

1. **STATE VARIABLE TECHNIQUES**: State variable representation of systems by various methods; Solution of state equations-state transition matrix; Transfer function from state variable model; Controllability and observability of state variable model.
2. **SECOND ORDER SYSTEMS & STATE PLANE**: Phase portrait of linear second systems; Method of isoclines; phase portrait of second order system with non-linearities; limit cycle; singular points.
3. **DESCRIBING FUNCTION ANALYSIS**: Definition; limitations; use of describing function for stability analysis; describing function of ideal relay; relay with hysteresis and dead zone; saturation/Coulomb friction and backlash.
4. **LINEAR APPROXIMATION OF NONLINEAR SYSTEMS**: Taylor series; Liapunov’s 2nd method.
5. **SAMPLED DATA SYSTEMS**: Sampling process; impulse modulation; mathematical analysis of sampling process; application of Laplace transform; Shannon’s theorem; reconstruction of sampled signal zero order and first order hold; Z-transform; definition; evaluation of Z-transform; Inverse Z-transform; pulse transfer function; limitations of Z-transform; state variable formulation of discrete time systems; Solution of discrete time state equations; stability; definition; the Schur-Cohn stability criterion; Jury’s test of stability of extension of Routh-Hurwitz criterion to discrete time systems.
6. **OPTIMAL CONTROL**: Introduction; formation of Optimal Control problem; calculus of variation; minimization of function; constrained optimization; performance index; optimality principle; linear quadratic problems.
7. **ADAPTIVE CONTROL**: Introduction; model reference adaptive controls and systems; controller structure; various adaptive control systems.

**TEXT BOOK**

**REFERENCE BOOKS**

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**OBJECTIVE**
Providing a sound understanding of the fundamental concepts of Utilization of Electrical Power for the various industrial applications such as heating, welding, Electrolytic processes and its applications to Electric Traction.

**PRE-REQUISITES**
Knowledge of Electrical Power Energy and Electrical Machines.

1. **ILLUMINATION**: Basic laws of illumination; light sources and their characteristics; sources of light; design of lighting schemes; incandescent lamp; sodium lamp; mercury lamp and fluorescent lamp; comparison of various lamps.
2. **ELECTRIC HEATING**: Principle and application of resistance; induction and dielectric heating; Infrared or radiant heating; High frequency eddy current heating; the arc furnaces.
3. **ELECTRIC WELDING**: Resistance welding; arc welding; welding generator and welding transformer; properties of arcing electrode; comparison between resistance and arc welding; comparison between A.C. and D.C. welding.
4. **ELECTROLYTIC PROCESS**: Principles and applications of electrolysis. Faraday’s law of electrolysis; electroplating; calculation of current required for depositing given amount of metal; current efficiency; voltage-energy efficiency; extraction of metals electro deposition; factors governing deposition process; charging and discharging of battery; capacity and efficiency of battery; defects in battery.
5. **TRACTION SYSTEMS**: Advantages of electric traction; requirements of an ideal traction system; different system of electric traction; comparison between D.C. and A.C systems of railway electrification; speed – time curves; mechanism of train movement; tractive effort for propulsion of train; power output and energy output from the driving axles; determination of specific energy output and specific energy consumption; factors affecting SEO and SEC.
6. **ELECTRIC TRACTION MOTORS**: General features of traction motors; characteristics of DC and AC motors from the point of view of traction duties; parallel operation of traction motors from traction services view point.
7. **CONTROL OF TRACTION MOTORS**: Speed control of DC traction motors; notching; Series – parallel starting; transition methods; Drum controller; the Metadyne control; starting and speed control of 3 Phase Induction motors; braking; advantages and disadvantages of regenerative braking; calculation of energy returned during regeneration; magnetic brakes; electro-mechanical drum brakes; multiple-unit control; auxiliary equipment.

**TEXT BOOK**
B.Tech. Electrical Engineering (Regular)

REFERENCE BOOKS

REFERENCE BOOKS

OBJECTIVE
Providing sound knowledge about the principles of operation of various electrical machines, their constructional features, and their behavior and characteristics under various condition of operation.

PRE-REQUISITES
Knowledge of electrical technology and electrical machines-I

EL-305 ELECTRICAL MACHINES-II

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1. THREE PHASE INDUCTION MOTOR: Review or constructional details; production of rotating field; induction motor action; torque production; testing of induction motor; losses and efficiency; development of equivalent circuit; performance characteristics; circle diagram; starting methods of 3 phase induction motor i.e. D.O.L starter; stator rheostat starter; Auto transformer starting; star delta starter; methods of speed control; stator voltage control; stator resistance control; frequency control; rotor resistance control; slip power recovery control; double squirrel cage rotor; deep bar squirrel cage motor; Induction generator-grid connected and self excited mode; space harmonics and their effect on motor performance.

2. SINGLE PHASE MOTORS: Double revolving field theory; cross field theory; equivalent circuit; characteristics and starting of single phase motor by different methods; shaded pole machine.

3. PRINCIPLES OF SYNCHRONOUS MACHINES: Construction features of synchronous machines; cylindrical rotor and salient pole machines; terms related to winding of synchronous machines; coil span factor; distributed A.C winding types; distribution factor; excitation systems; E.M.F equation and harmonic elimination armature reactions.

4. SYNCHRONOUS GENERATORS: Interaction between excitation flux and armature m.m.f; equivalent circuit model and phasor diagram for cylindrical rotor machine. Salient pole machine: two reaction theory; equivalent circuit; model and phasor diagrams; power angle equations and characteristics; slip test; transient and sub-transient reactances; voltage regulation: Different methods for finding voltage regulation i.e. EMF method; MMF method; Pottier triangle method; synchronization of alternators by different methods; parallel operation and load sharing; active and reactive power control.

5. SYNCHRONOUS MOTORS: Principles of synchronous motor; V-curve; starting method of synchronous motors; damping winding; hunting effect; synchronous condenser application of synchronous motor, testing of synchronous machine; stability considerations.

6. SINGLE PHASE SYNCHRONOUS MOTORS: Hysteresis motor; reluctance motor; single phase series and repulsion motor; stepper motors: Variable reluctance and permanent magnetic type.

7. SPECIAL ELECTRIC MOTORS: Switched reluctance motor; linear induction motor; servo motor – A.C and D.C.; scharge motor; disc motors; printed circuit motors.

TEXT BOOK

REFERENCE BOOKS

EL-306 ELECTRICAL MACHINES DESIGN

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OBJECTIVE
Providing sound knowledge about the principles of operation of various electrical machines, their constructional features, and their behavior and explaining the various principles of Design concepts of various components of each electrical machine so that machines after manufacturer operate at optimum efficiency and economy under various condition of operation.

PRE-REQUISITES
Knowledge of Electrical Materials and Electrical Machines.

1. BASIC CONSIDERATIONS: Basic concept of design; Factors and limitations in design; modern trends in design and manufacturing techniques; main dimensions; output equations and output co-efficient.

2. MAGNETIC FIELDS: Calculation of magnetic circuits, magnetizing, current, coils for given ampere-turns, real and apparent flux densities; tapered teeth; Carter's co-efficient, leakage fluxes reactances.

3. ARMATURE WINDING: General features of armature windings; single layer and double layer
and commutator windings; integral and fractional slot windings; winding factor; classification of insulating materials.

4. **HEATING COOLING AND VENTILATION:** Heat dissipation; heat flow; heating cooling cycles; Heating cooling cycles; estimation of maximum temperature rise; cooling media; Quantity of cooling media; Types of enclosures; ratings; heat dissipation; Methods of ventilation.

5. **TRANSFORMER DESIGN:** Output equation design of core; yoke and windings; overall dimensions; Computation of no load current to voltage regulation; efficiency and cooling system designs.

6. **DESIGN OF ROTATING MACHINES:** Output equations of rotating machines; specific electric and magnetic loadings; factors affecting size of rotating machines; separation of main dimensions; selection of frame size; Core and armature design of DC and 3-phase ac machines Rotor design of three phase induction motors. Design of field system of DC machine and synchronous machines; estimation of performance from design data.

7. **COMPUTER AIDED DESIGN:** Philosophy of computer aided design; advantages and limitations; Computer aided design approaches analysis; synthesis and hybrid methods; Development of computer program and performance prediction; Concept of optimization techniques and its general procedure. Flow charts and ‘c’ and ‘vb’ based computer programs for the design of transformer; DC machine; three phase induction and synchronous machines. Study of electrical machine design softwares like Ansoft RMXPert, speed.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
Providing sound knowledge about the various components of power system; Generation; distribution and transmission and explain the role and importance of each; explaining the principles governing the efficient operation of each component at optimum efficiency and various techniques for analyzing the stability of power system.

**PRE-REQUISITES**
Knowledge of electrical technology and electrical power systems.

**TEXT BOOK**

**REFERENCE BOOKS**

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**OBJECTIVE**
Providing a sound understanding of the fundamental concepts of microprocessor and microcontrollers 8085, 8086, explaining the various assembling level programming and Interfacing devices techniques and Data transfer techniques and their applications.

**PRE-REQUISITES**
Knowledge of basic electronics circuits.

1. **THE 8085 PROCESSOR:** Introduction to microprocessor; History and evolution; 8085
2. **ASSEMBLY LEVEL PROGRAMMING OF 8085:** Timing diagram; instruction cycle; machine cycles; T-states; timing diagram for different machine cycles.

3. **THE 8086 MICROPROCESSOR ARCHITECTURE:** Architecture; block diagram of 8086; details of sub-blocks such as EU:BIU; memory segmentation and physical address computations; program relocation; addressing modes; instruction formats; pin diagram and description of various signals.

4. **ASSEMBLY LEVEL PROGRAMMING IN 8086:** Instruction execution timing; assembler instruction format; data transfer instructions; arithmetic instructions; branch instructions; looping instructions; NOP and HLT instructions; flag manipulation instructions; logical instructions; shift and rotate instructions; directives and operators; programming examples.

5. **INTERFACING DEVICES AND TECHNIQUES:** The 8255 PPI chip: architecture; control words; modes and examples; 8259 PIC; 8253 Programmable interrupt timer.

6. **DATA TRANSFER TECHNIQUES:** Data transfer techniques; programmed data transfer; parallel data transfer using 8155; programmable ports and handshake input/output; asynchronous and Synchronous data transfer using 8251A; introduction to DMA process; 8237 DMA controller; DMA transfer; cycle stealing and burst mode of DMA; 8255; 8257 DMA controller.

7. **MICROCONTROLLERS:** comparison between Microcontrollers and Microprocessors; Block diagram of 8051; pin diagram and details; I/O structure; Memory organization; special function registers; External memory; 8032/8052 Enhancements; reset operation.

**INSTRUCTION SET:** Addressing modes; arithmetic; Logical; Data transfer; Boolean variable; program branching instructions.

**TEXT BOOK**

**REFERENCE BOOKS**

**LIST OF EXPERIMENTS:**
1. To study A.C. Servo-motor and to plot its torque-speed characteristics
2. To study magnetic amplifier and to plot its load current vs control current characteristics for (a) Series connected mode (b) Parallel connected mode
3. To implement a PID controller for temperature control of a pilot plant
4. To study different components of process control simulator kit
5. To study A.C. Motor position control through continuous command
6. To study Synchro transmitter and receiver and to plot stator voltage vs rotor angle for synchro transmitter
7. To study lead, lag, lead-lag compensator and to draw their magnitude and phase plot
8. To study D.C. Servo-motor and to plot its torque-speed characteristics
9. To study simple open loop and closed loop control system with disturbance and without disturbance using process control simulator kit
10. To study (PD), PI, PID controllers.
11. To study a stepper motor and control the speed by 8085 microprocessor kit

**ADDITIONAL EXPERIMENTS:**
12. Obtain the unit step response of a second order system with given zeta and Wn using MATLAB.
13. Determine the unit step response of a given close loop transfer function using MATLAB.
14. Determine the damping ratio, undamped natural frequency of oscillation and percentage overshoot of a unity feedback open loop transfer function to a unit step input using MATLAB.

**REFERENCE BOOKS**

**LIST OF EXPERIMENTS:**
1. Study of characteristics of diode, thyristor and triac.
2. Study of characteristics of transistor and MOSFET.
4. Study of UJT firing circuit.
5. Study of complementary voltage commutation using a lamp flasher.
7. Study of thyristorised d-c circuit breaker.
8. Study of a.c. phase control.
10. Study of dc chopper.
11. Study of series inverter.
12. Study of bridge inverter.
13. Study of single phase cycloconverter.
REFERENCE BOOKS
1. Bimbhra, P.S., “Power Electronics” Khanna Publisher, 2009

EL-355 ELECTRICAL MACHINES-II LAB. L-T-P Cr
EL-356 ELECTRICAL MACHINES DESIGN LAB L-T-P Cr

LIST OF EXPERIMENTS

EL-355 ELECTRICAL MACHINES-II LAB. L-T-P Cr

1. To perform the open circuit test and block rotor test on 3 phase induction motor and draw the circle diagram.
2. Speed control of induction motor by rotor resistance control.
3. To conduct the load test to determine the performance characteristics of the I.M.
4. To compute the torque vs speed characteristics for various stator voltages.
5. To perform the open circuit test and block rotor test on single-phase induction motor and determine equivalent circuit parameters.
6. To perform load test on a universal motor and determine the performance with dc/ac supply voltage.
7. Voltage Vs load Characteristics of 3 phase synchronous generator. And draw input vs. Output power.
8. To perform O.C. test on synchronous generator. And determine the full load regulation of a three phase synchronous generator by synchronous impedance method.
10. To plot V-Curve of synchronous motor.
11. To study the parallel operation of synchronous generators.
12. Determination of sequence impedances of synchronous machine for various stator voltages.

REFERENCE BOOKS

EL-358 MICROPROCESSOR AND MICROCONTROLLER LAB L-T-P Cr

LIST OF EXPERIMENTS

EL-358 MICROPROCESSOR AND MICROCONTROLLER LAB L-T-P Cr

1. Study Architecture of 8085 and familiarization with its hardware, commands and operation of Microprocessor kit.
2. Write a well-documented program for:
   a. addition of two 8-bit numbers (provision for carry)
   b. addition of two 8-bit numbers.
3. Write a well-documented program for:
   a. subtraction of two 8-bit numbers (display of borrow)
   b. subtraction of two 16-bit numbers (display of borrow)
4. Write a well-documented program for:
   Multiplication of two 8-bit numbers by repeated addition method. Check for minimum number of addition and also test for typical data.
5. Write a well-documented program for:
   Multiplication of two 8-bit numbers by bit rotation method.
6. Write a well-documented program for: Division of two 8-bit numbers by repeated subtraction method. Test for typical data.
7. Write a well-documented program for:
   Multiplication of two 8-bit numbers by bit rotation method. Test for typical data.
8. Write a well-documented program for:
   a. Finding a largest number from an array.
   b. Finding a smallest number from an array.
9. Write a well-documented program for arranging an array of numbers in descending order.
10. Write a well-documented program for arranging an array of numbers in ascending order.
11. Write a well-documented program for finding square of a number using Look-up table.
12. Identification of input and output pins of port 8255, for various control words.
13. To measure an electrical quantity using microprocessor and 8255.

Conventional and CAD of Electrical Machine design Design Lab

LIST OF EXPERIMENT:

With C/C++:
1. Design of a transformer, electrical specification
2. Finding main dimensions of a DC machine
3. Stator design of a 3 phase induction motor
4. Calculating main dimension of a transformer and the dimensions of a tank
5. Calculating main dimensions of synchronous machine
6. Calculating main dimensions of induction motor

Using Graphics libraries in C/C++;
7. Finding torque/slip, torque/speed and current/slip equations; drawing their respective graphs

With Visual Basic 6;
8. Design of a transformer, Electrical specification with VB
9. Design of a commutator and field winding of a DC machine
10. Finding equivalent circuit of a 3 phase squirrel cage induction motor with the help of a data obtained from Mo-load test and Locked rotor test

REFERENCE BOOKS
14. Write a program to interface a 2-digit number using seven-segment LEDs. Use 8085 microprocessor and 8255 PPI chip.

