Important

Academic Rules

Scheme of

Studies & Syllabus

B.Tech. Degree Programme
Electrical & Electronics Engineering
(Effective from 2009-2010)
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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" CAU/AUC 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 period, right from the very first day of admission into the programme that the student undergoes throughout the programme (degree awarding department) offering the 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.

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.

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 make-up 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 makeup 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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<td>W</td>
<td>-</td>
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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
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%
(Several over the term) : 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.
    - 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 to 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/Internship 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 FULFILLED</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>
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<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>
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</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>
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<tbody>
<tr>
<td>End of FIRST year</td>
<td>20*</td>
</tr>
<tr>
<td>End of SECOND year</td>
<td>50*</td>
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<tr>
<td>End of THIRD year</td>
<td>85</td>
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<tr>
<td>End of FOURTH year</td>
<td>125</td>
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</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 & Electronics Engineering

DEGREE OBJECTIVE

To impart quality study through a blend of courses such that the students who move on to concentrate on Electrical Engineering will have the knowledge on electronics to refer to when they come across an electronics problem. Similarly, those who are more focused on Electronics will be able to refer to electrical knowledge when dealing with problem from the domain of power engineering.

Focus on Industry – Relevant Skills Development to allow students to develop employment – enhancing skills across a number of key areas. Team – working skills will be developed by the significant amount of project work associated with the course. Communication skills will be enhanced through PDP (Personality Development Programme) and also by exercises though seminars and colloquium.

To enrich the student’s view of the profession and make them understand the business and social content of their work. More importantly, to make graduates develop independent thought process to enable them to investigate new ideas and tools as they arise in their professional career.
### CATEGORY-WISE LIST OF COURSES

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<td>1 CH-101 Applied Chemistry</td>
<td>1 EC-204 Electronics Engineering</td>
<td>1 EE-421 Extra High Voltage Engineering</td>
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**Project/Internship, Seminar Training, CSOP**

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<td>Major Project Phase-II</td>
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<td>Internship Documentation</td>
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<td>EE-491</td>
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<td>EE-492</td>
<td>Project (including Seminar)</td>
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**Professional Development (PD) – Gen.**

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<td>Co-curricular Activities</td>
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<td>PD-192</td>
<td>Personality Skills</td>
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<td>PD-193</td>
<td>Entrepreneurial &amp; Professional Skills</td>
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<td>PD-251</td>
<td>MATLAB</td>
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<td>PD-291</td>
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<td>Intra &amp; Inter-personal Skills</td>
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<td>Basic Principles of Book-Keeping and Accounts</td>
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**Mandatory Learning Course (MLC)**

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**Additional/Bridge Course**

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<td>Mathematics (Bridge Course)</td>
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# SUGGESTED PLAN OF STUDIES

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### Scheme of Studies
#### B. Tech. Degree Programme (Regular)
(Common to all Branches)

#### 1st Year

##### TERM – I

### 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.

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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.
## Scheme of Studies
B. Tech. Degree Programme (Regular)  
(Common to all Branches)

### 1st Year

#### TERM – II

#### THEORY

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### FINAL EVALUATION IN GRADES

(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits  
MTE - Mid-Term Exam  
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** One hour for explanation/demonstration.  
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### Scheme of Studies

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

*(Common to all Branches)*

#### 1st Year

**TERM – III**

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<td>C</td>
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<td>Entrepreneurial &amp; Professional Skills</td>
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<td>20</td>
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<td>6</td>
<td>A/B/C</td>
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<td>Co-curricular Activities</td>
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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**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TOTAL CONTACT HOURS</th>
<th>TOTAL CREDITS</th>
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<td>B</td>
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<td>18+1*</td>
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<td>C</td>
<td>15-3-10 (28)</td>
<td>17+1*</td>
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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.
### Scheme of Studies

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

**2nd Year**

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<td>EE-202</td>
<td>Electrical Network Theory</td>
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<td>Economics</td>
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**TERM-IV**

**20-1-8 (29)**

**TERM-V**

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<td>Semi-conductor Materials &amp; Devices</td>
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<td>EE-204</td>
<td>Engineering Electromagnetics</td>
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<td>EE-205</td>
<td>Digital Electroncis &amp; Logic Design</td>
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<td>Applied Numerical Methods</td>
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**TERM-VI**

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

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<td>Co-curricular Activities</td>
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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>EL-305</td>
<td>Electrical Machines – II</td>
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<td>Power Electronics</td>
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<td>PD-393/</td>
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**Total Credits (30)**

#### TERM-VIII

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<td>Power System Engineering – II</td>
<td>5-1-0</td>
<td>4</td>
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<td>3</td>
<td>EE-303</td>
<td>Micro-computer &amp; Microprocessors</td>
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<td>4</td>
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<td>4</td>
<td>EE-304</td>
<td>Electric Drives</td>
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<td>EE-352</td>
<td>Power System Engineering – II Lab</td>
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<td>EE-353</td>
<td>Micro-computer &amp; Microprocessors Lab</td>
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<td>Problem Solving Skills/</td>
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<td>PD-393/</td>
<td>Advanced Professional Development**/</td>
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<td>PD-355</td>
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**Total Credits (30)**

#### TERM-IX

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<td>Communication Systems</td>
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<td>EE-307</td>
<td>Antenna &amp; Wave Propagation</td>
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<td>Micro-electronics</td>
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<td>Problem Solving Skills/</td>
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**Total Credits (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 & Electronics Engineering  
Scheme of Studies  
B. Tech. Degree Programme (Regular)  
(PROJECT MODE)

4th Year

<table>
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<td>Digital Signal Processing</td>
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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.
### 4th Year

#### TERM-X

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<td>2</td>
<td>EC-309</td>
<td>Digital Signal Processing</td>
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<td>Programmable Logic Controllers &amp; SCADA Lab</td>
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<td>EE-483</td>
<td>Internship-I**</td>
<td>0-0-2</td>
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<tr>
<td>9</td>
<td>PD-455</td>
<td>Computer and Information Management</td>
<td>0-0-2</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
<td></td>
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</table>

**15-0-14 (29) 16**

#### TERM-XI

<table>
<thead>
<tr>
<th>SN</th>
<th>Course No.</th>
<th>Course Name</th>
<th>L-T-P</th>
<th>Cr</th>
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<tbody>
<tr>
<td>1</td>
<td>EE-494</td>
<td>Seminar-I***</td>
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<td>2</td>
<td>EE-484</td>
<td>Internship-II (in Industry)</td>
<td>0-0-24</td>
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<td>3</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
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**0-0-24 (24) 12**

#### TERM-XII

<table>
<thead>
<tr>
<th>SN</th>
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<th>Course Name</th>
<th>L-T-P</th>
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<tr>
<td>1</td>
<td>EE-403</td>
<td>Embedded Systems Engineering</td>
<td>5-1-0</td>
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<td>2</td>
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<td>Dept. Elective-II</td>
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<td>3</td>
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<td>Dept. Elective-III</td>
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<td>4</td>
<td>EE-453</td>
<td>Embedded Systems Engineering Lab</td>
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<td>5</td>
<td>EE-485</td>
<td>Internship Documentation</td>
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<td>6</td>
<td>EE-495</td>
<td>Seminar-II***</td>
<td>0-0-2</td>
<td>1</td>
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<td>7</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
<td></td>
<td>1*</td>
</tr>
</tbody>
</table>