15. Write a program to control the operation of stepper motor using 8085 microprocessor and 8255 PPI chip.

REFERENCE BOOKS

TEXT BOOK

REFERENCE BOOKS

EL-402 COMPUTER APPLICATION TO POWER SYSTEM ANALYSIS

OBJECTIVE
The subject solves the purpose of analyzing power system in finding unknown voltages, line power losses, etc. the concept of fault calculations can be done and it also incorporates the study of interconnected power system.

PRE-REQUISTES
Knowledge of basics of power system and numerical techniques.

1. LOAD FLOW STUDIES: Introduction; bus admittance matrix; formation of Y bus; tree graph; co tree; primitive network; bus incidence matrix; formulation of Y bus using singular transformation.
2. LOAD FLOW EQUATIONS: Approximate load flow study; Gauss-Seidel method for load flow study; algorithm and flow chart for computer application to load flow studies using G-S method; Newton-Raphson method for load flow studies; algorithm and flow chart for computer application to load flow studies using N.R. Method.
3. LOAD FLOW: decoupled load flow studies; fast decoupled load flow; comparison between G-S and N.R. Methods; load flow study of distribution system.
4. DIGITAL TECHNIQUES IN FAULT CALCULATIONS: Review of symmetrical components; sequence networks for synchronous machines; transforms and transmission lines; bus impedance matrix; algorithm for formulation of bus; all types of modifications.
5. SHORT CIRCUIT STUDIES: Single line to ground fault; line to line fault; double line to ground fault and symmetrical fault; consideration of prefault currents.
6. COMPUTER CONTROL & AUTOMATION: Introduction to energy control centers; various states of a power system; SCADA Systems and RTU.
7. INTRODUCTION TO THE MATLAB: Power system block set; introduction of the features of EMTP.

EL-421 RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

OBJECTIVE
Providing the knowledge to the students about various types of conventional and non-conventional electrical power plants and explain the concepts regarding their layout and their operations at different load conditions.

PRE-REQUISTES
Knowledge of electrical technology and circuits.

1. INTRODUCTION: Energy classification; sources; utilization; economics; power generation terminology; energy conversion matrix; and review of various principal fuels for energy conversion such as solar; biogas; wind ; tidal etc.
2. SOLAR ENERGY: Solar radiation and its measurement; solar energy collectors; storage and applications.
3. WIND ENERGY: Basic principles of wind energy conversion; site selection considerations; wind data and energy estimation; classification of WEC systems; Magnus effect; wind energy collectors; storage and applications of wind energy; safety systems.
4. ENERGY FROM BIOMASS: Introduction; biomass conversion technologies; biogas generation; classification of biogas plants; details of construction of some main digesters; methods for maintaining biogas production; problems related to biogas plants etc.
5. ENERGY FROM THE OCEANS: OTEC; open cycle; closed cycle OTEC systems; energy utilization; hybrid cycle etc. operation methods of utilization of tidal energy; prospects in India.
6. PRODUCTION OF THERMAL ENERGY: Introduction; conversion of mechanical energy; conversion of electrical energy; conversion of electromagnetic energy; conversion of chemical energy; conversion of nuclear energy etc. Study of typical energy converters such as high performance motors; special generators driven by biogas engines; wind turbines etc; mini-hydro generators; energy efficient motors; magneto hydro dynamics power generation; thermionic generation.
7. ENVIRONMENTAL IMPACT OF POWER PLANT
OPERATION: Introduction; particulate emissions; gaseous pollutants; thermal pollution; solid-waste pollution.

TEXT BOOK

REFERENCE BOOKS

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<th>EL-422</th>
<th>HVDC TRANSMISSION</th>
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OBJECTIVE
Providing a basic knowledge and understanding of the fundamental concepts of high voltage engineering, explaining various methods of HVDC power transmission, converter techniques and HVDC control and protection, and the method of measurement and testing of HVDC.

PRE-REQUISTES
Knowledge of electromagnetic field theory and power systems.

1. DC POWER TRANSMISSION TECHNOLOGY: Introduction; comparison of AC and DC transmission; application of DC transmission; description of DC transmission system; planning for HVDC transmission; modern trends in DC transmission.
2. THYRISTOR VALVE & ANALYSIS OF HVDC CONVERTERS: Introduction; thyristor device; thyristor value; value tests; recent trends; pulse number; choice of converter configuration; simplified analysis of Graetz circuit; converter bridge characteristics; characteristics of twelve pulse converter; detailed analysis of converters.
3. CONVERTER AND HVDC SYSTEM CONTROL: General; principles of DC link control; converter control characteristics; system control hierarchy; firing angle control; current and extinction angle control; starting and stopping of dc link; power control; higher level controllers; telecommunication requirements.
4. CONVERTER FAULTS AND PROTECTION: introduction; converter faults; protection against over currents; overvoltages in a converter station; surge arresters; protection against overvoltages introduction of multiterminal DC systems; potential applications of MTDC systems; types of MTDC systems; control and protection of MTDC systems; study of MTDC systems
5. SMOOTHING REACTOR AND DC LINE: Introduction; smoothing reactors; DC line; transient over voltages in DC line; protection of DC line; DC breakers; monopolar operation; effects of proximity of AC and DC transmission lines.

6. REACTIVE POWER CONTROL, HARMONIC AND FILTERS: Introduction; reactive power requirement in steady state; sources of reactive power; static var systems; reactive power control during transients; introduction of harmonic and filters; generation of harmonics; design of AC filters; DC filters; carrier frequency and RI noise

7. MEASUREMENTS & TESTING OF HVDC: Measurement of high direct voltage; electrostatic voltmeters; generating voltmeter; sphere-gap; measurement of ripple voltages; types tests and routine tests of equipment; dielectric testing of HVDC equipments; power frequency voltage withstand tests; impulse voltage withstand test; measurement by sphere gaps; application of test voltage to the equipments under test.

TEXT BOOK
Arrillaga, J., “High Voltage D.C.Transmission”, Peter Peregrinus Ltd, 1996

REFERENCE BOOKS

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<th>EL-423</th>
<th>HIGH VOLTAGE ENGINEERING</th>
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OBJECTIVE
Providing a basic knowledge and understanding of the fundamental concepts of high voltage engineering, explaining various basic laws governing the conduction and breakdown, voltage gradients on conductors, phenomenon of corona and lightening discharges and high voltage testing arrangements.

PRE-REQUISTES
Knowledge of Electromagnetic field theory and power systems.

1. INTRODUCTION: Recent trends in high voltage transmission.
2. CONDUCTION AND BREAKDOWN: Conduction and breakdown in gases; liquids and solid dielectrics; insulator breakdown; insulation characteristics of long air gaps.
3. VOLTAGE GRADIENTS ON CONDUCTORS: Electrostatic fields of sphere gaps; fields of line charges and their properties; charge-potential relations for multi-conductor lines; surface voltage gradients on conductors; distribution of voltage gradient on sub conductors of bundle.
4. CORONA: Corona and corona loss; corona loss formula; attenuation of traveling waves due to corona; audible noise-generation and
characteristics; corona pulses—their generation and properties; properties of pulse; radio interference.

5. **LIGHTENING**: Lightening phenomenon; lightening stroke mechanism; principle of lightening protection; tower foot resistance; insulator flash over and withstand voltage; lightening arresters and their characteristics.

6. **H.V. TESTING AND LAB EQUIPMENTS**: Standard wave-shapes for testing; wave-shaping circuits: principles and theory; impulse generator; generation of ac high voltage for testing; generation of direct voltage; measurement of high voltage; general layout of H.V. laboratory.

7. **MEASUREMENT OF HIGH ALTERNATING VOLTAGES**: Peak voltage measurement with sphere-gaps; peak voltage measurement using measuring capacitors; peak voltage measurement with capacitor voltage divider; measurement of rms values by electrostatic voltmeters; capacitance voltage transformer; digital recording.

**TEXT BOOK**


**REFERENCE BOOKS**


**OBJECTIVE**

To study different configuration and characteristics and analysis of machines

**PRE-REQUISITES**

Knowledge of electric machinery.

1. **HARMONICS**: Effect of space harmonics in MMF and permeance of 3 phase induction motor crowling; cogging and magnetic noise.
2. **ABNORMAL OPERATION**: Voltage and impedance unbalance.
3. **DERATING**: Analysis for external and internal asymmetry; effects of time harmonics and operation with non-sinusoidal voltages.
4. **SYMMETRICAL COMPONENTS**: Analysis of single phase induction motors with symmetrical components.
5. **TWO PHASE MOTORS**: Difference between single phase and two phase motors; analysis of two phase motors with asymmetrical windings.
6. **PERFORMANCE**: Starting torques; pole amplitude modulation techniques applied to induction motors.

**SPECIAL MACHINES**: D.W.R. Machines; linear motors; axial motors; twin stator motors; stepper motors.

**TEXT BOOK**


**REFERENCE BOOKS**


**EL-442 POWER MANAGEMENT**

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**OBJECTIVE**

To provide the detailed knowledge of power management in respect of resources and procurement. The subject also covers the different facets of power station which includes finance, management, risk etc.

**PRE-REQUISITES**

Knowledge of power stations and power equipments

1. **INTRODUCTION**: Power scenario; power development; planning; power resources; environment- power matters plan; pre-feasibility and feasibility studies; state relations for power etc; electricity industry structure and safety regulations bill - state and central power boards / power corporations.
2. **RESOURCES**: Resources; geophysical study; Seismic considerations; environmental restraints; resettlement and rehabilitation.
3. **PROCUREMENT**: Contracting and procurement; consulting services; types of contracts; project management; organization and economy management; organizational planning and time scheduling; project cost control.
4. **ENGINEERING**: Engineering and general layout of equipments; generator; transformer and switch gear and control equipment; construction methods; operation and maintenance principle; maintenance organization and planning; availability; life cycle cost and future development; visits to sites.
5. **POWER SECTOR**: Power sector structure in different states; regulatory regime in those states; power utilities in Haryana; grid management; power financing; visit to sites.
6. **POWER STATION**: Management of fuel; water resource electricity deviend scenario; storage and handling; pricing; contract etc.; human resource management; visit to sites.
7. **RISK & HAZARD**: Introduction to risk; rules and regulation aspects of risk and hazard health and risk assessment visit to site.
TEXT BOOK
Gill, A.B., “Power Plant Performance Management”,

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1. Subramanyam, B., “Power Plant Engineering”,
Dhanpat Rai Pub., 1995
2. Sharma P.C., “Power Plant Engineering”, Dhanpat
Rai Pub., 1997
3. Decenzo, David A., Robbins, Stephen P., " Human
Resource Management", Prentice Hill of India,
2004.
2003.

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Enhancement Using Custom Power Devices”
Kluwer Academic, 2002
2. Dugan, R.C., McGranaghan, M.F., Beaty, H.W.,
“Electric Power Systems Quality”, McGraw-Hill,
1996.
4. Arrillaga, J., Bradely, D.A, and Bodger, P.S.,
Laxmi Publication, 1986

OBJECTIVE
To provide in depth knowledge of different power
quality problems, analysis and providing the solutions
for the power quality issues.

PRE-REQUISITES
Knowledge of power electronic devices and common
power problems

1. INTRODUCTION TO ELECTRICAL POWER
QUALITY: Definition of power quality; power
quality issues; power quality v/s equipment
immunity; electric power quality standards.
2. POWER FREQUENCY DISTURBANCES:
Common power frequency disturbances; voltage
sag; isolation transformers; voltage regulators;
static uninterruptible power source systems.
3. ELECTRICAL TRANSIENTS: Types and causes
of transients; atmospheric causes; switching loads
on or off; interruption of fault circuits; capacitor
bank switching; motor start transient; power factor
correction; capacitor switching transient.
4. HARMONICS: Definition of harmonics; causes
of voltage and current harmonics; individual and
total harmonic distortion; effect of harmonics on
power system devices; guidelines for harmonic
voltage and current limitation; harmonic current
mitigation.
5. MEASURING & SOLVING POWER QUALITY
PROBLEMS: Power quality measurement devices;
harmonic analyzers; transient-disturbance
analyzers; oscilloscopes; data loggers and chart
recorders; true rms meters; power quality
measurements.
6. POWER RELIABILITY: Revaluation; interruptions;
reliability evaluation of power systems; causes of
long interruptions; origin of interruption; generation
reliability; transmission reliability; distribution
reliability.
7. POWER SYSTEM DESIGN: Redundancy through
switching; automatic reclosing; normally open
points; load transfer; redundancy though - parallel
operation, parallel and loop systems; spot
networks.

LIST OF EXPERIMENTS:
1. To study Pspice software.
2. To verify Thevenin and Norton theorems using
Pspice.
3. To verify KCL and KVL using Pspice.
4. To verify different logic gates using Pspice.
5. Pspice simulation of single-phase full converter
using R.L and E loads.
6. Pspice simulation of 3-phase full converter using
R.L and E loads.
7. Pspice simulation of single phase A.C. voltage
controller using R.L load.
8. Pspice simulation of 3-phase inverter using PWM
controller.
9. Pspice simulation of resonant pulse commutation
Circuit.
10. Make a program for computation of D.C. motor
response.
11. Develop a flow chart for the dynamic simulation of
the chopper controlled D.C. motor drive.
12. Make a flowchart for computation of steady state
performance of induction motor.
13. Make a flowchart for dynamic simulation of
induction motor.
14. Make a program for dynamic simulation of vector
controlled induction motor drive.

LIST OF EXPERIMENTS:
1. Draw the flow chart and develop the computer
program for the formation of the Y Bus of a
generalized network.
2. Draw the flow chart and develop the computer
program for the formation of the Z Bus of a
generalized network.
3. To plot the swing curve and observe the stability.
4. To perform load flow study using Gauss Shiedel
method.
5. Perform short circuit study for any type of fault.
6. To observe transmission losses and efficiency with
variations in power for the given example.
7. Design of distribution system
8. To study the features of EMTP
9. To study the MATLAB Power System block set
features.

TEXT BOOK
Heydt, G.T., “Electric Power Quality”, 2nd ed. West
OBJECTIVE

Providing knowledge about the computer programming and simulation techniques and also expose the students to the application of various software such as MATLAB, SIMULINK, PSPICE for the design and analysis of power systems, electrical and electronics circuit electrical machines etc.

PRE-REQUISITES

Knowledge of C, C++ and electrical and electronics circuits and systems

1. INTRODUCTION: Essentials of computer programming; simulation techniques; computer graphic - 2D and 3D visualizations modern learning materials.
2. INTRODUCTION TO OOPS (HIGH LEVEL LANGUAGES): Programming with C and C++ with application to machine design and power system analysis. Introduction to Java with application to ANN and interaction models.
3. VISUAL BASIC: Study of visual studies; programming with VB; application to machine design
4. MATLAB & SIMULINK: Computing language; study of toolboxes; application to machine analysis; power system; control system; AI and DSP.
5. PSPICE: Study of EDA tools; P-Spice; modeling and analysis of analog and digital circuits; PCB layout of design; VHDL for digital system design.
6. ELECTRO-MAGNETIC SYSTEM DESIGN: Tools for electro-magnetic system design; study Ansoft Maxwell and RMXpert; application to design of electrical machines.
7. SIMULATION SOFTWARES: power system and power electronics simulation and design software – PScad, PSIM, Etap, Snieder electrical E plan.

TEXT BOOK

REFERENCES BOOKS

WEB REFERENCES

OBJECTIVE

Different controllers are studied and further being employed in solving power quality issues by the means of series and shunt compensation.

PRE-REQUISITES
Basic knowledge of power electronics concept

FACTS INTRODUCTION AND CONCEPTS: Power flow in AC systems, loading capability; power flow and dynamic stability considerations of a transmission interconnection; relative importance of controllable parameters. basic types of facts compensators; brief description and definitions of FACTS controllers. benefits from FACTS technology.

POWER SEMICONDUCTOR DEVICES: Types of power devices, construction; characteristics and requirements of high-power device. diode (pn junction); MOSFET, thyristor (without turn-off capability); GTO; emitter turn-off thyristor; MTO; GCT; IGCT; IGBT and MCT.

POWER SOURCED CONVERTERS: Basic concept of voltage-sourced converters; single-phase full-wave bridge converter operation; single phase-leg operation; square-wave voltage harmonics for a single-phase bridge; three-phase full-wave bridge converter; sequence of value conducting process in each phase-leg; transformer connections for 12-pulse operation; 24 and 48-pulse operation; three-level voltage-sourced converter; pulse-width modulation (PWM) converter; generalized technique of harmonic elimination and voltage control; converter rating – general comments.

SELF AND LINE-COMMUTATED CURRENT: Sourced converters: basic concept of current-sourced converters; three-phase full-wave diode rectifier; thyristor based converter (with gate turn-on but without gate turn-off); current-sourced converter with turn-off devices (current stiff converter); current-sourced versus voltage-sourced converters.

STATIC SHUNT COMPENSATORS: Objectives of shunt compensation; methods of controllable var generation; static var compensators: (SVC and STATCOM); comparison between STATCOM and SVC; static var systems.

STATIC SERIES COMPENSATORS: Objectives of series compensation; variable impedance type series compensators; switching converter type series compensators; external (system) control for series reactive compensators characteristics and features of GCSC; TSSC; TCSC, AND SSSC.
7. **VOLTAGE REGULATORS AND COMPENSATORS:** Static voltage and phase angle regulators and combined compensators: objectives of voltage and phase angle regulators; approaches to thyristor-controlled voltage and phase angle regulators (TCVRs and TCPARs); switching converter-based voltage and phase angle regulators. Basic principle of combined compensators. The unified power flow controller (UPFC); the interline power flow controller (IPFC); generalized and multifunctional FACTS controllers.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
To acquaint and familiarize the students with different types of optimization techniques, solving optimization problems, implementing computational techniques, abstracting mathematical results and proofs etc.

1. **INTRODUCTION AND BASIC CONCEPTS:**
   - Historical Development; Engineering applications of Optimization; Art of Modeling; Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems; Classification of optimization problems based on nature of constraints, structure of the problem, deterministic nature of variables, separability of functions and number of objective functions; Optimization techniques – classical and advanced techniques.

2. **OPTIMIZATION USING CALCULUS:**
   - Stationary points - maxima, minima and saddle points; Functions of single and two variables; Global Optimum; Convexity and concavity of functions of one and two variables; Optimization of function of one variable and multiple variables; Gradient vectors; Examples; Optimization of function of multiple variables subject to equality constraints; Lagrangian function; Optimization of function of multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values; Kuhn-Tucker Conditions; Examples.

3. **LINEAR PROGRAMMING:**
   - Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP problem; Elementary operations; Graphical method for two variable optimization problem; Examples; Motivation of simplex method; Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems; Revised simplex method; Duality in LP; Primal-dual relations; Dual Simplex method; Sensitivity or post optimality analysis; other algorithms for solving LP problems – Karmarkar’s projective scaling method.

4. **LINEAR PROGRAMMING APPLICATIONS:**
   - Use of software for solving linear optimization problems using graphical and simplex methods; Examples for transportation, assignment, water resources, structural and other optimization problems.

5. **DYNAMIC PROGRAMMING:**
   - Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

6. **DYNAMIC PROGRAMMING APPLICATIONS:**
   - Problem formulation and applications for Design of continuous beam, Optimal geometric layout of a truss, Water allocation as a sequential process, Capacity expansion, Reservoir operation etc.

7. **INTEGER PROGRAMMING:**
   - Integer linear programming; Concept of cutting plane method; Mixed integer programming; Solution algorithms; Examples.

**TEXT BOOK**
OBJECTIVE
The Internship course is a formal method of linking university with the world of work and essentially takes the class room for 20-22 weeks to a professional location where the student and faculty solve real-life problems, of course, with the help of professional experts. Resident University faculty will supervise the education of the students.

OPERATION
The Internship course has two components, namely Internship-I of 6-8 weeks duration (Summer-term following 9th Term) and Internship-II of 13-14 weeks duration (11th Term). After the Internship-II, in 12th term the student will document internship work in detail and deliver colloquium. However, the student may contact industry during this period.

(a) Internship-I:
Internship-I is conducted at large industrial complexes during Summer Term after Term-IX and exposes the students to real-life situations.

(b) Internship-II:
This component is conducted at various production and manufacturing units, Design, Development and Consulting Agencies, National Laboratories, R&D Centers, etc. The students solve real-life problems of interest to the host organizations. The professional expert acts as a consultant while resident University faculty supervises the work.

Refer to EL-483 for details

OBJECTIVE
The students are required to prepare comprehensive report on the problem(s) solved in industry and suitably extend the work wherever required so as to help the industry implement the solution. For this purpose the student can interact with the industry.

The seminar is to cover the details regarding Major Project Phase-I/Major Project Phase-II and Internship-II viz. problem definition, literature survey, concepts and methodology employed, analysis, design and development, conclusions and future work.

Refer to EL-494 for details

OBJECTIVE
By doing this course the students will be acquiring reasonable level of oral and in writing proficiency in English language ultimately they will be able to communicate with their counter parts in business/industry in the country and abroad effectively.

1. Vocabulary; Use of Words; Synonyms; Homophones; Homonyms; Forms and Functions of Words
2. Sentence Structure; Verb patterns; Simple; Complex and Compound Sentences
4. Remedial English Grammar; Common Errors and Rules of Concord
5. Phonetics; Basic Concepts; Vowels; Consonants; Syllables; Manner of Articulation and Place of Articulation; Speech Sounds; Transcription of Words; Word Stress and Intonation
6. Comprehension; Interpretation of Seen/Unseen Passages
7. Book Review (for internal assessment)
   Language lab: Emphasis will be laid on accent, pronunciation, intonation, reading/listening comprehension

**TEXT BOOK**

**REFERENCE BOOKS**

**LIST OF EXPERIMENTS/EXERCISES**
1. Word accent based on stress: Cluster of words will be repeated by the students on the basis of recorded voice.
   (a) 1st syllable stress
   (b) 2nd syllable stress
   (c) 3rd syllable stress
2. Sentence intonation: Simple day to day sentences will be repeated by the students
3. Public speeches and debates: Recorded debates and public speeches will be heard by the students to enhance their knowledge on the pitch and tone.
4. Conversation: Regular conversations will be heard and later practiced in the lab.
5. Listening comprehension: Students will hear the text and answer the questions that follow.
6. Reading comprehension: Text at par with international standard will be read by the students. Questions will than be answered.
7. Speaking: Text conversation, debates & lecturers will be heard by the students. The students will be used their aptitude and language to give their on them
8. Error correction: Grammatically incorrect sentences will be given to the students to correct.
9. Listening and speaking exercises will be practiced for the improvement of the language.
10. Added exercise on reading comprehension.
B.Tech. Electrical Engineering (Regular)

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
To acquaint the students with the various concepts and tools of applied mathematics which will be very basic and the very soul and guide of various engineering subjects.

1. DIFFERENTIAL EQUATIONS OF HIGHER ORDER AND ITS APPLICATION: Linear differential equations of second and higher order; complete solution; complementary function and particular integral; method of variation of parameters to find differential particular integral; Cauchy’s and Legendre’s linear equations; simultaneous linear equations with constant coefficients; applications of linear differential equations to simple pendulum; oscillatory electric circuits.

2. LAPLACE TRANSFORMS AND ITS APPLICATIONS: Laplace transforms of elementary functions; properties of Laplace transforms; existence conditions; transforms of derivatives; transforms of integrals; multiplication by t; division by t.

3. EVALUATION OF INTEGRALS BY LAPLACE TRANSFORMS: Laplace transform of unit step function; unit impulse function and periodic function; Inverse transforms; convolution theorem; application to linear differential equations and simultaneous linear differential equations with constant coefficients.

4. FOURIER TRANSFORMS: Fourier integral transforms; shifting theorem (both on time and frequency axes); Fourier transforms of derivatives; Fourier transforms of integrals; convolution theorem; Fourier transform of Dirac-delta function.

5. CURVE TRACING: Applications of single integration to find volume of solids and surface area of solids of revolution; double integral; change of order of integration; double integral in polar coordinates.

6. APPLICATIONS OF MULTIPLE INTEGRALS: Applications of double integral to find area enclosed by plane curves and volume of solids of revolution; triple integral; volume of solids; change of variables; beta and gamma functions and relationship between them.

7. VECTOR CALCULUS: Differentiation of vectors; scalar and vector point functions; gradient of a scalar field and directional derivative; divergence and curl of a vector field and their physical interpretations; integration of vectors; line integral; surface integral; volume integral; Green’s, Stoke’s and Gauss’ theorems (without proof) and their simple applications.

TEXT BOOK

REFERENCE BOOKS
1. Ross, S. L., "Differential Equation", Wiley India Publishers

OBJECTIVE
To provide a foundation for numerical computing for scientific and engineering applications

PRE-REQUISITE
Knowledge of Basic Mathematics involving differentiation, integration, differential equations, linear equations, etc.

1. ERRORS IN NUMERICAL CALCULATIONS: Introduction; numbers and their accuracy; absolute; relative and percentage errors and their analysis; truncation errors; general formula; error calculation for inverse problem.

2. SOLUTION OF NON-LINEAR EQUATIONS: Bisection method; Regula-Falsi method; Secant method; Newton-Raphson method; fixed point method; initial approximation and convergence criteria.

3. SOLUTION OF LINEAR SYSTEMS: Gauss elimination method; Gauss-Jorden method; UV factorization, Jacobi’s method; Gauss-Seidal method.

4. INTERPOLATION & CURVE FITTING: Introduction to interpolation; Newton’s forward and backward formula; Sterling formula; Lagrangian polynomials; divided differences; least squares method.

5. NUMERICAL DIFFERENTIATION AND INTEGRATION: Derivatives from differences tables; numerical differentiation formulas, Newton-Cotes integration formulae; trapezoidal rule; Simpson’s rule; Bool’s rule; Weddle’s rule; Romberg’s rule.

6. SOLUTION OF DIFFERENTIAL EQUATIONS: Taylor’s series method; Euler and modified Euler’s method; Runge-Kutta method; Milne’s prediction corrector method, Adams–Bashforth method.
7. SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Finite difference approximation; solution of Laplace equation (standard 5 point formula) one-dimensional heat equation (Schmidt method, Crank-Nicolson method; Dufort & Frankel method and wave equation.

TEXT BOOK
Grewal B. S., “Numerical Methods in Engineering and Sciences”, Khanna Publisher

REFERENCE BOOKS

LIST OF EXPERIMENTS
1. To find the roots of non-linear equation using Bisection method.
2. To find the roots of non-linear equation using Secant method.
3. To find the roots of non-linear equation using Newton’s method.
4. To solve the system of linear equations using Gauss-Elimination method.
5. To solve the system of linear equation using Gauss-Seidel iteration method.
6. To find the values of function at a particular point using Newton’s forward formula.
7. To find the values of function at a particular point using Newton’s backward formula.
8. To find the values of function at a particular point using Lagrange’s interpolation formula.
9. To integrate numerically using Trapezoidal rule.
10. To integrate numerically using Simpson’s rule.
11. To find the solution of o.d.e (ordinary differential equation) by Euler’s method.
12. To find the solution of o.d.e by Runge-Kutta method.
13. To find the numerical solution of Laplace equation.
14. To find the numerical solution of heat equation.
15. To find the numerical solution of wave equation.

REFERENCE BOOKS

OBJECTIVE
Engineering Mechanics is one of the core subjects that introduces the student to analysis of forces and motion and prepares the student for studying strength of materials and theory of machines.

1. FORCE SYSTEMS: Basic concepts of space, time, mass, force, particle and rigid body; scalars and vectors; conventions for equations and diagrams; external and internal effects of a force; principle of transmissibility; force classification; rectangular components of two and three dimensional force systems; resultant of two and three dimensional and concurrent force systems; moment about a point and about an axis; Varignon’s theorem; resultant of non-concurrent force systems; couple; equivalent couples; force couple systems.
2. EQUILIBRIUM: Equilibrium in two and three dimensions; system isolation and the free-body-diagram; modeling the action of forces; equilibrium conditions; applications including plane trusses; frames and machines.
3. PROPERTIES OF SURFACES/CROSS SECTIONS: Centre of mass; determining the centre of gravity; centre of mass versus centre of gravity; centroids of lines, areas and volumes including composite sections; moments of inertia; MI of plane figures; MI with respect to axis in its plane and with respect to an axis perpendicular to the plane of figure; parallel axis theorem; moment of inertia of a rigid body – of a lamina and of three dimensional body; MI of composite figures.
4. SIMPLE STRESSES AND STRAINS: Resistance to deformation; Hook’s law and stress-strain diagram; types of stresses; stresses and strains in bars of varying sections; stresses in composite bars; lateral strain and Poisson’s ratio; volumetric strain, modulus of rigidity and bulk modulus; relation between elastic constants.
5. TORSION OF CIRCULAR SHAFTS, TORSION FORMULA POWER TRANSMISSION
6. SHEAR FORCE AND BENDING MOMENTS: Definitions: SF and BM diagrams for cantilevers, simply supported beams with or without overhang and calculation of max. BM and SF and point of contra-flexture under i) concentrated loads, ii) uniformly distributed loads over whole span or part of it iii) combination of concentrated and uniformly distributed loads, iv) uniformly varying loads and application of moments; relationship between rate of loading, shear force and bending moments.
8. KINEMATICS / KINETICS OF PARTICLES: Velocity and acceleration under rectilinear and circular motion; Newton’s Second Law; D’Alembert principle; Inertial system; Newton’s Second Law applied to bodies under rectilinear and circular motion; solutions of problems using D’Alembert Principle and free-body diagrams.

WEB REFERENCES
www.eCourses.ou.edu

ME-151 | ENGINEERING MECHANICS LAB | L T P | Cr.
| | 0 0 2 | 1

LIST OF EXPERIMENTS
1. To study various forces and moments.
2. Prove polygon law of coplanar forces, experiments with pulley systems.
3. Find support reactions for simply supported beam
4. Find Forces in Truss elements
5. Measuring forces in members of jib crane.
6. Finding C.G. and MOI of various parts like connecting rod. Flywheel using various methods
7. To find mechanical advantage and mechanical efficiency of compound screw jack.
8. To study various simple machines including gear trains e.g. Wedge; clock; sewing machine, etc.
9. To conduct tensile test and determining ultimate tensile strength percentage elongation of steel specimen
10. To conduct compression test and determine compressive strength of specimen
11. To calculate VR, MA and efficiency of single, doubles and triple start worm and worm wheel
12. To study slider crank mechanism of 2 stroke and 4 stroke IC engine models
13. To study and analyze gear trains

ME-152 | WORKSHOP PRACTICE | L T P | Cr.
| | 0 0 4 | 2

OBJECTIVE
To provide an overview of the basic production techniques and allied / supporting techniques used to produce finished products from raw materials. In addition to theory, students will be given practical training on various basic production techniques. After going through this course, the students will be in a position to understand the working of a mechanical workshop.

1. INTRODUCTION: Basic manufacturing processes and safety in workshop.
2. ENGINEERING MATERIALS: Classification of materials—their general mechanical properties and their selection
3. CASTING PROCESSES: Sand casting process; pattern making; types of moulding sands, cores, mould making, melting and pouring of metal; Casting defects.
4. MACHINING PROCESSES: Production of components involving turning; facing; taper turning; milling; shaping; planning and drilling operations.
5. METAL FORMING PROCESSES: Sheet metal forming operations; shearing, bending, punching and blanking, forging processes as upsetting, drawing down, bending etc.
6. JOINING PROCESSES: Metal arc welding; gas welding; resistance welding; soldering and mechanical fastening processes.

ME-153 | ENGINEERING GRAPHICS | L T P | Cr.
| | 0 0 6 | 3

OBJECTIVE
Engineering graphics is the primary medium for development and communicating design concepts. Through this course the students are trained in engineering Graphics concepts through manual drafting. The ISI code of practice is followed. With this course students can improve the visual concepts in all engineering streams.
INTRODUCTION: Need drawing instruments; geometrical drawing, conventional representation—inclining welds, joints, surface texture, structural work etc.; various types of projections; first and third angle systems of orthographic projections.

SIMPLE PROJECTS: Projection of points in different quadrants; projections of lines parallel to or inclined to one or both reference planes; true length of a line and its inclination with reference planes; traces of a line; concept of auxiliary plane.

PROJECTIONS OF PLANES: Parallel to one reference plane; inclined to one plane but perpendicular to the other, inclined to both reference planes.

PROJECTIONS OF SOLIDS AND SOLIDS OF REVOLUTION: In simple positions with axis perpendicular to a plane; with axis parallel to both planes; with axis parallel to one plane and inclined to the other.