**15-1-8 (24) 15 + 1***

**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

<table>
<thead>
<tr>
<th>Dept. Elective - I</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>EE-421</td>
<td>Extra High Voltage Engineering</td>
<td>3</td>
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<tr>
<td>2</td>
<td>EE-422</td>
<td>Flexible AC Transmission System</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>EE-423</td>
<td>High Voltage DC Transmission</td>
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<table>
<thead>
<tr>
<th>Dept. Elective - II</th>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>1</td>
<td>EE-431</td>
<td>Industrial Electronics</td>
<td>3</td>
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<tr>
<td>2</td>
<td>EE-432</td>
<td>Advanced Digital System Design with VHDL</td>
<td>3</td>
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<tr>
<td>3</td>
<td>EE-433</td>
<td>Industrial Process Control</td>
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<table>
<thead>
<tr>
<th>Dept. Elective - III</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>EE-441</td>
<td>Fuzzy Logic Control Systems</td>
<td>3</td>
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<tr>
<td>2</td>
<td>EE-442</td>
<td>Non-Conventional Energy Sources</td>
<td>3</td>
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<tr>
<td>3</td>
<td>EE-443</td>
<td>Artificial Intelligence &amp; Robotics</td>
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<tr>
<td>4</td>
<td>EE-444</td>
<td>Digital Image Processing</td>
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<table>
<thead>
<tr>
<th>Dept. Elective - IV</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>EE-461</td>
<td>Power Quality Monitoring &amp; Conditioning</td>
<td>3</td>
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<tr>
<td>2</td>
<td>EE-462</td>
<td>Electrical Machines Design</td>
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</tr>
<tr>
<td>3</td>
<td>EE-463</td>
<td>Control System Design</td>
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</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>Professional Development (PD) – Gen.</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD-251 MATLAB</td>
<td>0-0-2</td>
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<tr>
<td>PD-191 Co-curricular Activities</td>
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<tr>
<td>PD-292 Effective Communication</td>
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<tr>
<td>PD-393 Advanced Professional Development</td>
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<tr>
<td>PD-151N* Basics of Computer Fundamentals</td>
<td>0-0-2</td>
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<td></td>
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<tr>
<td>PD-291 Co-curricular Activities</td>
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<tr>
<td>PD-192 Personality Skills</td>
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<tr>
<td>PD-193 Entrepreneurial &amp; Professional Skills</td>
<td>0-0-2</td>
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<tr>
<td>PD-355 Basic Principles of Book-Keeping and Accounts</td>
<td>0-0-2</td>
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<tr>
<td>PD-391 Co-curricular Activities</td>
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<td>PD-392 Problem Solving Skills</td>
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<tr>
<td>PD-293 Intra &amp; Inter-personal Skills</td>
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<td>PD-455 Computer and Information Management</td>
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<tr>
<td>PD-491 Co-curricular Activities</td>
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</tr>
</tbody>
</table>

* The contents for PD-151N are the same as for PD-151.
DETAILED SYLLABUS
GEN., BSM, ESTA, DEPT. CORE & ELECTIVE

BA-225  ECONOMICS  L T P  Cr
BA-225  500 3

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

REFERENCE BOOKS

BA-226  PRINCIPLES OF MANAGEMENT  L T P  Cr
BA-226  500 3

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
OBJECTIVE
Environmental Studies is a multidisciplinary area, the issues of which every one should know. The aim of the course is to make everyone aware of environmental issues like continuing problems of pollution, loss of forest, solid waste disposal, and degradation of environment. Issues like economic productivity and national security, global warming, the depletion of ozone layer and loss of biodiversity are other serious concerns before the mankind.

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: dereliction 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 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: Biogeographical 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

OBJECTIVE
To introduce to the students the latest topics of interests of the new generation science with the accomplishment of various technological advancements of biochemistry and texture of advanced photochemistry.

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, pitting 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 no.; saponification no.; steam emulsion no.; neutralization no.; decomposition stability and their significance.

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 tautomerism form and mutarotation; lipids; definition; 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.

REFERENCES

TEXT BOOK

REFERENCE BOOKS

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 KMnO 4 solution spectro-photometrically.
8. Determination of strength of HCl solution by titrating it against NaOH solution conductomterically.
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.

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 specification; 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 indirectiion, 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, fprintf() 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
OBJECTIVE
The purpose of this course is to give basic electronics concept; their operational significance and its basic application.

PRE-REQUISITES
Knowledge of electricity, solid state physics

1. HISTORICAL BACKGROUND: Vacuum tubes; working of vacuum tube and their characteristics; vacuum diode; triode; tetrode and pentode
2. PN JUNCTION: Depletion layer; Barrier potential; Forward and reverse bias; Breakdown voltage; PIV; switching characteristics of p-n junction diode; knee voltage; load line; and operating Point Ideal p-n junction diode; junction capacitance; zener diode
3. RECTIFIERS AND FILTERS: Half wave; centre tap full wave and bridge rectifier; percentage of regulation; PIV; ripple factor; C; RC; LC and PI filter; voltage doubler; clipping and clamping circuit; voltage regulation.
4. BIPOLAR JUNCTION TRANSISTOR: Introduction; basic theory of operation of PNP ad NPN transistor-I characteristics; CB; CE and CC configuration; different biasing techniques.
5. FET: Introduction; Theory of operation; JFET Parameters; and JFET Amplifiers. MOSFET: Introduction; theory of operation; MOSFET parameters; application; graphical analysis of BJT and FET circuits; linear models of BJT and FET; pulse and large signal models of BJT and FET
6. BIASING TECHNIQUES OF FET: Introductory idea of multistage and feedback amplifiers; base bias; emitter feedback bias; collector voltage divider bias; Load line and operating point.
7. INTEGRATED CIRCUIT: Analysis of principle of integration. Introduction to Digital Integrated circuits. THRISTORS: Introduction to thyristor family; SCR theory of operation; SCR characteristics and triggering. TRIAC: Theory of 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

OBJECTIVE
Fourier Transform and spectrum analyzer also be discussed in digital. These two digital instrument are gaining wide acceptance in electronics instrumentation. Transducer and data acquisition have received considerable overhead to include modern transducer.

1. ELECTRONIC INSTRUMENT: Instruments for measurement of voltage; current and other circuit parameters; Q; meters; R.F. power measurements; introduction to digital meters.
2. OSCILLOSCOPE: Block diagram; study of various stages in brief; high frequency CRO considerations. Sampling and stopage oscilloscope.
3. GENERATION and ANALYSIS OF WAVEFORMS: Block diagram of pulse generators; signal generators; function generators wave analysers; distortion analysers; spectrum analyser; Harmonic analyser; introduction to power analyser.
4. FREQUENCY and TIME MEASUREMENT: Study of decade counting Assembly (DCA); frequency measurements; period measurements; universal counter; introduction to digital meters.
5. TRANSUDERS: Classification; Transducers of types: RLC photocell; thermocouples etc. basic schemes of measurement of displacement; velocity; acceleration; strain; pressure; liquid level and temperature.
6. DISPLAY DEVICES: Nixie tubes; LED’s LCD’s; discharge devices; data acquisition and conversion system.
7. INTRODUCTION TO SIGNAL CONDITIONING: DC signal conditioning system; AC signal conditioning system; data accusation and conversion system.