SECTIONS OF SOLIDS: Prisms; pyramids; cylinders and cones; section plane is parallel, perpendicular and inclined to both reference planes; true shape of sections.

DEVELOPMENT OF LATERAL SURFACES OF REGULAR SOLIDS: Rectangular block; cylinder; cone; pyramid.

ISOMETRIC VIEWS OF PLANES: circle, square, rectangle; Isometric views of solids- prisms, pyramids and cylinders; principle of perspective projection, perspective of planes and solids.

TEXT BOOK

REFERENCE BOOKS
3. SP 46-1988, Bureau of Indian Standards (BIS), New Delhi

WEB REFERENCES
1. www.technologystudent.com
2. www.animatedworksheets.co.uk
3. www.ider.herts.ac.uk/school/courseware

LIST OF SHEETS TO BE MADE:

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<thead>
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<th>Sl. No.</th>
<th>Details of the sheet</th>
<th>No. of sheets</th>
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<tbody>
<tr>
<td>1.</td>
<td>Basic Geometrical Constructions including the curves, ellipse, parabola, Hyperbola, and cycloidal curves.</td>
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<td>2.</td>
<td>Projection of Lines including traces.</td>
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<td>3.</td>
<td>Projection of Planes.</td>
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<td>4.</td>
<td>Projection of Solids.</td>
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<td>5.</td>
<td>Section of solids.</td>
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<td>6.</td>
<td>Developments of surfaces</td>
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<tr>
<td>7.</td>
<td>Isometric and Perspective views.</td>
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OBJECTIVE
To educate the students with the present day physical sciences through concepts like optics, acoustics, EM theory, etc.

INTERFERENCE: Interference by division of wave front; Fresnel's biper and its application to find wavelength; interference by division of amplitude; Newton's rings and its applications; determination of wavelength and refractive index of liquids; Michelson interferometer and its applications; determination of wavelength; resolution of spectral lines (difference in wavelength); determination of refractive index of thin sheet.

DIFFRACTION: Difference between Interference and diffraction; difference between Fraunhofer and Fresnel diffraction; Fraunhofer diffraction through single slit; variation of intensity (analytical); plane transmission diffraction grating; absent spectra; maximum order spectra; dispersive and resolving power of grating.

POLARIZATION: Polarised and unpolarized light; double refraction; Nicol prism; quarter and half wave plates; optical activity; Dextro and Leavo rotatory; specific rotation; biquartz and Laurent's half-shade polarimeters.

LASER AND FIBRE OPTICS: Spontaneous and stimulated emissions; laser action (pumping and population inversion); characteristics of laser beam-concepts of coherence; solid state (Ruby) laser; gas (He-Ne) laser; applications; basic principles; fiber construction; propagation of light in fibers; numerical aperture; single mode and multi mode fibers; applications of optical fibers.

SPECIAL THEORY OF RELATIVITY: Inertial frames of reference; Galilean transformations; non-inertial frames of reference; Michelson-Morley experiment; postulates of special theory of relativity; Lorentz's transformations; length contraction; time dilation; variation of mass with velocity; mass energy equivalence.

ELECTRO MAGNETIC THEORY and ELECTROSTATICS: Review of basic concepts of electrodynamics; Maxwell's modification of Ampere's law, equation of continuity; Maxwell's equations and its simple plane wave solution in free space; Poynting's theorem; dielectric polarization; electric displacement; susceptibility and permittivity and various relations between these; Gauss law in dielectrics; electrostatic energy stored in dielectrics; behaviour of dielectrics in A.C. field: simple concepts; dielectric losses.

ULTRASONICS: Production of ultrasonics by magnetostriction and piezoelectric oscillator methods; detection of ultrasonics by Kundt's tube and acoustic grating method.

TEXT BOOK

REFERENCE BOOKS
1. Sears, F.W., "Electricity and Magnetism", Narosa
B.Tech. Electrical Engineering (Regular)

PHYSICS LAB

7. Wehr, Richards and Adair, “Physics of the Atom”, Narosa

PH-102 | APPLIED PHYSICS | L T P | Cr.
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OBJECTIVE
To educate the students with the present day physical sciences through concepts like nanotechnology, quantum physics, thermal physics, super conductivity, etc.

1. CRYSTAL STRUCTURE: Space lattice; unit cell and translation vector; Miller indices; simple crystal structure (sc; bcc; fcc; hcp); principle of X-ray diffraction; Bragg’s law; experimental X-ray diffraction methods: Laue method and Powder method; point defects in solids; concentration of Frenkel defects and Schottky defects.

2. QUANTUM PHYSICS: Failure of classical concepts; black body radiation; Planck’s radiation law; wave packets; group velocity and phase velocity; Schrödinger wave equations; time dependant and time independent equations; significance of wave function; wave function for a particle in a box.

3. FREE ELECTRON THEORY: Elements of classical free electron theory and its limitations; Drude’s theory of conduction; quantum theory of free electrons; Fermi level; Density of states (3D); average kinetic energy \( \frac{3}{5} E_r \) of free electrons (3D); Fermi-Dirac distribution function; thermonic emission; Richardson’s equation.

4. BAND THEORY and NANO TECHNOLOGY: Origin of energy bands; classification of solids into metals; semiconductors and insulators; Kronig Penney model (Qualitative); E-K diagrams; Brillouin zones; concept of effective mass and holes; hall effect and its application, nanotechnology (basic concept only) and its application.

5. THERMAL PHYSICS: Gas law; iso-thermal and isentropic process; Rankin cycle; Carnet cycle; principal of equipartition of energy; specific heat of monoatomic gases; Maxwell’s velocity distribution; mean velocity; RMS velocity; most probable speed; Joule Thomson’s expansion; liquefication of He I and He II Stefan Boltzmann’s law; Newton’s law of cooling.

6. MAGNETIC PROPERTIES OF SOLIDS: Atomic magnetic moments; orbital diamagnetism; classical Langevin’s theory of dia-magnetism and para-magnetism; ferro-magnetic domains; antiferromagnetism; ferrimagnetism (simple ideas).

7. SUPERCONDUCTIVITY: Introduction (experimental survey); Meissner effect; Type I and Type II superconductor; London equation.

TEXT BOOK

REFERENCE BOOKS
5. Ghatak and Loknathan, “Quantum Mechanics”, McMillan

PH-151 | PHYSICS LAB | L T P | Cr.
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LIST OF EXPERIMENTS
The experiments in 1st term will be based mainly upon optics, electrostatics, wave and oscillations which are the parts of the theory syllabus of 1st term.

1. To find the wavelength of sodium light by Newton’s rings experiment.
2. To find the wavelength of sodium light by Fresnel’s bipism experiment.
3. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
4. To find the refractive index and Cauchy’s constants of a prism by using spectrometer.
5. To find the wavelength of sodium light by Michelson interferometer.
6. To find the resolving power of a telescope.
7. To find the pitch of a screw using He-Ne laser.
8. To find the specific rotation of sugar solution by using a polarimeter.
9. To compare the capacitances of two capacitors by De’Sauty bridge and hence to find the dielectric constant of a medium.
10. To find the flashing and quenching potentials of Argon and also to find the capacitance of unknown capacitor.
11. To study the photoconducting cell and hence to verify the inverse square law.
12. To find the temperature co-efficient of resistance by using platinum resistance thermometer and Callender and Griffith bridge.
13. To find the frequency of A.C. mains by using soundmeter.
14. To find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method.

REFERENCE BOOKS
1. Worshnop, B. L. and Flint, H. T. “Advanced Practical Physics”, KPH
2. Gupta, S. L. & Kumar, V. “Practical Physics”, Pragati Prakashan
LIST OF EXPERIMENTS

1. To find the low resistance by Carey – Foster's bridge.
2. To find the resistance of a galvanometer by Thomson's constant deflection method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionization potential of Argon/Mercury using a thyratron tube.
8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photo electric cell.
11. To find the value of co-efficient of self-inductance by using a Raleigh bridge.
12. To find the value of Hall co-efficient of semi-conductor.
13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.

REFERENCE BOOKS

1. Worshnop, B.L. and Flint, H.T. "Advanced Practical Physics", KPH
2. Gupta, S.L. and Kumar, V. "Practical Physics", Pragati Prakashan.
ADDITIONAL/BRIDGE COURSES

OBJECTIVE
A student found deficient in any area of knowledge/skill needed for programmes of study e.g. Communication Skill, Mathematics, etc. may be required to do suitable additional course(s) on audit basis which will not be shown on his Grade Card. However if a bridge course(s) is (are) required for those students admitted to second year the same will be shown on the Grade Card as an audit course.

Note: These Courses are made for a specific purpose and are available only for the intended purpose.

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<tr>
<th>EN-291</th>
<th>ESSENTIALS OF COMMUNICATION OBJECTIVE (BRIDGE COURSE)</th>
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OBJECTIVE
The objective of bridge course is to bring some of the students who are not up to the mark and are not able to pursue the technical education like their counter parts. This course has been devised to bring the students to that level from where they can do justice to the technical education they are going to pursue.

1. Advertisements; notices; formal and integral invitations.
2. Report writing; or factual description based on verbal input provided.
3. Letter writing: business letter; enquires; registering complaints; asking and giving information; placing orders and sending replies; letter to editor.
4. Parts of speech: noun; pronoun; verb; adverb; adjective; proposition; conjunction; explanation and general English grammar.
5. Verb patterns and sentences structure and tense.
6. Foreign words; one word substitutions and word formation.
7. Group discussion and debate on various current affairs.

TEXT BOOK
Wren & Martin, “A High School Grammar & Composition”

REFERENCE BOOKS
2. Tikku M. C., “An Intermediate Grammar Book”

<table>
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<tr>
<th>MA-191</th>
<th>MATHEMATICS (MAKEUP COURSE)</th>
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OBJECTIVE
Mathematics is a very essential part of all engineering courses. The students entering in the first year who are some how weak in concepts of Mathematics need upgradation in their level of Mathematics. This course is designed keeping in view such students.

1. BASIS OF CURVES: Important equations for different types of curves in plane including Cartesian, Parametric forms; Concept of polar coordinates and important curves in polar coordinates.
2. SEQUENCE AND SERIES: Sequences, A.P, G.P., H.P; Special sequences \( \sum_{n=1}^{n} n, \sum_{n=1}^{n} n^2, \sum_{n=1}^{n} n^3 \);
   Expansions of important functions.
3. DIFFERENTIAL CALCULUS: Definition of derivatives and concepts of partial derivatives, Differentiation of parametric curves up to second order; Successive differentiation including Leibnitz rule; analytical and geometrical significance of differentiation.
4. INTEGRAL CALCULUS: Formulae of indefinite integrals; Properties of definite integrals; Integration by parts and continued integration by parts.
5. THREE DIMENSIONAL GEOMETRY: Dimensional coordinates and important equation of planes and surfaces (including sphere, cone, cylinder and ellipsoid); cylindrical and spherical coordinates in three dimensions.
6. VECTORS: Representation of vectors in two and three dimensions; operations on vectors including dot and cross product of three vectors and four vectors.
7. PROBABILITY THEORY: Permutation; Combination; Binomial theorem.

TEXT BOOK
NCERT, “Mathematics for XI and XII”, NCERT, New Delhi

REFERENCE BOOKS

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<th>MA-291</th>
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OBJECTIVE
The students, who join the University after diploma course, are deficient in mathematics. This course is designed to upgrade and update their knowledge in mathematics so that they are at par with second year students.
1. **PARTIAL DIFFERENTIATION:** Functions of two or more variables; Partial derivatives; Total differential and differentiability; Derivatives of composite and implicit functions; Jacobians; Higher order partial derivatives; Homogeneous functions; Euler’s theorem.

2. **MULTIPLE INTEGRALS:** Double integrals; Change of order of integrations; Double integrals in polar co-ordinates; Applications of double integral to find area enclosed by plane curves and volume of solids of revolution; triple integrals; Volume of solids; Change of variables.

3. **SPECIAL INTEGRALS:** Differentiation under integral sign; Beta and gamma functions and relationship between them.

4. **LAPLACE TRANSFORMS:** Laplace transforms and its elementary properties; Inverse transforms; Convolution theorem.

5. **FOURIER SERIES AND FOURIER TRANSFORMS:** Euler’s formulae; Change of intervals; Fourier series of odd and even functions; Half range sine and cosines series; Fourier integrals; Fourier transforms; Elementary properties.

6. **DIFFERENTIAL EQUATIONS:** Formations of ordinary differential equations; Solutions of ordinary linear differential equations including solutions by Laplace transform.

7. **PARTIAL DIFFERENTIAL EQUATIONS:** Formations of partial differential equations; Solutions of linear and non-linear partial differential equations.

**TEXT BOOK**

**REFERENCE BOOKS**
PROFESSIONAL DEVELOPMENT

OBJECTIVE
To meet the corporate requirements bridge the gap between technological skills and soft skills, by improving communication, behavioural, analytical skills, etc.

METHODOLOGY
To enable students become competent professionals and good citizens with moral and ethical values, a set of 14 courses of one credit each will be provided covering
(i) Value Added Courses,
(ii) Professional Development Courses, and
(iii) Co-curricular Activities.

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<tr>
<th>PD-151</th>
<th>BASICS OF COMPUTER FUNDAMENTALS</th>
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OBJECTIVE
To understand fundamentals of computer applications, networking and building projects.

1. **MS-WORD**: Introduction to MS-Word: Menus, toolbars, ruler, scroll bars, creating, saving, importing, exporting and inserting files, formation, indents/out dents, lists, tabs, styles, working with frames, columns, pictures, chart/graphs, forms, tools, equations and macros.

2. **MS-EXCEL**: Worksheet overview: rows, columns, cell, menus, creating worksheets; opening and saving worksheet; formatting, printing, charts, window, establishing worksheet links, macros, database, tables, using files with other programs.

3. **MS-POWERPOINT**: Overview of MS-PowerPoint, creating slides and presentations, rehearsing presentation, insert, tools, format, slide-show, Window options.

4. **MS-PROJECT**: Starting a Project, Starting Microsoft Project 2000, planning a project, defining the project scope, outlining and task relationships, outlining the project, developing the schedule, changing task relationships and constraints, adding and assigning resources, developing the project calendar, assigning project resources, determining project costs, adjusting project resources and timelines, analyzing the project, using different views and reports, displaying project data, organizing project information, sorting and filtering project data, creating custom filters.

5. **NETWORKING**: Basics of networking, study of topology: LAN, WAN, MAN, Connecting devices: passive hub, repeater, active hub, bridges, two layer switches, routers, three layer switches, gateway, network attack and defense: most common attacks.

6. **TROUBLESHOOTING**: Ping command, TRACERT or TRACEOUT, IP configuration, NETSTAT, NET, recovery commands DISKPART etc., setting up local security policies, installation of servers.

7. **FUNDAMENTALS OF CYBER LAW**: Overview of computer and web technology, access control: operating system access controls, group and roles, access control lists, Unix operating system security, Windows NT, capabilities, added features in Windows 2000, granularity, sandboxing and proof-carrying code, hardware protection, other technical attacks.

REFERENCE BOOKS:
1. Habraken, "MS-Office 2000 8 in 1", Prentice Hall
3. Sandler, "Teach Yourself MS Office", BPB Publications
7. Bansal S. K., "Cyber Crime"
8. Ahmand Tabrez, "Cyber law , E-commerce & M-Commerce"

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<th>PD-191</th>
<th>CO-CURRICULAR ACTIVITIES</th>
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OBJECTIVE
To help the students in their all round growth and acquire attributes like team spirit, organizational ability, leadership qualities, etc.

OPERATION
The students are to take part in Co-curricular activities outside contact hours through clubs/societies spread over all the three terms of the year. They are required to register for this course in each term and their performance will be evaluated in last term of the year.

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<th>PD-192</th>
<th>PERSONALITY SKILLS</th>
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OBJECTIVE
To equip the students with the understanding of human behavior, develop time management skills, and enhance personality.

1. **TRANSACTIONAL ANALYSIS**: Winners and losers; ego states; OK states; positive and negative strokes; life scripts; exercises.
2. CREATIVE THINKING: What is creativity; 6 thinking hats; mental blocks; exercises.
3. SELF DISCOVERY: Importance of knowing yourself; SWOT analysis; benefits; strengths and weaknesses; exercises.
4. DEVELOPING POSITIVE ATTITUDE: Meaning; changing attitudes; power of positive thinking; overcoming negative attitude; exercises.
5. TIME MANAGEMENT: Features, time management matrix; tips for time management; effective scheduling; time wasters; time savers; exercises and time bound tasks.
6. STRESS MANAGEMENT: What is stress; causes; positive and negative stress; effects; signs; tips to overcome stress; stress busters; exercises
7. DECISION MAKING: Definition; models and types; skills and techniques; courses of action; steps involved in decision making; individual decision making and group decision making; exercises

REFERENCE BOOKS
2. Harris, Thomas Anthony, "I'm OK, You're OK", Galahad Books, 2004
3. Dr. Alex, K., "Soft Skills", 2009, S. Chand, 2009

NOTE: One trainer per lecture and two trainers per practical session. Classroom with board/projector for PPT and video clips will be required.

PD-193 ENTREPRENEURIAL & PROFESSIONAL SKILLS L T P Cr 0 0 2 1

OBJECTIVE
To empower the students with entrepreneurial skills, behaviour, grooming and effective interaction at the work place.

1. GOAL SETTING: Types of goals; setting smart goals; personal goal setting; business goal setting; goal setting techniques.
2. ENTREPRENEURIAL SKILLS: Meaning; entrepreneurial competencies; advantages; risks involved, avenues and opportunities; support from Govt.; basic and significant personality traits; venture project planning and entrepreneurship cycles; planning the project; entrepreneurship in daily life; case studies in entrepreneurship; exercises.
3. CORPORATE DRESSING: The corporate fit; corporate culture; dress codes; dressing for interviews; clothing do’s and don’ts.
4. CORPORATE GROOMING: Making a good impression at work; grooming check list; accessories, do’s and don’ts for men and women; hygiene and skin care; hands and feet; make up and hair accessories.
5. ETIQUETTE & MANNERS: Social etiquette; dining etiquette; party and wedding etiquette; sensitivity towards diverse cultures; respecting religions and traditions.
6. BUSINESS ETIQUETTE: Dealing with people at work place (peers, subordinates and superiors); international business; etiquette at meetings and conferences.
7. COMMUNICATION MEDIA ETIQUETTE: Telephone etiquette; email etiquette; media etiquette.

REFERENCE BOOKS

NOTE: One trainer per lecture and two trainers per practical session. Classroom with board/projector for PPT and video clips will be required.

PD-251 MATLAB L T P Cr 0 0 2 1

OBJECTIVE
MATLAB is a powerful language for technical computing. It is widely used in universities and colleges for courses in mathematics, science and especially in engineering. In industry the software is used in research, development and design. This course is intended for students who are using MATLAB for the first time and have little or no experience in computer programming.

1. BASIC STRUCTURE and FEATURES OF MATLAB: Command window; figure window; editor window and help window; arithmetic operations with scalars, order of precedence; using MATLAB as a calculator; display formats; elementary math built-in functions; scalar variables, assignment operator; predefined variables; useful commands for managing variables; applications in problem solving.
2. CREATING ARRAYS – one dimensional, two-dimensional; array addressing; built-in functions for handling arrays; mathematical operations with matrices; strings and strings as variables; generation of random numbers; examples of MATLAB applications.
3. SCRIPT FILES: Creating and saving a script file, current directory; output commands.
4. TWO – DIMENSIONAL PLOTS: Plot command; line specifiers plot of a given data; plot of a function; plotting multiple graphs in the same plot.
5. FUNCTIONS AND FUNCTION FILES: Creating a function file; input and output arguments; function
B.Tech. Electrical Engineering (Regular)

body; comment lines; saving a function files; using a function file; programming in MATLAB.

TEXT BOOK

REFERENCE BOOK

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<th>PD-291</th>
<th>CO-CURRICULAR ACTIVITIES</th>
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<tr>
<th>PD-292</th>
<th>EFFECTIVE COMMUNICATION</th>
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OBJECTIVE
To acquaint the students with the basics of effective spoken and written English and enhance their reading, listening, and communication skills.

1. **COMMUNICATION**: Importance; barriers and types of communication; methods to develop effective communication skills.
2. **GRAMMAR**: Parts of speech; subject/verb agreement; tenses; error correction; business idioms; Indianism in English; frequently mispronounced words; exercises.
3. **SPOKEN ENGLISH**: Vowel and consonant sounds; syllables and syllabic stress; conversational skills; extempore; JAM.
4. **READING & LISTENING SKILLS**: Reading with comprehension; story reading; passage reading; newspaper reading; listening and active listening; barriers to listening; effective listening and types of listening; exercises.
5. **WRITING SKILLS**: Importance of writing skills; how to develop writing skills; writing exercises i.e., essay writing, reviews, reports, etc.
6. **NON VERBAL COMMUNICATION**: History; kinesics; postures; gestures; functions; importance and challenges of non verbal communication.
7. **BUSINESS COMMUNICATION**: Business letters and messages; business reports; presentation skills; do’s & don’ts; personal journal.

REFERENCE BOOKS


NOTE: One trainer per lecture and two trainers per practical session. Classroom with board/projector for PPT and video clips will be required.

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<tr>
<th>PD-293</th>
<th>INTRA &amp; INTER-PERSONAL SKILLS</th>
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OBJECTIVE
To acquaint the students with the understanding of self development through good inter-personal skills for effective social communication in order to succeed in maintaining relationships in professional and social environments. This module will also help at learning group discussions and interview skills to enable employability and professional fit.

1. **SELF AWARENESS**: Development of our self image; social comparison; significant others; self esteem; self confidence.
2. **ASSERTIVENESS & CONFIDENCE**: Assertiveness; being confident; strategies to make assertive NO easier; dealing with emotions; difference between being aggressive and being assertive.
3. **TEAM BUILDING & TEAM WORK**: The team concept; elements of team work; stages of team formation; effective team; essential building blocks of effective teams; team player’s style; team tasks; exercises.
4. **LEADERSHIP SKILLS**: Leadership skills and styles; motivating people; understanding abilities; delegating tasks; managing people; overcoming hurdles; exercises.
5. **INTERVIEW SKILLS**: Why an interview; the first step to a successful interview; resumes that make an impact; the interview process; the interview preparation checklist; interviewing skills; putting your best foot forward; common interview mistakes; one on one HR interviews (two for each student).
6. **GROUP DISCUSSION SKILLS**: Meaning of a GD; types; role of a moderator; do’s and don’ts; mock GDs on general, knowledge based and abstract topics.
7. **THE ART OF CONVERSATION**: Skills to strike a conversation; sustaining conversation; communicating across cultures; conflict management.

REFERENCE BOOKS

**Notes:** One trainer per lecture and two trainers per practical session. Classroom with board/projector for PPT and video clips will be required.

**PD-356**

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<th>BIO ELECTRONICS INSTRUMENTATION</th>
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**LIST OF EXPERIMENTS**

1. Study of ECG and its functional circuit
2. Study of EMG and its functional circuit
3. Study of EEG and its functional circuit
4. Study of EOG and its functional circuit
5. Study of ERG and its functional circuit
6. Introduction to Pressure Transducer
7. Introduction to Temperature sensor and pulse sensor
8. Measurement of B.P., Blood flow and heart sounds
9. Design of differential Bio potential Amplifier

**REFERENCE BOOKS**


**PD-391**

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<th>CO-CURRICULAR ACTIVITIES</th>
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**PD-392**

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<th>PROBLEM SOLVING SKILLS</th>
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**OBJECTIVE**

To train and enhance the students' problem solving skills, reasoning ability, quantitative ability, and reading comprehension skills.

1. **LOGICAL REASONING:** Logical deductions (Syllogism & Venn Diagrams); logical connectives.
2. **ANALYTICAL REASONING:** Seating arrangements; combinations; selections; comparisons; blood relations; directions, etc.
3. **NON-VERBAL REASONING (ALPHA-NUMERIC & VISUAL PUZZLES):** To solve problems on numbers, alphabet, symbols and visuals; problem types are series, analogies, odd man out, coding decoding, and symbols & notations.
4. **BUSINESS MATHS:** Number system; ratios; averages; time & work; time & distance; percentages; profit & loss; simple & compound interest; HIGHER MATHS: Algebra; Mensuration.
5. **DATA INTERPRETATION & SUFFICIENCY:** Tables, Bar chart, line graph, pie charts; to enable student assess whether the given data is sufficient to solve a question; for both reasoning based and quant based problems.
6. **READING COMPREHENSION:** To enable a student comprehend short and long passages from the perspective of solving questions based on the passage.

**REFERENCE BOOKS**


**PD-393**

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<th>ADVANCED PROFESSIONAL DEVELOPMENT</th>
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**OBJECTIVE**

To equip the students with the basics of law, accounting, corporate policies, and ethics; the general awareness useful in leading a well informed life.

1. **LAW FOR THE LAYMAN:** Indian Judiciary System; Intellectual Property Rights (IPR); labour laws; employee rights; human rights; criminal laws, civil rights.
2. **BASICS OF ACCOUNTING:** Credit-Debit transactions; balance sheet; ledgers; receipts & vouchers; P & L statement; exercises.
3. **MONEY MANAGEMENT:** Types of taxes; how to manage taxes; investment options; an overview of stocks & shares; savings options; understanding important terms (depreciation, VAT, education cess).
4. **CORPORATE RULES & POLICIES:** The need; advantages; illustrations of certain rules & policies followed by selected corporate; code of conduct.
5. **RIGHTS & DUTIES:** An overview of the Indian constitution; fundamental rights & duties; directive principles of state policy; societal values; ideologies of some famous personalities.
6. **TECHNOLOGY, POLITICS & RELIGIONS IN INDIA:** various religions and their teachings; political developments in India; history of science & technology.
7. **HUMAN VALUES:** Ethics at work place; human values; morals & ethics; professional ethics; case studies.
REFERENCE BOOKS

NOTE: One trainer per lecture and two trainers per practical session. Classroom with board/projector for PPT and video clips will be required.

PD-456 | ROBOTICS AND AUTOMATION | L T P | Cr
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LIST OF EXPERIMENTS
1. Introduction to Automation and Robotics – An overview of Robotics – present and future applications – classification by coordinate system and control system, Dynamic stabilization of Robotics.
2. Design and testing of fluid power circuits to control (i) velocity (ii) direction and (iii) force of single and double acting actuators
3. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
4. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
5. Measurement and control of pressure flow and temperature using Lab VIEW.
6. Study of different types of robots based on configuration and application.
7. Study of different type of links and joints used in robots
8. Study of components of robots with drive system and end effectors.
9. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
10. Robot programming exercises (Point-to-point and continuous path programming)

TEXT BOOKS
1. Industrial Robotics / Groover M P /Pearson Edu.

REFERENCE BOOKS:
1. Mittal R K & Nagrath I J / Robotics and Control / TMH.
4. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science
5. Introduction to Robotics / John J Craig / Pearson Edu.

PD-491 | CO-CURRICULAR ACTIVITIES | L T P | Cr
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Refer to PD-191 for details.

* * * * * * *
OPEN ELECTIVE

OBJECTIVE
The idea of open elective is to expand the application horizon of the knowledge acquired beyond the boundaries of one's own discipline

METHODOLOGY
The student may enroll for one course from the list provided in the Scheme of Studies & Syllabus. The course shall strictly be from any other discipline. Selection of course from the same discipline of study is not allowed.

AE-411 TRANSPORT MANAGEMENT

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OBJECTIVE
The course has been designed such that the student can own a fleet of buses; trucks etc and manage the same; He also gets familiar with provisions of motor vehicle act and vehicle insurance.

1. INTRODUCTION: Necessity for making acts and rules on motor vehicles; Procedure for enactment and implementation of these acts by central and state Govts; Formats of the acts; rules and titles; Definitions – articulated vehicle; axle weight; certificate of registration; driver; conductor; licence; contract carriage; stage carriage; dealer; educational institution bus; goods; goods carriage; gross vehicle weight; heavy goods vehicle; invalid carriage; learners licence; HMV; LMV; motor cabs etc.

2. DRIVING LICENCE: Necessity; age limit to obtain D.L learners D.L permanent D.L grant; restrictions; renewal; endorsement; disqualification; suspension; fees; documents; educational qualifications required for driving trucks; buses; oil tankers; missile carriers; driving on hills; Driving schools:requirements; Effectiveness of different DLs; Maintenance of state registers of D.L. conductors licence – necessity; grant; age limit; disqualifications; revocation; disqualification; uniforms.

3. VEHICLE REGISTRATION: Necessity; area of registration; time given for registration; format and documents to be attached and fees; period of registration; renewal; suspension; Temporary and permanent registration; vehicle fitness; refusal; NOC; registration for embassy vehicles; production of vehicle at the time of registration; Migration of vehicle from one state to other; Hire purchase; lease or hypothecation; transfer of registration on sale; removal of hypothecation clause; Transfer of ownership; Change of residence or place of business; death of owner; sale or purchase; Alteration in motor vehicle; age limit of vehicles; attachment of trailers; Maintenance of state registers of motor vehicles.

4. PERMITS: Necessity; route allotments; state Govts; powers; provisions for application of permits; Procedure of R,T,A to grant permits; limits of issuance of permits and rules; documents to be attached; preferences while issuing permits; Types of permits – Private service; all India goods carriage; temporary; national; composite etc; Renewal; duration; cancellation; suspension of permits and transfer of permits; Rules for replacement of vehicles; colour schemes; general conditions attached; Validation of permits for use in outside region; Issue of permits to state transport undertakings: restrictions.

5. CONSTRUCTION; EQUIPMENT; MAINTENANCE AND TRAFFIC REGULATION: General provisions; Central Govt; rules and provisions regarding construction; maintenance of vehicle; emissions and safety provisions; Control of traffic limits of speed; weight; length and height; power to restrict and erect traffic signs; design of traffic signs and its colour scheme; Signals; driving test; Driving regulations; signaling devices; Definitions– Pass; ticket; removal of vehicle obstructing traffic; Safety measures for drivers and pillion riders; Precautions at unguarded railway crossings; Schemes for investigation of accidents and wayside amenities; Traffic navigation; global positioning system.

6. LOGISTICS: Definition of fleet; types of fleet-luxury cars; buses; trucks; cash vans; fire-fighting vehicles etc; Management; supervisory; training and staffing; Driver; conductor and Mechanics hiring; duties; Vehicle operations-productivity and control; Fleet maintenance programs; tyre maintenance; productivity and control; Budget activity; Fleet management and data processing; Procurement and disposal; labour relations; energy management; Loss prevention management; control and predicting costs; Fitness of vehicles; Stores; definition; management; storing methods; inventory control; Duties and responsibilities of store manager; purchase manager; Storing methods;Bin card; requisition card; Inventory control procedures; Vendor development; Stores-layout; spare parts flow chart; Store documentation; store organization.

7. MOTOR INSURANCE: Types; scope; limitations; liability of insurance Cos; insurance documents-claim form; estimate and bills; Necessity for insurance against third party risk; Requirements and limits of liability of insurance policies; Procedure to be followed for settlement of a claim after an accident; Surveyor and loss assessor; Surveyors report; Certificate of insurance transfer; Compensation to third party deaths; Motor accident claims tribunal (MACT); Transit insurance

TEXT BOOK
The Motor Vehicle Act, 1988; Govt. of India Publication.

REFERENCE BOOKS
OBJECTIVE
The course aims to provide the insights into effective management of human resources to enable the students to meet the HR challenges in the present scenario.

1. INTRODUCTION: Meaning, scope, objective, functions, policies & roles and importance of Human Resource Management; Interaction with other functional areas; HRM & HRD - a comparative analysis, organizing the Human Resource Management department in the organization; Human Resource Management practices in India.
2. HUMAN RESOURCE PLANNING: Definition, objectives; process and importance job analysis; Description, specification and job evaluation.
3. DEVELOPING EFFECTIVE HUMAN RESOURCE: Recruitment; selection; placement and introduction process; human resource development: concept, employee training & development, career planning & development.
4. PERFORMANCE MANAGEMENT: concept and process, performance appraisal, Potential appraisal Job Compensation: Wage & salary administration, incentive plans & fringe benefits; Promotions, demotions, transfers, separation, absenteeism and turnover; Quality of work life (QWL): Meaning, origin, development and various approaches and; to QWL, techniques for improving QWL; Quality circles: concept, structure, role of management OC in India.
5. JOB SATISFACTION AND MORALE: Health, safety & employee welfare; counseling for effective; enforcing equal employment opportunity legislation; fair employment; fair practice laws.
6. HUMAN RESOURCE DEVELOPMENT: Human Resource: definition, objectives & approaches to human relations; Employee grievances and discipline; participation & empowerment; Introducing to collective bargaining; HR Audit.
7. HIGH PERFORMANCE WORK SYSTEM: Fundamental principles-Principle of shared info; principle of knowledge development; principle of performance reward linkage; principle of Egaliitarianism; Testing alignment of the HR system-HR deliverables.