TEXT BOOK

REFERENCE BOOKS

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 is 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**

**EC-254**

<table>
<thead>
<tr>
<th>ELECTRONICS MEASUREMENTS AND INSTRUMENTATION LAB</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Cr</th>
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</thead>
<tbody>
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<td>0</td>
<td>2</td>
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</tbody>
</table>

**LIST OF EXPERIMENTS**
1. Measurement of displacement using LVDT.
2. Measurement of distance using LDR.

**EC-309**

<table>
<thead>
<tr>
<th>DIGITAL SIGNAL PROCESSING</th>
<th>L</th>
<th>T</th>
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**OBJECTIVE**
• To induce a thorough understanding of theory of DSP.
• To get in-depth knowledge of various applications- Filters, MultiMate DSP, DSP to speech & Radar, Transforms etc.

1 **DISCRETE-TIME SIGNALS:** Signal classifications; frequency domain representation; time domain representation; representation of sequences by Fourier transform; properties of Fourier transform; discrete time random signals; energy and power theorems.
2 **DISCRETE-TIME SYSTEM:** Classification; properties; time invariant system; finite impulse Response (FIR) system; infinite impulse response (IIR) system.
3 **SAMPLING OF TIME SIGNALS:** Sampling theorem; applications; frequency domain representation of sampling, reconstruction of band limited signal from its samples; discrete time processing of continuous time signals; changing the sampling rate using discrete time processing.
4 **Z-TRANSFORM:** Introduction, properties of the region of convergence; properties of the Z-transform, inversion of the Z-transform, applications of Z-transform.

5 **BASICS OF DIGITAL FILTERS:** Fundamentals of digital filtering; various types of digital filters; design techniques of digital filters; window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP; DSP algorithm implementation consideration. Applications of DSP.
6 **ERRORS IN DIGITAL FILTERING:** Errors resulting from rounding and truncation, round-off effects in digital filters. Finite word length effects in digital filter.
7. **MULTIRATE DIGITAL SIGNAL PROCESSING:** Introduction to multirate digital signal processing; sampling rate conversion; filter structures; multistage decimator and interpolators; digital filter banks.

**TEXT BOOK**

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

**EC-359**

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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.

**EE-201**

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<tr>
<th>ELECTRICAL MEASUREMENTS &amp; MEASURING INSTRUMENTS</th>
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**OBJECTIVE**
Lord Kelvin wrote 'when you can measure what you are speaking about, and you can express it in numbers, you know something about it but when you cannot...
express it in numbers, your knowledge is meagre and unsatisfactory’. Students of engineering are, therefore, called upon to learn the rudiments of measurements very early in their study period.

1. **UNITS, STANDARDS & MEASUREMENT ERROR:** S. I. Units; accuracy & precision; error & correction; significant figures; types of errors – gross, systematic & random; types of standards; constructional aspects (only general features) of primary standards; absolute determination of resistance; resistance standards; primary and laboratory standards of e.m.f.

2. **MEASURING SYSTEM FUNDAMENTALS:** The generalized instrumentation system block diagram & description of blocks; classification of Instruments (Absolute & Secondary Instruments); Indicating, Recording & Integrating instruments (Based upon Principle of operation); three forces in electromechanical indicating instrument (Deflecting, controlling & damping forces), Comparison between gravity & spring controls; comparison of damping methods & their suitability; bearing supports, pivotless supports (Simple & taut-band); Scale information; Instrument cases (Covers).

3. **MEASURING INSTRUMENTS:** Galvanometers – D ‘Arsonval, ballistic and vibration galvanometers, construction and theory; Ammeter and Voltmeters – general constructional features, operating principle, torque equation, shape of scale; advantages and disadvantages of PMMC type, electro dynamic type, moving iron type (attraction & repulsion), induction type and rectifier type instruments; errors (both on AC/DC type); extension of instrument range – shunts and multirange ammeters, voltmeter multipliers; potential divider arrangement; sensitivity; multimeters.

4. **MEASUREMENT OF POWER AND ENERGY:** Electro dynamos types wattmeter; low power factor wattmeter; reactive power measurements; induction type energy meter – construction, theory, errors and adjustments, calibration.

5. **MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE:** Wheatstone bridge; limitations; sensitivity analysis; Kelvin’s double bridge; earth resistance measurement; measurement of insulation resistance; a standard inductor; frequency error in inductance and capacitor; general considerations of inductance and capacitance comparison bridges; Anderson bridge; Hay’s bridge; Wein’s bridge; Schering bridge; detectors used in A.C. bridges; errors in bridge measurements and precautions to be taken in minimizing errors or eliminations; Wagner’s earthing device and shielding.

6. **INSTRUMENTS TRANSFORMERS:** Current and potential transformers; ratio and phase angle errors; construction, theory; use of instrument transformers for measurement of power.

7. **MAGNETIC MEASUREMENTS:** Construction & working of Flux meter; determination of B-H Curve and hysteresis loop. Determination of iron losses by Lloyd Fisher Square; separation of iron losses.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVES**
Electric networks make up an inseparable part of the electric gadgets and equipment of modern –day living. An electric system without network is un-imaginable. This subject provides an in-depth understanding of the theoretical concepts and practical applications of circuits and their analysis – which are very essential to grasp the fundamentals of other disciplines of engineering such as communications, power systems and computer etc.

1. **NETWORK ANALYSIS:** Independent and dependent voltage and current sources; circuit analysis with independent & dependent sources – Mesh current and node voltage analysis, Thevinin’s and Norton’s theorems; maximum power transfer theorem & impedance matching; superposition principle; Tellegen’s theorem; network graphs and definitions; branch to node incidence matrix; reduced incidence matrix; branch to loop incidence matrix; cut set matrix; Kirchhoff’s laws; network equilibrium equations.

2. **POLYPHASE SYSTEMS:** Double-subscript notation; phase sequence; voltage relations in balanced – Wye system and delta systems; current relations in Wye and delta systems; current in the neutral of unbalanced Wye systems; Unbalanced 3-wire, and 4-wire Wye-Wye systems; Unbalanced delta systems – fixed voltages assumed at the load terminals; combination of single – phase along with balanced three phase loads; problem of neutral shift; residential circuits wiring.

3. **TRANSIENT RESPONSE:** Capacitive transients – v-i relationships; circuit model of charged capacitor, capacitive power, energy, stored in capacitance; Inductive transients – v-i relationships, circuit model of fluxed inductor, inductive power, energy stored in inductance; comparison of capacitive and inductive v-i relationships; transient response of RC, RL, RLC circuits to various excitation signals such as step, impulse and sinusoidal excitations using Laplace Transform.

4. **TWO PORT NETWORKS:** Type of problems; representation of networks; two port network parameters –short circuit admittance, open circuit impedance, ABCD, transmission and hybrid
parameters; relationship between parameter sets; interconnection of two ports; and analysis of ladder networks; the insertion problem.

5. **NETWORK FUNCTIONS**: The concept of complex frequency; network functions of one – and two – ports; calculations of network functions for general networks; features of network functions; restrictions on location of poles and zeros of network functions; response of a circuit in the time domain from pole and zero plots; amplitude and phase response from pole and zero plots.

6. **MAGNETIC COUPLED CIRCUITS**: Magnetic coupling, dot convention, coefficient of coupling in series and parallel circuits; singly and doubly tuned circuits.