TEXT BOOK

REFERENCE BOOKS

BA-272
ENTREPRENEURSHIP DEVELOPMENT
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3

OBJECTIVE
To acquaint the students with the challenges of starting new ventures and enable them to investigate, understand and internalize the process of setting up a business.

1. CONCEPT OF ENTREPRENEURSHIP: meaning and characteristics of entrepreneurship, entrepreneurial culture, socio-economic origin of entrepreneurship, factors of affecting entrepreneurship, conceptual model of entrepreneurship, traits of a good entrepreneur, entrepreneur, intra-preneur and manager.
2. ENTREPRENEURIAL MOTIVATION: motivating, compelling and facilitating factors, entrepreneurial ambition, achievement motivation theory and kakinada experiment.
3. ESTABLISHMENT OF ENTREPRENEURIAL SYSTEMS: search, processing and selection of idea, Input requirements.
4. SMALL SCALE INDUSTRY: meaning, importance, characteristics, advantages and problems of SSIs. Steps for starting a small industry, guidelines for project report, registration as SSI.
5. ASSISTANCE TO SSI: need for incentives & subsidies, need for institutional support, role of government and other institutions.
6. FUNCTIONAL PLANS: Marketing plan- marketing research for the new venture, steps in preparing marketing plan, contingency planning; Organizational plan- Forms of ownership, designing organizational structure, job design, manpower planning; Financial plan- cash budget, working capital, proforma income statement, Proforma cash flow, proforma balance sheet, break even analysis.
7. SOURCES OF FINANCE: Debt or Equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; legal issues- intellectual property rights, patents, trade marks, copy rights, trade secrets, licensing, franchising.

TEXT BOOK

REFERENCE BOOKS
characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

2. TRAFFIC SURVEYS: Methods of conducting the study and presentation of the data for traffic volume study; speed study and origin and destination study. Speed and delay study. Parking surveys. On street parking; off street parking. Accident surveys. Causes of road accidents and preventive measures. Use of photographic techniques in traffic surveys.


4. TRAFFIC CONTROL: Types of traffic control devices. Traffic signs; general principles of traffic signing; types of traffic signs. Road markings; types; general principles of pavement markings. Design of rotary. Grade separated intersections. Miscellaneous traffic control aids and street furniture.

5. Signal Design: Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method; approximate method; Webster's method and IRC method

6. Traffic Regulation And Management: Need and scope of traffic regulations. Regulation of speed; vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements; one way streets; tidal flow operations; exclusive bus lanes; traffic restraint; road pricing.


TEXT BOOK
Khanna S. K. and Justo C. E. G., "Highway Engineering", Nem Chand Bros., Roorkee

REFERENCE BOOKS

WEB REFERENCES
1. www.nitkkr.ac.in/WebCivil/Civil_syllabus.doc
2. www.uniqueinstitutes.org/kuk/civilengg/38civilf.pdf

OBJECTIVE
To impart knowledge on various aspects of town planning and architecture, historical structures, planning development of habitats.

1. INTRODUCTION TO ARCHITECTURE: Origin & definition; factors influencing architecture – climate; topography; metarials; socio – cultural conditions; economic and technological factors etc. components of architecture – functional; aesthetic and structural.

2. BASIC ELEMENTS OF ARCHITECTURE: Principles of architectural composition - concept of beauty; unity; balance; proportion scale; rhythm; harmony; contract; symmetry; character; integration etc. aesthetic responses to colour; texture; light & shade; formal and informal organizations of solids and void

3. INTRODUCTION OF TOWN PLANNING: General Planning concepts in town planning; ancient town planning Greak; Roman; Medieval & Renaissance towns; history of town planning in India; modern town planning – industrial revaluation and its impact ; garden city concept new town and satellite towns.

4. TOWN PLANNING LEGISLATIONS: Urbanisation trends in India ; classification of town; Evolution of planning legislation in India; organizations and administration of planning agencies at National state; regional level and metropolitan level ; building bye laws; provision of building regulation; function of local authorizes.

5. DEVELOPMENT PLANS: Need; objective; scope and content of master plan; regional plan; structural plan; zonal development plan etc; Planning of land uses – residential; industrial; commercial; principles of planning for traffic & transportation; utility and services ; zoning regulation; sub division regulation; FARs; dentitions etc.

6. ELEMENTS OF A TOWN / CITY PLAN: Planning attributes- physical infrastructure; social infrastructure; commerce; housing etc ; surveys for town planning ; importance of climate; topograpy; drainage; water supply in selection of site for development; planning standards – UDPFI guidelines.

7. COMPONENTS OF TOWN PLANNING: Housing; housing problems in India; National housing policy; housing agencies; housing finance institutions; Dhum housing; transportation planning process; national transportation policy; surveys of transportation planning; urban conservation; National Building Code of India 1983 guidelines; norms for planting of shrubs, trees, etc.

TEXT BOOK
REFERENCE BOOKS

WEB REFERENCES
1. www.jadavpur.edu/academics/.../Architecture/arch syl.htm
3. www.unitytempleutrf.org/Unity%20Temple%20Tea ches.pdf-issuu.com/brentallpress/docs/adr3_vol3_1

OBJECTIVE
To make students familiar with the concept of chemistry associated with dairy life, with the general method of analysis and other aspects related to engineering field.

1. FUELS & PETROCHEMICALS TECHNOLOGY: Classification of fuels; coal biomass; biogas determination of calorific values using bomb calorimeter; bio- fuels and liquid fuels; general consideration of petrochemicals; an overview of petroleum refining; petroleum transpiration; an elementary ideas of petrochemicals; petroleum refining -catalytic cracking & naphtha reforming.

2. CHEMICALS TOXICOLOGY: Introduction; kind of toxic pollutants; toxic chemicals in air water and soil; toxic elements in waste water; carcinogenesis, impact of toxic chemicals on enzymes; biochemical effects of As ,Cd, Pd, Hg, CO, NO2, O3 CN- Toxic metal pollutants; Toxic minerals and dust; Toxic organic compounds .

3. ENVIRONMENTAL HAZARDS & POLLUTION: Cause; Effects; control & measures of water pollution; soil pollution; thermal pollution; Nuclear pollution; solid waste management; industrial waste and bio-medical waste management; cause; effects and control measures of urban and industrial waste.

4. INDUSTRIAL WASTE MANAGEMENT: Magnitude of industrial waste generation & their characteristics; effluent standards for disposal into water bodies; waste water characterization & process survey; advanced treatment &sludge handing; combined treatment of raw industrial waste with sewage; common effluent treatment for industrial estates; management of industrial waste from small scale industries; Selection procedure for physical, chemical & biochemical methods of industrial waste water treatment.

5. CORROSION & ITS CONTROL: Introduction; dry corrosion; wet corrosion; mechanism of wet corrosion galvanic corrosion; concentration; Cell; corrosion fitting corrosion; intergranular corrosion; waterline corrosion; stress corrosion; galvanic series; factors influencing corrosion; control methods.

6. POLYMER TECHNOLOGY: Introduction of natural and synthetic polymers; classification of polymers on different basis; Natural rubber; Source; Formula; Elasticity of rubber; chemical relativity; properties; isomerism in rubber; vulcanized rubber and its uses .

7. ADVANCED ANALYTICAL METHODS: Thermo analytical methods; Thermo gravimetric analysis (TGA); Differential thermal analysis (DTA); Differential scanning calorimetry (DSC); Instrumentation; Flame photometry; spectrophotometry; conductometry; conductometry chromatographic methods; Adsorption; liquid - liquid partition; ion-exchange; paper & thin-layer chromatography; gas chromatography; HPLC & Electrophorisis.

TEXT BOOK

REFERENCE BOOKS
2. Hutzinger, "Hand Book of Environmental Chemistry", Springer Verlag
3. Fristschen L. J. and Gay L. W., "Environmental Instrumentation", Springer Verlag

OBJECTIVE
Students completing this course are expected to be able to:
- Write programs that utilize the OpenGL graphics environment.
- Use polygonal and other modeling methods to describe scenes.
- Understand and be able to apply geometric transformations.
- Create basic animations.
- Understand scan-line, ray-tracing, and radiosity rendering methods.

PRE-REQUISITES
Knowledge of computer programming, 2D and 3D geometry.

1. INTRODUCTION: What is computer graphics, computer graphics applications, computer graphics hardware and software, two dimensional graphics primitives: points and lines, line drawing algorithms: DDA, Bresenham’s; circle drawing algorithms: using polar coordinates, Bresenham’s circle drawing, mid point circle drawing algorithm; polygon filling algorithm, boundary filled algorithm, scan-line algorithm, flood fill algorithm.

2. TWO DIMENSIONAL VIEWING: The 2-D viewing pipeline, windows, viewports, window to view port mapping; clipping: point, clipping line (algorithms):
4 bit code algorithm, Sutherland-Cohen algorithm, parametric line clipping algorithm (Cyrus Beck).
3. POLYGON CLIPPING ALGORITHM: Sutherland-Hodgeman polygon clipping algorithm, homogeneous coordinates system, two dimensional transformations: transformations, translation, scaling, rotation, reflection, shearing, transformation, composite transformation.
4. THREE DIMENSIONAL GRAPHICS: Three dimensional graphics concept, matrix representation of 3-D transformations, composition of 3-D transformation; viewing in 3D: projections, types of projections; the mathematics of planner geometric projections; coordinate systems.
5. HIDDEN SURFACE REMOVAL: Introduction to hidden surface removal; the Z-buffer algorithm, scan-line algorithm, area sub-division algorithm.

**TEXT BOOK**

**REFERENCE BOOKS**

**WEB REFERENCES**

**CS-402 ARTIFICIAL INTELLIGENCE**

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**OBJECTIVE**
To introduce about artificial intelligence approaches to problem solving, various issues involved and application areas

**PRE-REQUISITES**
Knowledge of neural networks, data structures

1. INTRODUCTION TO AI AND SEARCH TECHNIQUES: Foundation and history of AI; data, information and knowledge; AI problems and techniques – AI programming languages, problem space representation with examples; blind search strategies, breadth first search, depth first search, heuristic search techniques: hill climbing: best first search, A * algorithm AO* algorithm, Means-ends analysis.
2. KNOWLEDGE REPRESENTATION ISSUES: predicate logic; logic programming; constraint propagation; representing knowledge using rules.
3. REASONING UNDER UNCERTAINTY: Reasoning under uncertainty, non monotonic reasoning; review of probability; Bayes’ probabilistic interferences and Dempster Shafer theory; heuristic methods; symbolic reasoning under uncertainty; statistical reasoning, fuzzy reasoning.
4. PLANNING & GAME PLAYING: Minimax search procedure; goal stack planning; non linear planning, hierarchical planning, planning in situational calculus; representation for planning; partial order planning algorithm.
5. LEARNING: Basic concepts; rote learning, learning by taking advice, learning by problem solving, learning from examples, discovery as learning, learning by analogy; explanation based learning; neural nets; genetic algorithms.
6. OTHER KNOWLEDGE STRUCTURES: semantic nets, partitioned nets, parallel implementation of semantic nets; frames, common sense reasoning and thematic role frames; architecture of knowledge based system; rule based systems; forward and backward chaining; frame based systems.
7. APPLICATIONS OF ARTIFICIAL INTELLIGENCE: Principles of natural language processing; rule based systems architecture; expert systems, knowledge acquisition concepts; AI application to robotics, and current trends in intelligent systems; parallel and distributed AI: psychological modeling, parallelism in reasoning systems, distributed reasoning systems and algorithms

**TEXT BOOK**

**REFERENCE BOOKS**

**WEB REFERENCES**
OBJECTIVE
The course will attempt to dispel some of the many myths that surround the idea of cryptography. Cryptography is (and will continue to be) an increasingly important area of IT and it is important that practitioners are aware of the realities of the subject. The course will provide a down-to-earth overview of cryptographic techniques applicable in an IT environment, and outline the constraints and limitations of realistic secure systems. A running theme is the tradeoff between usability and security of a system. Also covered are a number of compression techniques - data compression and data encryption are, in some respects, closely related. A working knowledge of C is assumed and essential.

PRE-REQUISITES
Knowledge of cryptography, analysis & design algorithms and mathematics

1. INTRODUCTION: Basics of cryptography; history; usefulness of compression techniques
2. COMPRESSION: Packing, Huffman coding, Run length encoding, Lempel-Ziv-Welch, PKZIP, Delta modulation, JPEG; latest compression techniques
3. ERROR DETECTION AND CORRECTION: Parity, 1, 2, n-dimensions, Hamming codes, p-out-of-q codes
4. CRYPTOGRAPHY: vocabulary; history; steganography - visual textual, cipher hiding, false errors; public key cryptography – authentication; signatures; deniability
5. MATHEMATICS: information; confusion; diffusion; modular arithmetic; inverses; Fermats little theorem; Chinese remainder theorem, factoring; prime numbers; discrete logarithms
6. ALGORITHMS: DES, AES (Rijndael), IDEA, One time pad, Secret sharing and splitting, RSA, Elliptic curves, Modes, Random numbers
7. ATTACKING SYSTEMS: Recognition, Destroying data, Cryptanalysis - Differential cryptanalysis - cracking DES

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES

OBJECTIVE
The course intends to cover the design issues involved in embedded systems and system-on-chip technologies. The course also deals with the applications and programming languages and processor architectures used for embedded systems. This course introduces the students to standard Embedded System Development tools and gives a hands-on experience in developing various embedded applications.

1. INTRODUCTION: Different types of microcontrollers: Embedded microcontrollers; External memory microcontrollers; Processor Architectures: Harvard V/S Princeton; CISC V/S RISC; microcontrollers memory types; Introduction to Real Time Operating System.
2. 8051 MICROCONTROLLER ARCHITECTURE: Architecture; memory considerations; Addressing modes; clocking; i/o pins; interrupts; timers; peripherals; serial communication; Instruction set; simple operations.
3. PIC MICROCONTROLLER ARCHITECTURE: Introduction to PIC microcontrollers; Architecture and pipelining; program memory considerations; Addressing modes; CPU registers; Instruction set; simple operations.
4. INTERRUPTS AND I/O PORTS: Interrupt logic; Timer2 scalar initialization; IntService Interrupt service routine; loop time subroutine; External interrupts and timers; synchronous serial port module; serial peripheral device; O/P port Expansion; I/O port expansion; UART.
5. SOFTWARE: Development tools/ environments; Assembly language programming style; Interpreters; High level languages; Intel hex format object files; Debugging.
6. PROGRAMMING WITH MICROCONTROLLERS: Arithmetic operations; Bit addressing; Loop control; Stack operation; Subroutines; interfacing of 8051 with LCD; LED; keyboard; motors; seven segment and other interfacing; PIC simple operations.
7. DESIGNING USING MICROCONTROLLERS: Music box; Mouse wheel turning; PWM motor control; aircraft demonstration; ultra sonic distance measuring; temperature sensor; pressure sensor; magnetic field sensor.

TEXT BOOK

REFERENCE BOOKS

**OBJECTIVE**
This subject covers the entire concept behind the cellular technology. It covers the different standards like GSM; CDMA and going through these topics will help the students to face telecom sector and software companies.

1. **MOBILE RADIO SYSTEM**: reference model; frequencies for radio transmission; signals; antennas; signal propagation; multiplexing; modulation
2. **CHARACTERISTICS OF RADIO WAVES**: Multipath characteristics of radio waves; signal fading; time dispersion; Doppler spread; coherence time; LCR; fading statistics; diversity techniques
3. **WIRELESS SYSTEMS**: GSM; architecture; services; frame structure; signal processing
4. **WI-FI AND THE IEEE STANDARD 802.11**: 802.11 architecture; MAC layer; PHY layer; Bluetooth and the IEEE standard 802.15
5. **MOBILE NETWORK LAYER: MOBILE IP**: Goals and requirements; IP packet delivery; agent discovery; registration; tunneling and encapsulation; optimization; reverse tunneling; IP-V6; Mobile ad-hoc networks
6. **MOBILE TRANSPORT LAYER**: Traditional TCP; classical TCP improvement; TCP over 2.5 G/3G wireless networks; performance enhancing proxies
7. **CDMA IN MOBILE COMMUNICATION SYSTEMS**: Introduction, spreading sequences, basic transmitter and receiver schemes in the CDMA system, RAKE receiver, joint detection of CDMA signals, basic properties of a CDMA mobile system
8. **PROGRAMMABLE LOGIC CONTROLLERS & SCADA**: Programmable Logic Controllers (PLC) based automation is its outcome. This subject is useful to understand the concept of automation used in industry.

**REFERENCE BOOKS**

**TEXT BOOK**

**OBJECTIVE**
The programmable logic controller represents a key factor in industrial automation. Its use permits flexible adaptation to varying processes as well as rapid fault finding and error elimination. Today, Industrial environment is steered with the latest technological advancements in computers and communication.

**OBJECTIVE**
Students who enter the job market and become electronic engineers must be prepared to work on industrial electronics in many forms. The job responsibilities for these fields are rapidly changing because electronic devices and circuits have become thoroughly integrated into all aspects of modern industrial control systems during the past ten years. The role of an electronic engineer has changed to the point where he is expected to work on every aspect of industrial system from the simplest electrical components, such as fuses and motor, to the most
complex, such as electronic boards, motor drives, and programmable controllers. This course provides sufficient depth to be a useful resource while working on job.

1. **INDUSTRIAL LOGIC CIRCUITS**: Relay logic; Types of relays; voltage ratings for coils and contacts; typical logic circuits; relay ladder & its application; solid state devices used for relay logic; solid state logic blocks; solid state relays.

2. **PROGRAMMABLE LOGIC CONTROLLERS (PLC)**: Programmable logic controller systems; PLC operation; input module circuitry; processor; processor operations; memory & its layout; program scanning; programming – assembly language; relay language or logic; programming basics; ladder diagram; timing function; sequencing operations; arithmetic functions; move function, conversion.

3. **TIMERS**: Functions, types – delay timers; interval times; repeat cycle timers; reset timers; timer classification – thermal timers; electromechanical timers; motor driven delay timers; block diagram of the basic elements of an electronic timer.

4. **ILLUMINATION**: Nature of light; basic laws of illumination; light sources and their characteristics; light production by excitation and ionization; incandescence; fluorescence; different types of lamps; their construction; operation and characteristic; application, latest light sources; design of illumination system.

5. **POWER SUPPLIES**: Performance parameters, of power supplies, comparison of rectifier circuit; filters, regulated power supplies; switching regulators; switch mode converter.

6. **POWER FACTOR CONTROL**: Static reactive power compensation; shunt reactive power compensator; application of static SCR controlled shunt compensators for load compensation; power factor improvement and harmonic Control of Converter fed systems; methods employing natural and forced commutation schemes; implementation of forced commutation.

7. **MOTOR CONTROL**: Voltage control at constant frequency; PWM control; phase control of dc motor; PLC control of a DC motor.

**TEXT BOOK**

**REFERENCE BOOKS**

**LABORATORY**: Performance parameter of various power converters, sequence control of AC-DC power converter, Comparison of AC-DC converters with and without filters; Project on illumination, simulation of power converters using MATLAB, relay network programming, programming PLC.

**OBJECTIVE**
Providing the knowledge to the students about various types of conventional and non-conventional electrical power plants and explain the concepts regarding their layout and their operations at different load conditions.

**PRE-REQUISTES**
Knowledge of electrical technology and circuits.

1. **INTRODUCTION**: Energy classification; sources; utilization; economics; power generation terminology; energy conversion matrix; and review of various principal fuels for energy conversion such as solar; biogas; wind; tidal etc.
2. **SOLAR ENERGY**: Solar radiation and its measurement; solar energy collectors; storage and applications.
3. **WIND ENERGY**: Basic principles of wind energy conversion; site selection considerations; wind data and energy estimation; classification of WEC systems; Magnus effect; wind energy collectors; storage and applications of wind energy; safety systems.
4. **ENERGY FROM BIOMASS**: Introduction; biomass conversion technologies; biogas generation; classification of biogas plants; details of construction of some main digesters; methods for maintaining biogas production; problems related to bio-gas plants etc.
5. **ENERGY FROM THE OCEANS**: OTEC; open cycle; closed cycle OTEC systems; energy utilization; hybrid cycle etc. operation methods of utilization of tidal energy; prospects in India.
6. **PRODUCTION OF THERMAL ENERGY**: Introduction; conversion of mechanical energy; conversion of electrical energy; conversion of electromagnetic energy; conversion of chemical energy; conversion of nuclear energy etc. Study of typical energy converters such as high performance motors; special generators driven by biogas engines; wind turbines etc; mini-hydro generators; energy efficient motors; magneto hydro dynamics power generation; thermionic generation.
7. **ENVIRONMENTAL IMPACT OF POWER PLANT OPERATION**: Introduction; particulate emissions; gaseous pollutants; thermal pollution; solid-waste pollution.

**TEXT BOOK**

**REFERENCE BOOKS**
OBJECTIVE
Providing a basic knowledge and understanding of the fundamental concepts of high voltage engineering, explaining various methods of HVDC power transmission, converter techniques and HVDC control and protection, and the method of measurement and testing of HVDC.

PRE-REQUISITES
Knowledge of electromagnetic field theory and power systems.

1. DC POWER TRANSMISSION TECHNOLOGY:
   Introduction; comparison of AC and DC transmission; description of DC transmission system; planning for HVDC transmission; modern trends in DC transmission.

2. THYRISTOR VALVE & ANALYSIS OF HVDC CONVERTERS:
   Introduction; thyristor device; thyristor value; value tests; recent trends; pulse number; choice of converter configuration; simplified analysis of Graetz circuit; converter bridge characteristics; characteristics of twelve pulse converter; detailed analysis of converters.

3. CONVERTER AND HVDC SYSTEM CONTROL:
   General; principles of DC link control; converter control characteristics; system control hierarchy; firing angle control; current and extinction angle control; starting and stopping of dc link; power control; higher level controllers; telecommunication requirements.

4. CONVERTER FAULTS AND PROTECTION:
   Introduction; converter faults; protection against over currents; overvoltages in a converter station; surge arresters; protection against overvoltages; introduction of multiterminal DC systems; potential applications of MTDC systems; types of MTDC systems; control and protection of MTDC systems; study of MTDC systems.

5. SMOOTHING REACTOR AND DC LINE:
   Introduction; smoothing reactors; DC line; transient over voltages in DC line; protection of DC line; DC breakers; monopolar operation; effects of proximity of AC and DC transmission lines.

6. REACTIVE POWER CONTROL, HARMONIC AND FILTERS:
   Introduction; reactive power requirement in steady state; sources of reactive power; static var systems; reactive power control during transients; introduction of harmonic and filters; generation of harmonics; design of AC filters; DC filters; carrier frequency and RI noise.

7. MEASUREMENTS & TESTING OF HVDC:
   Measurement of high direct voltage; electrostatic voltmeters; generating voltmeter; sphere-gap; measurement of ripple voltages; types tests and routine tests of equipment; dielectric testing of HVDC equipments; power frequency voltage withstand tests; impulse voltage withstand test; measurement by sphere gaps; application of test voltage to the equipments under test.

REFERENCE BOOKS

OBJEVTIVE
Providing a basic knowledge and understanding of the fundamental concepts of high voltage engineering, explaining various basic laws governing the conduction and breakdown, voltage gradients on conductors, phenomenon of corona and lightening discharges and high voltage testing arrangements.

PRE-REQUISITES
Knowledge of Electromagnetic field theory and power systems.

1. INTRODUCTION: Recent trends in high voltage transmission.
2. CONDUCTION AND BREAKDOWN: Conduction and breakdown in gases; liquids and solid dielectrics; insulator breakdown; insulation characteristics of long air gaps.
3. VOLTAGE GRADIENTS ON CONDUCTORS:
   Electrostatic fields of sphere gaps; fields of line charges and their properties; charge-potential relations for multi-conductor lines; surface voltage gradients on conductors; distribution of voltage gradient on sub conductors of bundle.
4. CORONA: Corona and corona loss; corona loss formula; attenuation of traveling waves due to corona; audible noise-generation and characteristics; corona pulses—their generation and properties; properties of pulse; radio interference.
5. LIGHTENING: Lightening phenomenon; lightning stroke mechanism; principle of lightning protection; tower foot resistance; insulator flash over and withstand voltage; lightning arresters and their characteristics.
6. H. V. TESTING AND LAB EQUIPMENTS:
   Standard wave-shapes for testing; wave-shaping circuits: principles and theory; impulse generator; generation of ac high voltage for testing; generation of direct voltage; measurement of high voltage; general layout of H.V.labatory.
7. MEASUREMENT OF HIGH ALTERNATING VOLTAGES:
   Peak voltage measurement with sphere-gaps; peak voltage measurement using measuring capacitors; peak voltage measurement with capacitor voltage divider; measurement of rms values by electrostatic voltmeters; capacitance voltage transformer; digital recording.
B.Tech. Electrical Engineering (Regular)

REFERENCE BOOKS
1. Wadhwa C. L., "High Voltage Engineering", New Age International Ltd. 1995

EN-471
PROFESSIONAL COMMUNICATION

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OBJECTIVE
The objective of devising this course is to prepare the students or this University to be ready to take up their professional job on the completion of this course. Professional communication is essential for the pass outs of this University to help them prove their abilities in the interviews and to utilize their knowledge in active job.

1. PRACTICAL ENGLISH: Parts of speech; noun; pronouns; adjective; verb, adverb, propulsion, conjunctural interjection; conjunctural interjection; use of articles.
2. ADVANCED ENGLISH: Phrasal verbs; reported speech; conditional clauses; concord; correct the sentences; question tags; idioms.
3. VOCABULARY: Word formation; one word substitution; foreign words; words often confused; homophones; antonyms; synonyms.
4. BUSINESS ENGLISH: Importance: business phrases; emphatic expression; e-mail writing; resume writing; interview techniques; business letter; covering letter; application job; resignation letter, effective telephone handling.
5. PHONETICS: Basic concepts; vowels, consonants; phonemes; syllabus; articulation of speech; transcription of words; word stress; Intonation.
6. BOOK REVIEW
7. MOVIE REVIEW

TEXT BOOK

EN-472
BUSINESS COMMUNICATION

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OBJECTIVE
The course proposes to help students develop competence in business and technical communication. It focuses on writing skills and strategies for specific purposes. The inevitability of introducing this course to Engineering students is embodied in that it has comparatively a high concentration of certain complex writing techniques and procedures.

1. BUSINESS CORRESPONDENCE: Characteristics and formats of business letter; quotations, orders, tenders, sales letters, complaints, claim and adjustment letters; credit and collection letters; application; letters for vacant situations with emphasis on resumes and curriculum vitae; e-mail and netiquette- format, style and tone.
2. BUSINESS REPORTS AND PROPOSALS: Importance; function; pattern and formats of reports, typical business reports; report presentation, and formal reports: proposal formats, writing problem- solving proposals; executive summery proposals and project proposals.
3. MEETINGS: Writing of memoranda; notes; agenda and minutes of the meeting.
4. PUBLIC RELATIONS AND ADVERTISING DOCUMENTS: Press releases; public service announcements, advertising strategy and its objectives; designing of classified and display advertising copies.
5. PHONETICS: Vowels; consonants; syllables; transcription; word stress & intonation.
6. ESSAY WRITING ON BUSINESS TOPICS-TRADITIONAL & CONTEMPORARY
7. BOOK REVIEW/MOVIE REVIEW

TEXT BOOK
Bansal R. K. and Harrison J. B., "Spoken English for India", Orient Longman

REFERENCE BOOKS
INTRODUCTION TO E-COMMERCE & ERP

OBJECTIVE
To provide knowledge about the protocols, methods, security issues in electronic commerce as well as about enterprise resource planning tools, models and techniques

PRE-REQUISITES
Knowledge of internet and web development, data mining, computer networks, software engineering

PART A
1. INTRODUCTION AND CONCEPTS: Networks and commercial transactions – Internet and other novelties, networks and electronic transactions today; model for commercial transactions; Internet environment – internet advantage; world wide web and other internet sales venues; online commerce solutions.

2. ELECTRONIC PAYMENT METHODS: Updating traditional transactions, secure online transaction models; online commercial environments; digital currencies and payment systems; offline secure processing; private data networks; security protocols; electronic payment systems: digital payment systems

3. DIGITAL CURRENCIES: Operational process of Digicash; Ecash Trail; Using Ecash; Smart cards; Electronic Data Interchange: basics, EDI versus Internet and EDI over Internet; Strategies, Techniques and Tools; Shopping techniques and online selling techniques.

PART B

5. ERP – RESOURCE MANAGEMENT PERSPECTIVE: Functional and Process of Resource; Management; Introduction to basic modules of ERP System: HRD, Personnel management, training and development; skill inventory, material planning and control, inventory; forecasting; manufacturing; production planning; production scheduling; production control; sales and distribution; finance; resource management in global scenario.

6. ERP - INFORMATION SYSTEM PERSPECTIVE: Introduction to OLAP (Online Analysis and Processing), TP, OAS, KBS, MRP, BPR, SCM, REP, CRM, Information Communication Technology.

7. ERP-KEY MANAGERIAL ISSUES: Concept Selling; IT infrastructure; implication of ERP systems on business organization; critical success factors in ERP System; ERP Culture implementation issues; resistance to change; ERP selection issues; return on investment; pre and post implementation issues.

TEXT BOOK
Ravi Kalakota and Whinston Andrew, "Frontiers of Electronic Commerce", Addison Wesley, 1996

REFERENCE BOOKS

WEB REFERENCES
2. www.bizautomation.com
3. itmanagement.earthweb.com/erp
4. www.e2-lic.com/e2_ecommerce_erp.aspx
5. e-comm.webopedia.com/TERM/e/ERP.html

INFORMATION STORAGE & MANAGEMENT

OBJECTIVE
Using a “building block” approach, the ISM curriculum provides a core understanding of storage technologies and progresses into system architectures, introduction to networked storage, and introduction to information availability. The course provides a comprehensive introduction to data storage technology fundamentals. Students will gain knowledge of the core logical and physical components that make up a storage systems infrastructure.
B.Tech. Electrical Engineering (Regular)

PRE-REQUISITES
Knowledge of Computer Networks at B Tech level

1. **INTRODUCTION:** Meeting today’s data storage needs - data creation; data creation: individuals, business; categories of data; data storage models; common data storage media and solutions - tape storage systems, optical data storage, disk based storage

2. **DATA CENTER INFRASTRUCTURE:** Example; key requirements of storage systems management activities

3. **STORAGE SYSTEMS ARCHITECTURE:** Storage system environment; components of a host; connectivity; physical disks; RAID array; disk storage systems; data flow exercise

4. **NETWORKED STORAGE:** Direct Attached Storage (DAS), Network Attached Storage (NAS), Fiber Channel Storage Area Network (FC SAN), IP Storage Area Network (IP SAN). Content Addressed Storage (CAS)

5. **BUSINESS CONTINUITY:** Introduction, overview, backup and recovery, local replication, remote replication.

6. **MONITORING AND MANAGING THE DATA CENTER:** Areas of the data center to monitor; considerations for monitoring the data center; techniques for managing the data center.

7. **SECURING STORAGE AND STORAGE VIRTUALIZATION:** Securing the storage infrastructure; virtualization technologies.

**TEXT BOOK**
Osborne Marc Farley, “Building Storage Networks”, Tata McGraw Hill

**REFERENCE BOOKS**

**WEB REFERENCES**

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**OBJECTIVE**
To acquaint the students with the various concepts and tools of applied mathematics which will be very basic and the very soul and guide of computer field.

1. **SET THEORY:** Different types of sets; Set operations; Classes of sets; Relation; Types of relation; Functions; Types of functions and composition of functions and relation; Cardinality and inverse relations; Fuzzy sets; Basic operations of fuzzy sets.