7. **HARMONIC ANALYSIS**: Types of wave forms; time-average properties and spectral properties of wave forms (in brief only); Fourier analysis of various wave forms; effective value, power and phase angle associated with nth harmonic component in complex waveforms.

**TEXT BOOK**


**REFERENCE BOOKS**


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**EE-203 SEMICONDUCTOR MATERIALS & DEVICES**

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**OBJECTIVE**

Electronics is a rapidly changing science, with significant advances in the state of art introduced each year. What is needed is an approach that will remain stable as the science of electronics changes, allowing the student to understand device operation today and to adjust to changes which surely will come. Such an approach is implemented using “black box” equivalent circuits for active semiconductor devices. The topics discussed are semiconductor physics to understand the diode and transistor which also covers practical applications developing equivalent circuits useful in circuit analysis.

1. **CHARGE CARRIERS IN SEMI-CONDUCTORS**: Energy band theory for solids; types of semiconductors; charge carriers and their properties; Fermi level; invariance of Fermi level at equilibrium; carrier concentration at equilibrium; temperature and doping effect on carrier concentration; conductivity and mobility; compensation and space charge neutrality; effect of electric and magnetic fields; Hall effect and its applications.

2. **EXCESS CARRIERS IN SEMICONDUCTORS**: Optical absorption, optical and electro luminescence; photo conductivity; direct and indirect combination of electrons and holes; steady state carrier injection; carrier diffusion and diffusion length; drift; Haynes Shockley experiment; gradients in quasi Fermi level.

3. **SEMI-CONDUCTOR DIODE AND ITS FABRICATION**: Theory and band diagram of pn-junction; pn-junction as diode; contact potential; equilibrium Fermi levels; space charge at junction; junction biasing; current components; I-V characteristics of pn-diode; effect of temperature on diode current; breakdown mechanism; avalanche and zener diodes; LED; fabrication of pn-junction – rapid thermal processing, ion implantation, chemical vapor deposition, photolithography, itching metallization.

4. **PN-DIODE CIRCUITS**: Diode as a circuit element; the load line concept; half wave and full wave rectifiers; clipping circuits; clamping circuits; filter circuits; peak to peak detector and voltage multiplier circuits.

5. **TRANSISTOR AT LOW FREQUENCIES**: Bipolar junction transistor operation and characteristics; different regions of operation; load line; Ebers-moll model of transistor; hybrid model; h-parameters (CE, CB, CC configurations), analysis of a transistor amplifier circuits using h-parameters; emitter follower; Miller’s Theorem; frequency response of R-C coupled amplifier.

6. **TRANSISTOR BIASING**: Operating point; bias stability; collector to base bias; self-bias; emitter bias; bias compensation; thermistor & sensor compensation.

7. **FIELD EFFECT TRANSISTORS**: Junction field effect transistor; pinch off voltage; volt-ampere characteristics; small signal model; MOSFET Enhancement & Depletion mode V-MOSFET. Common source amplifier; source follower; biasing of FET; applications of FET as a voltage variable resistor (VVR).

**TEXT BOOK**


**REFERENCE BOOKS**


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**EE-204 ENGINEERING ELECTROMAGNETICS**

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**OBJECTIVE**

Electromagnetic field theory is the study of electric and magnetic fields. As the circuit dimensions become comparable with wave length, simple current and voltage parameters do not allow an adequate description or analysis of the circuit. Then it becomes necessary to use the field concepts. In particular phenomenon like induction and radiation can only be explained using the concept of electromagnetic fields.
1. REVIEW OF VECTOR ANALYSIS: Scalar and vector fields; review of vector algebra; review of Cartesian; cylindrical & spherical coordinate systems, introduction to del operator, use of del operator as gradient, divergence curl; Stoke's theorem.

2. ELECTROSTATIC FIELDS: The field concept; coulomb's Law – Forces upon charges; Electric Field Intensity and Electric Potential; relationship between Intensity and potential. Field of Simple charge configuration – Fields of Finite and infinite lines of charge; electric dipole; method of images, & its applications. Effect of Dielectric on capacitance; Electrostatic energy, Boundary condition.

3. CAPACITANCE OF TRANSMISSION LINES: Electric field due to a single and group of ‘n’ conductors; potential coefficients and capacitance coefficients; calculation of the capacitance of single conductor and multi-conductor single phase and three phase transmission lines; effect of ground.

4. STEADY CURRENT: current density vector; continuity equation; conservative and non-conservative fields; Resistance of arbitrarily shaped conductors.

5. MAGNETIC FIELDS: Magnetic Field due to a steady electric current; magnetic flux; magnetic flux density and magnetic intensity; Biot Savart's Law, force and torque on a current carrying conductor. Magnetomotive Force and Ampere's Law, magnetic vector potential; boundary conditions at magnetic surfaces; Electromagnetic Induction – Faraday's Law, self and mutual inductance, Newmann's formula; energy stored in a magnetic field.

6. INDUCTANCE OF TRANSMISSION LINES: Flux and flux linkages of a single and group of ‘n’ conductors; inductance of single and three phase single conductor and multi conductor lines; inductance of cables.

7. MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES: Maxwell's equations in differential and integral forms; Wave equation, Propagation of uniform plane wave in free space; Sinusoidal electromagnetic wave in free space; Poynting vector – Instantaneous, Average and complex.

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
The course will enable students to design some of the fundamental and very important interface circuits on predominately mixed signal digital systems. It also provides knowledge and understanding of the different issues related to the development of digital integrated circuits.

1. BASIC CONCEPTS: Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR; Boolean Algebra; Number Systems; Binary Codes: BCD, Excess-3, Gray, EBCDIC, ASCII; Error detection and correction codes.
2. MINIMIZATION TECHNIQUES: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables; simplification of logic functions with K-map; conversion of truth tables in POS and SOP form; Incomplete specified functions; variable mapping; Quinn-Mc Klusky minimization techniques.
3. COMBINATIONAL CIRCUITS: Combinational logic circuit design, Adders/ Subtractors; BCD adder; Binary multiplier; Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, Demultiplexer, Encoder; Octal to binary, BCD to excess-3 encoder. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers, regenerative comparator (Schmitt Trigger), multivibrators; Comparator (2-bit, 4-bit).
4. SEQUENTIAL CIRCUITS: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops; conversions of flip-flops; Counters: Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications; Registers: buffer register, shift register, Pulse mode sequential circuits.
5. LOGIC FAMILIES: Switching mode operation of p-n junction, bipolar and MOS devices; Bipolar logic families, DTL, DCTL, HTL, TTL, ECL, MOS and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.
6. CONVERTERS: Sample and hold circuit, weighted resistor and R-2R ladder D/A converters, specifications for D/A converters, Types of A/D converters, specifications of A/d converters.
7. PROGRAMMABLE LOGIC DEVICES: ROM, PLA, PAL, FPGA, CPLD

TEXT BOOK

REFERENCE BOOKS
OBJECTIVE

The development of electric power systems has contributed to the phenomenal technological advance of human mankind over the past century. This course present methods of power generation & power system analysis in sufficient depth to give the students the basic theory at the undergraduate level. The contents are designed to develop students’ thinking process, enabling them to reach a sound understanding of topics related power system engineering.

1. GENERAL PRINCIPLES: An electric energy system—operations, objectives and structure—distribution level, subtransmission level and grid level; feeders; distributors and service mains; electric energy demand; and power development in India; resources for generation; present power position in India; future planning; Power Corporations in India. Basic definitions; connected load; maximum demand; demand factor; load and load duration curve; load factor; 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 layout 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 dielectric loss; thermal rating of cables.

TEXT BOOK


REFERENCE BOOKS


OBJECTIVE

The course will enable students to design some of the fundamental and very important analogue interface circuits on predominately mixed signal analog systems. It also provides a general overview of analog integrated circuits and systems, Knowledge and understanding of the different issues related to the circuit design, fabrication, design methods and tools.

1. TRANSISTOR AT HIGH FREQUENCIES: Hybrid Pi model, CE short circuit current gain, frequency response, alpha, cutoff frequency, gain bandwidth product, emitter follower at high frequencies. Series and shunt voltage regulators, power supply parameters, SMPS.
3. FEEDBACK AMPLIFIERS: Feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, input resistance, output resistance, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.
4. OSCILLATORS: Sinusoidal oscillators, Barkhausen criteria, R-C phase shift oscillator, general form of oscillator circuit, Wien-bridge oscillator, crystal oscillator.
5. POWER AMPLIFIERS: Class A, B, and C operations; Class A large signal amplifiers, higher order harmonic distortion, efficiency, transformer coupled power amplifier, class B amplifier: efficiency & distortion; class A and class B push-pull amplifiers; class C power amplifier.
6. **OPERATIONAL AMPLIFIERS**: Ideal and practical operational amplifiers, inverting and non-inverting amplifier, differential amplifier, emitter coupled differential amplifier, transfer characteristics of a differential amplifier, offset error : voltage and current, common mode rejection ratio (CMRR).

7. **LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS**: Scale changer, phase shifter, adder, voltage to current converter, current to voltage converter, DC voltage follower, Bridge amplifier, AC coupled amplifier, AC voltage follower, Integrator, differentiator.

**TEXT BOOK**

**REFERENCE BOOKS**

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**EE-251**

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**LIST OF EXPERIMENTS**
1. Comparison of different types of indicating instruments.
2. To measure resistance of an installation to earth.
3. Calibration of an energy meter with the help of a standard wattmeter and a stopwatch.
4. Measurement of low resistance by Kelvin’s double bridge.
5. Measurement of high resistance by loss of charge method.
7. To measure capacitance by De Sauty’s bridge.
8. To measure frequency by Wien’s bridge.
10. Study of CRO circuits and controls and measurement of (a) Voltage and current (b) Phase and frequency.
12. To measure power and power factor by (a) 3 – ammeter method and (b) 3 – voltmeter method.
13. To measure power and power factor in 3-phase circuit by 2-wattmeter method.

**EE-252**

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**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

**EE-253**

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**LIST OF EXPERIMENTS**
1. Design & construction of half wave, full wave, and bridge rectifier circuits. Evaluation of each circuit, calculation of respective output voltage, and observation of waveforms.
2. Design & construction three phase, full wave rectifier power supply and evaluation of its output.
3. Design, construction and evaluation of half wave and full wave voltage – doubler power supplies.
5. To find the value of Hall co-efficient of semiconductor.
6. To find the band gap of intrinsic semi-conductor using four probe method.
7. To study the characteristics of a solar cell and to find the fill factor.
8. To develop a load line for a bipolar junction transistor.
9. To build a bipolar junction transistor switch and measure current voltage values for on and off operation conditions.
10. To build and test the operation of a JFET switch.
11. To study the Op-Amp characteristics.

**EE-255**

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**LIST OF EXPERIMENTS:**
1. To study TTL gates – AND, OR, NOT, NAND, NOR, EX-OR
2. Design & realize a given function using K – Maps
3. To verify the operation of multiplexer & Demultiplexer
4. To study and perform experiment - (a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points.
5. To study and perform experiment on various types of counters and shift registers.
6. Design 2-bit binary up/down binary counter on bread board.
7. To verify the operation of comparator.
8. To verify the truth tables of S-R, J-K, T & D flip-flops.
9. To design & verify the operation of synchronous UP/DOWN decade counter using J K flip – flops & drive a seven – segment display using the same.
10. To design & realize a sequence generator for a given sequence using J K flip flops.
11. Study of CMOS NAND & NOR gates and interfacing between TTL & CMOS gates.
12. To verify the operation of diode & transistor as a switch.

**LIST OF EXPERIMENTS**

1. To plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback.
2. To study half wave & full wave rectifiers.
3. To study diode as clipper & clamper.
4. To study and perform zener diode as a voltage regulator.
5. To study and design a dc voltage doubler & compaprator.
6. To study FET as amplifier (common source & drain).
7. To study series and shunt voltage regulators and measurement of line and load regulation and ripple factor.
8. To study the frequency response of R-C coupled amplifier.
9. To study CE amplifier for voltage, current, power gain & i/o impedances.
12. Design Fabrication and testing of k-derived filters (LP/HP) using OP-AMP 741.

**OBJECTIVE**

The main objective of the subject is to develop the basic concepts / design of transmission lines and two port networks. The contents provide comprehensive, integrated and design oriented information on networks and transmission links.

1. **INTRODUCTION:** Primary constants of a transmission line; loop inductance; shunt capacitance; loop resistance; skin and proximity effects; transmission line equation; characteristic impedance; propagation constant; computation of primary and secondary constants.
2. **OPEN, SHORT AND TERMINATED LINES:** Reflected and incident waves; standing waves in open and short circuited lines; input impedance of terminated open and short circuited lines; transmission lines as circuit elements; input impedance of terminated lines; reflection coefficient, standing wave ratio; reflection loss due to mis-matching; Smith chart; loaded transmission lines.
3. **TRANSMISSION LINE MEASUREMENTS:** Measurement of standing wave ratio; wave length; impedance; power and reflection coefficient; special impedance measuring methods; measurement of standing wave guides; measurement of insertion loss.
4. **EQUALIZERS:** Classification of equalizers; inverse impedance and inverse network; full series equalizer; full shunt equalizer and bridge-T-equalizer lattice equalizer; characteristics of equalizer; equalizer for transmission of digital data.
5. **ACTIVE FILTERS:** First order and second order Butterworth filter; universal active filters.
6. **ATTENUATOR:** Symmetrical attenuator; symmetrical T-attenuator, pi-attenuator, bridged T-attenuator, Lattice attenuators, a symmetrical T-attenuator, L-attenuator, Pi-attenuator, minimum loss attenuator, attenuator for variable load, balanced and un-balanced attenuators, ladder attenuators.
7. **NETWORK SYNTHESIS:** Positive real functions; synthesis of one port and two port networks; elementary ideas of active networks.

**TEXT BOOK**


**REFERENCE BOOKS**

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 restriction voltage and rate of rise of restricting voltage and factors affecting them; air blast circuit breakers; oil circuit breakers; SFI 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**

**REFERENCE BOOKS**

### EE-303 MICRO COMPUTER AND MICROPROCESSORS

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**OBJECTIVE**
The electronics student or specialist of tomorrow must have a knowledge of micro processors and microprocessor – based systems. This will include knowledge not only of micro-computer hardware but of software as well. Micro-processors are the basis for an exciting new breed of intelligent devices. Micro-processor are found in diverse products: from children's toys to automobiles, from microcomputers to home appliances, from industrial robots and machinery to home entertainment equipment. A because of being a programmable device, the development of intelligent machines is expected to accelerate in future.