2. **BOOLEAN ALGEBRA & LATTICES:** Definition of Boolean algebra; Basic operations of Boolean algebra; Partially ordered sets; Lattices; Sub Lattices; Different types of Lattices; Operations on Lattices.

3. **NUMBER THEORY:** Basic properties; Divisibility theory; Congruences; Chinese remainder theorem; Fermat's little theorem; $\tau$ & $\mu$ functions.

4. **COMBINATION:** Fundamental principal of counting; Pigeonhole principal; Multinomial coefficients; Recurrence relation; Generating functions.

5. **ALGEBRAIC STRUCTURES:** Binary operations; Group; Subgroup; Normal subgroup and their elementary properties; Order of element and group; Lagrange’s theorem; Rings; Sub ring; Ideal; Integral domain; Field only definition and examples.

6. **GRAPH THEORY:** Introduction to graphs; Type of graphs; Sub graphs and isomorphic graphs; Representation of graphs; Properties of graphs; Euler's formula for planar graph; Eulerian and Hamiltonian graph; Ore's theorem.

7. **TREES:** Trees and their properties; Spanning trees; Kruskal's algorithm; Prim's algorithm; Binary tree.

**TEXT BOOK**

**REFERENCE BOOK**
3. Deo, "Graph Theory", Prentice Hall of India.

**OBJECTIVE**
To acquaint the students with the various concepts and tools of applied mathematics which will be very basic and the very soul and guide of various engineering subjects.

1. **SERIES SOLUTION OF DIFFERENTIAL EQUATION:** Series solution and its validity; General method; Forms of series solution.

2 & 3. **CALCULUS OF VARIATIONS:** Introduction; Functionals; Euler's equation; solutions of Euler's equation; Geodesics; Isoperimetric problems; Several dependent variables; Functionals involving higher order derivative; Approximate solution of boundary value problems- Rayleigh-Ritz methods; Hamilton's principle; Lagrange's equations.

4 & 5. **TENSOR ANALYSIS:** Introduction; Summation convention; Transformation of co-
ordinates; Tensor of order zero; Kronecker Delta; Contravariant and Co-variant tensors; Quotient law; Riemannian space; Conjugate tensor; Christoffel symbols; Transformation of Christoffel symbol; Covariant differentiation of a covariant tensor; Covariant differentiation of a contravariant tensor.

6 & 7. INTEGRAL EQUATIONS: Definition and classification of integral equations; Conversion of a linear differential equation to an integral equation and vice versa; Volterra Integral equations, solution of integral equation by resolvent Kernel. Method of successive approximation, Euler integrals, Volterra Integral equation of the first kind, Fredholm equation of second kind.

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
To acquaint the students with the various concepts and tools of applied mathematics which will be very basic and the very soul and guide of various engineering subjects.

1. EIGEN VALUE PROBLEMS: Eigen values and eigen vectors; Power methods; Jacobi's methods; Given's methods; House-holder's methods.
2 & 3. DIFFERENCE EQUATIONS: Introduction; formation of difference equations; complementary function; particular integral; difference equations reducible to linear form; simultaneous difference equations and its applications.
4. PARABOLIC PARTIAL DIFFERENTIAL EQUATION: Transient heat flow equation; the explicit method; Crank-Nicolson method; parabolic equation in two or three dimension; finite elements for heat flow.
5. HYPERBOLIC PARTIAL DIFFERENTIAL EQUATION: The wave equation; solving the wave equation by finite differences; comparison to the d'Alembert solution; method of characteristics; the wave equation in 2-D; finite elements and the wave equation.
6. APPROXIMATION OF FUNCTION: Chebyshev polynomials; economized power series; approximation with rational functions; Fourier series; getting Fourier co efficient numerically and fast Fourier transform.
7. APPLICATION IN ENGINEERING FIELD: Application of Gaussian quadrature in evaluating stiffness and stress matrices for 2D and 3D elements.

TEXT BOOK

REFERENCE BOOKS
2. Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India

MA-473 | OPERATION RESEARCH | L T P | Cr
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OBJECTIVE
The aim of the topic is to provide a common platform for the Engineers, Scientists along with people from management, industry & defence sector. This topic also provides how to get optimal solution in above said branch.

1. LINEAR PROGRAMMING: Linear programming modeling and examples; resolution of degeneracy; duality theory; dual-simplex and primal-dual algorithms; transportation; assignment problems; sensitivity analysis; industrial applications of linear programming like product mix problems; blending problems; optimal allocation of resources, etc.
2. INTEGER PROGRAMMING, GOEL PROGRAMMING & MULTICRITERIA DECISION MAKING: Formulation of various industrial problems as integer and mixed integer programming problems; branch and bound algorithm; cutting plane methods for pure and mixed integer programming problems; Knap-sack; travelling salesman and shortest route problems; multicriteria decision; multicriteria decision making models; determination of set of feasible alternatives; solution techniques; goal programming approach; goal programming models; ranking and weighting of multiple goals; simplex method in goal programming.
3. NON-LINEAR PROGRAMMING: Constraint qualification and Kuhn-Tucker necessary conditions; sufficiency of Kuhn-Tucker necessary conditions and convex programs; Linear Complementarity Problem (LCP); Quadratic programming and use of LCP for solving quadratic programming problems.
4. SEQUENCING MODEL: Two machine and n jobs (no passing) problem and three machine and n jobs (no passing) problems; different routing; 2 jobs and m machines; n jobs and m machines; branch
and bound algorithms.

5. QUEING THEORY & INVENTORY CONTROL: Introduction to queuing line models; steady state behavior of M/M/1 and M/M/C queues; the problem of machine interference and use of finite queuing tables; introduction to M/G/1 and G/M/1 inventory control problem; Concept of inventory and various costs; EOQ formula newspaper boy problems.

6. PERT/CPM: Introduction to network analysis; Definition of a project; job and events; drawing of arrow diagrams; determination of critical paths and calculation of floats; resource allocation and least cost planning; use of network flows for least cost planning; uncertain duration and PERT.

7. STOCHASTIC PROGRAMMING: Stochastic programming with one objective function; stochastic linear programming; two stage programming technique; chance constrained programming technique.

TEXT BOOK

REFERENCE BOOK

ME-442 ERGONOMICS L T P Cr
- 5 0 0 3

OBJECTIVE
The course provides knowledge of ergonomics principles so that the students are able to visualize factors which affect the efficiency of human beings. After the study of the subject, the students will be able to select a proper design of display controls, equipment, work plan and environment.

1. INTRODUCTION: Definition of ergonomics and ergonomist; social and economic values of ergonomics; general and individual ergonomics.
2. POSTURE AND MOVEMENT: Biomechanical; physiological and anthropometric background; postures; sitting and standing; Movement – lifting; carrying; pulling and pushing; Workplace design and assessment.
3. INFORMATION AND OPERATION: User; information – visual; hearing and other senses; Control for operation – fixed and others diagues user friendliness; different forms and help; Website design; mobile interaction; virtual reality.
4. ENVIRONMENTAL FACTORS: Noise reduction; hearing conservation; Vibration prevention; illumination – light intensity; brightness differences; colour of light; Climate – heat and cold; Chemical substances – measures; ventilation.

5. WORK ORGANISATION JOBS & TASKS: Tasks; jobs; work organization – flexible; autonomous groups; coaching measurement styles.

6. ERGONOMIC APPROACH: Project management – initiative phase; problem identification phase; selection of solution phase; implementation phase; evaluation phase.

7. CASE STUDIES: A set of case studies will be used to demonstrate how ergonomics had led to changes in work activity; safety and product design; Case studies will include advanced computer application; workplace assessment; accidents; analysis and industrial inspection.

TEXT BOOK
Jan Dul and Bernard Weerdancester, "Ergonomics for Beginners", CRC Press/Taylor and Francis Group

REFERENCE BOOKS
1. Knoz Stephana, Johnson Steven, Halconts "Work Design - Industrial Ergonomics", Hathaway, Scottsdagta, AZ
3. Verma A. P., "Industrial Engineering", S. K. Kataria and Sons

ME-443 FINITE ELEMENT ANALYSIS L T P Cr
- 5 0 0 3

OBJECTIVE
The objective of the course is to teach the fundamentals of finite element method of solids; structures and fluids with emphasis on the underlying theory, assumptions, and modeling issues as well as providing hands on experience using finite element software to model, analyze and design systems of relevance to mechanical engineering. This includes the theoretical foundations and appropriate use of finite element methods.

1. INTRODUCTION - VARIATIONAL FORMULATION: General field problems in Engineering; Modeling; Discrete and Continuous models; Characteristics; Difficulties involved in solution; The relevance and place of finite element method; Historical comments; Basic concept of FEM; Boundary and initial value problems; Gradient and divergence theorems; Functional; Variational calculus; Variational formulation of VBPS; The method of weighted residuals; The Ritz method.

2. FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS: 1D second order equations; discretisation of domain into elements; Generalised coordinates approach; derivation of elements equations; assembly of element equations; imposition of boundary conditions; solution of equations; Cholesky method; Post processing.

3. EXTENSION OF THE METHOD TO FOURTH ORDER EQUATIONS AND THEIR SOLUTIONS: time dependent problems and their solutions; example from heat transfer; fluid flow and solid mechanics.
4. **FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS**: Second order equations involving a scalar; valued function; model equation; Variational formulation – Finite element formulation through generalised coordinates approach; Triangular elements and quadrilateral elements; convergence criteria for chosen models; Interpolation functions; Elements matrices and vectors; Assembly of element matrices; boundary conditions; solution techniques.

5. **ISOPARAMETRIC ELEMENTS AND FORMULATION**: Natural coordinates in 1, 2 and 3 dimensions; use of area coordinates for triangular elements in; 2 dimensional problems; Isoparametric elements in 1, 2 and 3 dimensions; Large rangean and serendipity elements; Formulation of element equations in one and two dimensions; Numerical integration.

6. **APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSIONS**: Equations of elasticity; plane elasticity problems; axisymmetric problems in elasticity; Bending of elastic plates; Time dependent problems in elasticity; Heat transfer in two dimensions; Incompressible fluid flow and related problems.

7. **INTRODUCTION TO ADVANCED TOPICS (NOT FOR EXAMINATION PURPOSES)**: Three dimensional problems; Mixed formulation; use of software packages.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
This gives the knowledge of estimation; conversion and utilization of non conventional sources of energy. With the depletion of fossil fuel sources, the importance of non-conventional renewable sources of energy has gained tremendous importance. This course introduces the students to these sources and how these can be utilized for power production.

1. **INTRODUCTION**: Trends of energy consumption; sources of energy; conventional and Renewable; fossil fuel; availability and limitations; need to develop new energy sources.
2. **SOLAR ENERGY**: Solar radiation characteristics and estimation; Solar Collectors; Flat Plate and concentrating types; Their comparative study; design and material selection; Efficiency; Selective paints and surfaces; Heating of air and water for building and other Uses; Thermal storages; Solar Ponds; Solar pumps; solar Power; Solar Cookers etc; Direct Conversion of Solar energy to electricity and its various uses; materials; limitations and Costs.
3. **BIO-CONVERSION**: Generation of bio-gas; digesters and their design; selection of material; feed to digester; paralytic gasification; production of hydrogen; Algae production and their uses.
4. **WIND ENERGY**: Types of rotors; horizontal axis and vertical axis systems; system design and site selection.
5. **GEO-THERMAL ENERGY**: Sites; potentiality and limitation; study of different conversion systems.
6. **TIDAL ENERGY**: Sites; potentiality and possibility of harnessing from site; limitations; Ocean Thermal Energy; Principle of utilization and its limitations; description of various systems.
7. **OTHER NON-CONVENTIONAL ENERGY SOURCES**: Fluidized bed combustions; heat from waste and other sources.

**TEXT BOOK**

**REFERENCE BOOKS**
2. Duffie J. A. and Beckman, "Solar Heating and Cooling"
4. Sharma P. C., “Power Plant Engineering”, S. K. Kataria and Sons

**ME-461 NON DESTRUCTIVE TESTING TECHNIQUES**

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**OBJECTIVE**
To give a general overview of novel non destructive testing methods, the principles behind them, their uses, the advantages and limitations, both in application and defect detection capability.

1. **NON-DESTRUCTIVE TESTING**: Non-destructive testing (NDT): role, components and advantages; common NDT techniques.
2. **ULTRASONIC TESTING**: ultrasonic flaw detection: principle, working and applications, advantages and limitations.
3. **RADIOGRAPHY**: X-ray radiography, Gamma my radiography and Neutron radiography; principle, working and applications, advantages and limitations.
4. **EDDY CURRENT TESTING**: Principle, working and applications of eddy current testing; probes and sensors; testing procedures, applications, advantages and limitations.
5. **MAGNETIC TESTING**: Magnetic testing: particle, flux leakage testing; magnetization methods; detectables. applications and limitations.
6. **DYE PENETRANT TESTING**: Principle, working and applications of dye penetrant testing, advantages and limitations.
7. **VISUAL AND OPTICAL TESTING**: Principle, working and applications of holography, optical interference techniques, advantages and limitations.
B.Tech. Electrical Engineering (Regular)

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
The goal is to teach students some basic nanoscience/nanotechnology. Students are expected to learn both some basic science and technology. Students from all branches are encouraged to take this course. In addition, students are expected to assist each other in teaming and discussing the content and die context, and to maintain respect for the scientific approach.

1. **NANOMATERIALS:** Introduction to nanomaterials; nano-scale in one dimension: thin films, layers and surfaces, nanoscale in two dimensions: carbon nano-tubes; inorganic nano-tubes, nano-wires, biopolymers; nano-scale in three dimensions: nano-particles, fullerenes (Carbon 60), dendrimers, quantum dots
2. **NANOMETROLOGY:** Introduction to nanometrology; length measurement; force measurement; measurement of single molecules; applications of metrology.
3. **ELECTRONICS, OPTOELECTRONICS AND INFORMATION AND COMMUNICATION TECHNOLOGY:** Introduction to electronics; optoelectronics and information and communication technology; nanoscience in electronics, opto-electronics and information and communication technology; current applications: computer chips, information storage, opto-electronics; applications anticipated in the future: sensors.
4. **NANO-BIOTECHNOLOGY AND NANOMEDICINE:** Introduction to nano-biotechnology and nano-medicine; nano-science in nano-biotechnology and nano-medicine, current and future applications array technologies, drug delivery, drug discovery, medical imaging, nano-technologies and cancer treatment, implants and Prosthetics.
5. **NANOFABRICATION:** Lithographic techniques for nano-printing; nano-manipulation techniques, self assembly.
6. **SYNTHESIS AND CHARACTERIZATION:** Metallic, semiconducting, magnetic and carbon based nano structures, nanocomposites and biological nanomaterials.

7. **APPLICATIONS OF NANOMATERIALS:** Sunscreens and cosmetics, composites, clays, coatings and surfaces, tougher and harder cutting tools, paints; remediation, fuel cells; displays, batteries, fuel additives, catalysts; carbon nanotube composites; lubricants, magnetic materials; medical implants; machinable ceramics, water purification, military battle suits.

**TEXT BOOK**
Poole Charles P. and Owens Frank J., “Introduction to Nanotechnology”, Wiley Interscience, 2003

**REFERENCE BOOKS**

**OBJECTIVE**
To give a general overview of fundamentals of Laser, Laser production techniques and applications.

1. **CONDITIONS:** Conditions for producing laser, concept of coherence - spatial and temporal, population inversions
2. **GROWTH FACTOR:** Einstein coefficients, gain and gain saturation, saturation intensity, development and growth of a laser beam, exponential growth factor, threshold requirement for a laser.
3. **NORMAL INVERSION:** Inversions and two level systems, steady state inversions.
4. **POPULATION INVERSION:** Three and four level systems, transient population inversions, factors effecting population inversion, laser Amplifiers.
5. **EXCITATION AND PUMPING:** Excitation or pumping threshold requirements, pumping pathway and specific excitation parameters associated with optical and particle pumping.
7. **LASER SPECTROSCOPY:** Introduction and applications

**TEXT BOOK**

**REFERENCE BOOKS**
Lingaya’s Group of Institutions:
- Lingaya’s University (Faridabad)
- Lingaya’s Institute of Health Sciences
  - Lingaya’s Public School
- Lingaya’s Lalita Devi Institute of Management & Sciences, New Delhi (I.P. University)
- Sri Viveka Institute of Technology, Vijayawada