1. **MICRO-COMPUTER FUNDAMENTALS:** Importance of micro-computer; simplified microcomputer architecture CPU clock, RAM, ROM, Interface, interrupts, three buses, the peripherals (Hard disk, keyboard, monitor, printer, modem, RAM etc.); simplified memory organization – memory addresses, cache memory; operating system (in brief); instruction set; micro-computer operation.

2. **THE 8085 PROCESSOR:** The micro-processor; micro-processor based system; common microprocessor characteristics; 8085 microprocessors – architecture, instruction set, interrupt structure, memory interfacing I/O ports and data transfer concepts; timing diagram.

3. **PROGRAMMING OF 8085 PROCESSOR:** Instruction format and addressing modes, Assembly language format; Data transfer; Data manipulation and control instructions; Programming: Loop structure with counting and indexing; look up table; Subroutine instructions stack.

4. **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.

5. **INSTRUCTION SET OF 8086:** Instruction execution timing; assembler instruction format; Data transfer instructions; Arithmetic instructions; branch instructions; looping instructions; NOP andHLT instruction; flag manipulation instructions; logical instructions; shift and rotate instructions; directives and operators; programming examples.

6. **PERIPHERAL INTERFACING:** Study of Architecture and programming of ICs: PPI–8255; Control words; Modes and examples.

7. **DMA AND INTERRUPT/TIMER:** Introduction to DMA process; 8237 DMA Controller; 8259 PIC; Programmable interval timer chips.

**TEXT BOOK**

**REFERENCE BOOKS**
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.

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
Among man-made systems, the electric power system has three distinctions (i) High financial involvement (ii) Immense utility (iii) Challenging technical aspects. The system needs careful planning and operation, which is gaining complexity due to the increase in size of individual systems as well as due to the inter connection of the regional systems to form a power pool etc. Considerations such as economy & security in operation are very important against the background of rising costs of operation & production. This course assumes significance because the power systems which have earlier been studied in parts is now being dealt with as a system. The contents of the course relate to the efficient operation of the system as well as problems may arise during operation.


2. ECONOMIC POWER DISPATCH: Formulation of economic power dispatch problem of an All-Thermal power system with and without considering transmission losses and its solution using Lagrange multipliers and K-T conditions, concept of incremental fuel cost; incremental transmission loss and penalty factors.

3. FORMULATION OF LOAD FLOW PROBLEM: Primitive network; formation of Y-bus by inspection and using singular transmission (qualitative treatment only), load flow equations; types of buses and classification of variables; solution of load flow problem by Gauss – Seidel method (for small systems only).

4. POWER SYSTEM STABILITY: Steady state; transient and dynamic stabilities; equal area criterion; effect of fault clearing time on transient stability; factors affecting steady state and transient stability.

5. CONTROL OF POWER AND FREQUENCY: Necessity of maintaining frequency constant; load frequency control; turbine – governor characteristic, control loops, division of load between generators; power –frequency characteristics of an interconnected system; systems connected by lines of relatively small capacity; effect of governor characteristics

6. CONTROL OF VOLTAGE AND REACTIVE POWER: Power transfer between two sources; generation and absorption of reactive power; relation between voltage, power and reactive power at a node, methods of voltage control; generator controllers-P-f and Q-V (qualitative treatment only)

7. VOLTAGE STABILITY: Basic concept; voltage collapse & prevention.

TEXT BOOK
REFERENCE BOOKS

OBJECTIVE
To give an idea about the basic concepts and fundamental principles involved in the communication of information. Its study involves the elements of communication systems which help to transform, process, and transmit the intelligence from one place to another place. It describes at the receiving end, the principles, methods, and systems required to retrieve the intelligence from the transmitted signal in its original form.

PREREQUISITE
A brief knowledge of mathematics (Trigonometry, Differentiation, and Integration) and basic knowledge of elementary signals.

1. INTRODUCTION TO COMMUNICATION SYSTEMS: Block diagram of basic Communication system, elements of basic communication system; modes and media of communication; Fourier analysis of signals; modulation and need for Modulation.
2. AMPLITUDE MODULATION: Linear modulation; amplitude modulation; depth of modulation; bandwidth and power calculations; generation and demodulation of AM, DSBS, SSB and VSB.
3. ANGLE MODULATION: Frequency and Phase modulation; narrow band and wide band FM; transmission bandwidth of FM; power calculations; direct and indirect methods of FM signal generation; demodulation of FM signals; slope detector; balanced slope detector; Foster-seely discriminator; pre-emphasis and De-emphasis.
4. RECEIVERS: TRF and super heterodyne receiver RF, mixer and IF stages; image frequency; choice of IF AGC; receiver characteristics & measurements; fading and diversity reception; special features of Communication Receivers.
5. PULSE ANALOG MODULATION: Sampling theory; PAM, PWM and PPM-generation and detection; TDM &FDM.
6. PULSE DIGITAL MODULATION: PCM; Signal to quantization noise ratio of a PCM; electrical representation of binary data; on-off, RZ, NRZ, Differential encoding; Manchester coding; DPCM, DM, ADM.
7. NOISE IN COMMUNICATION SYSTEMS: External noise; internal noise; S/N ratio. noise figure (Qualitative analysis).

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
Antenna and Wave propagation is an important field in communication engineering. Antennas deals with transmission and reception of radio waves. This course provides a unified treatment of the theoretical and practical aspects of antenna & wave propagation.

1. INTRODUCTION: Review of vector theory; gradient; divergence & curl; coordinate system; rectangular; cylindrical spherical and their transformation.
2. FUNDAMENTAL PARAMETERS OF ANTENNA: Radiation resistance; Radiation pattern; power density; beam width; Input Impedance; Gain; Directivity; Effective height; Effective aperture; polarization; bandwidth and antenna temperature.
3. WIRE ANTENNAS: Electromagnetic radiation, Retarded vector and scalar potential, Radiation from elementary dipole (Hertzian dipole) short dipole (Linear current distribution), halfwave dipole. Radiating Wire Structures: Folded dipole, monopole, bioxa, quad, antennas, loop antenna.
6. PROPAGATION OF RADIO WAVES: Different modes of propagation: Ground waves, space waves, space wave propagation over flat and curved earth, optical and radio horizons, surface waves and Troposphere waves. Ionosphere; Wave propagation in the Ionosphere; Critical frequency, Maximum usable frequency (MUF), skips distance. Virtual height.
7. APPLICATION OF ANTENNAS: Antennas in communication systems, Antennas in remote sensing, Antennas for bio medical application, antennas in Astronomy application, radar antennas.
TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
Microelectronics is a subfield of electronics and is related to the study and manufacture or micro fabrication of electronic components which are very small and is associated with integrated circuits (IC). The aim of the subject is to familiarize the students to focus on the upcoming field of VLSI which includes not only the fabrication process but also the designing of circuits by using MOSFETs.

1. INTRODUCTION TO MOSFETS: Structure & Operation of MOSFETs; enhancement type MOSFETs, (n-MOS & p-MOS); depletion type MOSFETs (n-MOS & p-MOS); equivalent circuit for MOSFET; CMOS.
2. MOS TRANSISTOR THEORY: MOS device; design equations; MOS transistor; Evaluation aspects of MOS transistor; threshold voltage; MOS transistor transconductance & output conductance; MOS transistor figure of merit; determination of pull up to pull down ratio for an n-MOS inverter driven by another nMOS inverter and by one or more pass transistor; alternative forms of pull up; CMOS inverter – DC characteristics; static load MOS inverters; Differential inverter pass transistor; transmission gates, tri-state inverter; Latch up in CMOS circuitry & Bi-CMOS Latch up susceptibility.
3. MOS CIRCUITS & LOGIC DESIGN: Basic physical design of simple logic gates using n-MOS; p-MOS & CMOS; CMOS logic gate design considerations, CMOS logic structures; clocking strategies.
4. CIRCUIT CHARACTERIZATION & PERFORMANCE ESTIMATION: Resistance estimation; capacitance estimation; inductance; switching characteristics; CMOS gate transistor sizing; power dissipation
5. SEMICONDUCTOR MEMORIES: Type of memories, shift register sequential memories MOS register stages; two phase ratio less shift-register stage; four phase ratio less register stage; CMOS register stage; a static shift register stage; a three phase static register; MOS-REAMS Organization of a RAM; parallelizing of semiconductor mem; integrated circuit chips; charged couple devices (CCD).
6. VLSI FABRICATION PROCESS: Crystal growth & wafer preparation; epitaxy; oxidation; diffusion; Dielectric & poly silicon film deposition; Metallization.
7. VLSI FABRICATION PROCESS: Lithograph, Etching, Ion implantation, yield & reliability; Design example using CMOS: Incriminator / decremementer, left / right shift serial / parallel register, comparator for two n-bit number, a two phase non-overlapping clock generator for two n-bit number; a two phase non overlapping clock generator with buffed output on both phases, design of an even driven (δ latch) element for EDL system.

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.
Check for minimum number of additions and test for typical data.

4. Write a program using 8085 for multiplication of two 8-bit numbers by bit rotation method and verify.

5. Write a program using 8085 for division of two 8-bit numbers by repeated subtraction method and test for typical data.

6. Write a program using 8085 for dividing two 8-bit numbers by bit rotation method and test for typical data.

7. Study of 8086 microprocessor kit

8. Write a program using 8086 for division of a defined double word (stored in a data segment) by another double Word division and verify.

9. Write a program using 8086 for finding the square root of a given number and verify.

10. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.

11. Write a program using 8086 and verify for:
   a. Finding the largest number from an array.
   b. Finding the smallest number from an array.

12. Write a program using 8086 for arranging an array of numbers in descending order and verify.

13. Write a program using 8086 for arranging an array of numbers in ascending order and verify.

14. Write a program for finding square of a number using look-up table and verify.

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.

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.

LIST OF EXPERIMENTS

1. Study of Amplitude Modulation and determination of modulation index.

2. Study of Frequency Modulation and determination of Modulation index.

3. Study of Phase Modulation.


5. Study of Pulse Width Modulation.


7. Study of Pulse Code Modulation.

8. Study of frequency shift keying.

9. Study of ASK and QASK.

10. Study of PSK and QPSK.

11. Project related to the scope of the course.

LIST OF EXPERIMENTS

1. Introduction to the simulation software, PSPICE.

2. To obtain the drain current of the enhancement PMOS using PSPICE. Also compare with theoretical value.

3. To obtain the noise margin of a CMOS inverter using PSPICE.

4. To obtain dynamic power dissipation of a CMOS inverter using PSPICE.

5. To obtain propagation delay of CMOS NAND gate using PSPICE.

6. To plot voltage transfer characteristics of a depletion load MOSFET with substrate connected to the ground.


9. To study the effect of change in temperature on CMOS inverter.

10. To study the effect of change in W/L ratio on CMOS inverter.

11. Study of power dissipation in Pseudo-NMOS inverter and comparison with CMOS inverter using PSPICE.

12. Evaluation of electrical parameters of an OPAMP.

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, Discrete 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
4. **Program Control Instructions**: Master Control Relay Instructions; Latching Relay instruction; immediate input output instruction; Jump and Label Instruction.

5. **PROGRAMMING TIMER & COUNTERS**: Pneumatic Timers; Cascading Timers; Allen Bradley PLCs Counters; Combining Timer & Counters.

6. **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 BOOKS**


**OBJECTIVE**

Embedded system can be defined as information processing systems embedded into enclosing products such as cars, tele-communication or fabrication equipment. Embedded computing systems have grown tremendously in recent years, not only in their popularity, but also in their complexity. The subject provides material for a first course on embedded systems. It details the basic hardware and software elements of an embedded systems followed by interfacing and software techniques to embed codes into the system book.

1. **INTRODUCTION**: Difference between microprocessor and Micro-controller; Embedded versus External memory devices; 8-bit and 16-bit microcontrollers; CISC and RISC Processors; Harvard and Von Neumann Architectures.

2. **8-BIT MICRO-CONTROLLER**: 8051 Architectures; Memory Organization and Registers; Integrated peripherals such as Timers/Counters; Serial port; Instruction set and Assembly language Programming; Interfacing by port mapping; Study of examples of micro-controllers.

3. **MICRO-CONTROLLERS RISC FARMILY PIC CONTROLLER**: Architecture; Memory organization; Interrupts; in-built controller features (ADC; PWM; Timer etc.) Assembly instruction set and introduction to C programming. Study of examples of PIC 16 F877.

4. **DEVELOPMENT TOOLS FOR EMBEDDED SYSTEMS**: Software development tools: Assembler, linker; simulator; compiler. Hardware development tools: Programmer; (EPROM programmer; Micro-controller; Universal Programmer) Logic Analyser; General purpose Evaluation Boards/Single Board Corn Hardware + Software combination tools; In circuit Emulator, Debugger.

5. **EMBEDDED C PROGRAMMING**: C programming for Micro-controller; Optimizing Techniques; Interrupt sub-routines in C; Design patterns for embedded C Programming; C Programming for MCS51.

6. **REAL TIME OPERATING SYSTEM (RTOS)**: Introduction to RTOS concept; Introduction to “Embedded Software development using RTOS.

7. **COMMUNICATION/NETWORKING STANDERDS FOR EMBEDDED SYSTEM**: UART (serial port); Buses like 12C, SPI; Ethernet network; Universal serial Bus (USB) controller Area Network (CAN).

**TEXT BOOK**


**REFERENCE BOOKS**

5. Design with PIC Microcontrollers by John B. Peatman, Pearson Education.
between electric strength of solids and time; Intrinsic breakdown strength.

3. **IMPULSE GENERATOR**: Specifications of an impulse voltage wave; Standard impulse; reasons for adopting the particular shape; Analysis and control of simple circuit of impulse generator; multistage impulse generator (Marks circuit) circuit working; earthing and tripping; techniques to observe wave front on C. R. O.

4. **GENERATION OF HIGH VOLTAGE**: Methods of generation of power frequency high voltage; cascade transformers and resonance methods; Methods of generation of High voltage D. C.; Voltage stabilization. Tesla coil.

5. **MEASUREMENT OF HIGH VOLTAGE**: Potential dividers-resistive; Capacitive and mixed dividers for high voltage. Sphere gap; Construction; mounting; Effect of nearby earthed objects; Humidity and atmospheric conditions; Effect of irradiation and polarity; Electrostatic voltmeter; Principle and classification; constructional details of an absolute electrostatic voltmeter; Oscilloscopes and their applications in high voltage measurement.

6. **HIGH VOLTAGE TESTING**: Measurement of insulation resistance of cables; Wet and dry flashover test of insulators; testing of insulators in simulated polluted conditions; testing off transformers and rotating machines; measurement of breakdown strength of oil basic techniques of non-destructive testing of insulators; measurement of loss angle; High voltage Schering Bridge and partial discharge measurement techniques.

7. **OVER VOLTAGE AND INSULATION COORDINATION**: Lightning; Switching and temporary over voltages; BIL; SIL; Methods of insulation coordination.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
Flexible AC transmission system (FACTS), a new technology, is based on power electronics. This subject enables one to enhance controllability, stability and power transfer capability of AC transmission systems.


2. **POWER ELECTRONICS CONTROLLERS**: Basics; challenges and needs; static power converter structures; AC controller based structures; D.C. link converter topologies; converter output and harmonic control; power converter control issues.

3. **SHUNT COMPENSATION**: Operation and control of SVC, STATCOM configuration, control & applications.

4. **SERIES COMPENSATION**: Principle of operation; application of TCSC for damping of electromechanical oscillations; application of TCSC for mitigation of sub-synchronous resonance; TCSC layout and protection; static synchronous series compensator (SSSC).

5. **UNIFIED POWER FLOW CONTROLLER**: Steady state operation; control and characteristics; introduction to transient performance; power flow studies in UPFC embedded systems; Operational constraints on UPFC.

6. **OTHER FACTS CONTROLLERS**: Circuit, model and operating features of Dynamic Voltage Regulator (DVR); Thyristor Controlled Braking Resistors (TCBR); Thyristor Controlled Phase angle Regulator (TCPAR); comparison of all FACTS Controllers.

7. **CONTROL STRATEGIES AND CO-ORDINATION**: Conventional control, Hysteresis control, Artificial Neural Network, fuzzy logic controls, comparison between different control schemes, co-ordination between different FACTS controllers.

**TEXT BOOK**

**REFERENCE BOOKS**

**EE-422**
**FLEXIBLE AC TRANSMISSION SYSTEM**

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**OBJECTIVE**
HVDC systems are quite reliable and converter control allows flexibility in the system operation as well as contributing to the improved performance of AC system. The course contents are designed to enable the students to make them familiar with the new technology.

1. **INTRODUCTION TO DEVICE**: Thyristor valve; valve tests; recent trends.

2. **COMPONENT MODELS FOR THE ANALYSIS OF AC/DC SYSTEMS**: General, converter model;
converter control; modeling of DC network; modeling of AC networks.

3. **ANALYSIS OF HVDC CONVERTERS**: Pulse number; choice of converter configuration; simplified analysis of graetz circuit; converter bridge characteristics; characteristics of a twelve-pulse converter; detailed analysis of converters with and without overlap.

4. **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.

5. **POWER FLOW ANALYSIS IN AC/DC QUANTITIES**: General; modeling of DC links; solution of DC load flow; per unit system for DC quantities, solution techniques of AC-DC power flow equations.

6. **CONVERTER FAULTS AND PROTECTION**: Introduction; converter faults; protection against over –currents; over-voltages in a converter station; surge arresters, protection against over-voltages.

7. **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.

**TEXT BOOK**


**REFERENCE BOOKS**


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<th>EE-431</th>
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**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 d.c. motor.

**TEXT BOOK**


**REFERENCE BOOKS**


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<th>EE-432</th>
<th>ADVANCED DIGITAL SYSTEM DESIGN WITH VHDL</th>
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**OBJECTIVE**

VHDL is a hardware description language that can be used to model a digital system. It contains elements that can be used to describe the behavior or structure of the digital system, with its timing. The course contents are designed to enable the students to make them familiar the language and design.

1. **INTRODUCTION TO VHDL**: The origins of VHDL; VHDL basics; benefits of VHDL; VHDL levels of abstraction; abstraction and timing; modeling hardware in VHDL; VHDL design
Fuzzy logic belongs to the consortium of soft computational methodologies. Fuzzy logic is a generalization of classical set theory. Fuzzy logic based representations used fuzzy set theory to handle uncertainty present in real world control applications. Fuzzy logic tremendous expressive power for modeling vagueness inherent in qualitative data. Fuzzy logic as a tool offers great potentials in addressing the need of robust controller to be used in modern industry. The objective of the course is to equip the students with this form of intelligent controller. The content of the course has been designed to enable them to design intelligent & robust controllers required in modern industry.

1. **INTRODUCTION**: Fuzzy control from an industrial perspective; knowledge-based controllers; knowledge representation in KBC's.
2. **THE MATHEMATICS OF FUZZY CONTROL:**
   Introduction of fuzzy sets; properties & operations on fuzzy sets; vagoness, fuzzy logic versus probability theory, fuzzy relations & operations on fuzzy relations; the extension principle; fuzzy propositions; compositional rule of inference; different implications; representing a set of rules.

3. **FKBS DESIGN PARAMETERS:**
   The FKBC architecture; choice of variables & content of rules; derivation of rules; choice of membership functions; choice of scaling factors; choice of fuzzification procedure; choice of defuzzification procedure; comparison and evaluation of defuzzification methods.

4. **NONLINEAR FUZZY CONTROL:**
   The Control Problem; the FKBC as a Non-Linear Transfer Element; Types of FKBC such as PID-like FKBC; Sliding Mode FKBC; Sugeno FKBC.

5. **ADAPTIVE FUZZY CONTROL:**
   Design & Performance Evaluation; approaches to design such as membership function tuning using gradient descent; membership function tuning using performance criteria; the self-organizing controller; model based controller.

6. **STABILITY OF FUZZY CONTROL SYSTEMS:**
   The state space approach; Stability and robustness indices; input-output stability, circle criterion, the conicity criterion.

7. **NEURO-FUZZY AND FUZZY NEURAL CONTROLLERS: NEURO–FUZZY SYSTEMS:**
   An unified approximate reasoning approach – Construction of rule bases by self learning; system structure and learning algorithm; a hybrid neural network based Fuzzy controller with self learning teacher.

**TEXT BOOK**


**REFERENCE BOOKS**


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**EE-442**

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**OBJECTIVE**

It is a well known fact that fossil fuels (coal, oil, natural gas) in the world are depleting very fast and eventually man will have to increasingly depend upon non-conventional sources of energy (solar-thermal systems, biogas, PV cells, wind energy etc.). Non-conventional sources of energy is one of the areas of emerging technologies which have higher priority with reference to national needs. The contents of this subject give concise description of some important non-conventional sources of energy.

1. **INTRODUCTION:**
   Global and National Energy Scenarios; concept of energy services; patterns of energy supply; energy resource availability; cultural, economic, and national security aspects of energy consumption. Forms and Characteristics of Renewable energy sources Energy Classification; Sources and Utilization, thermodynamic Power Cycles and Binary Cycles.

2. **SOLAR THERMAL ENERGY:**
   Solar radiation; flat plate collectors & their materials; effect of design parameters on performance; laws of thermal radiation; performance analysis of liquid flat plate collector; solar concentrating collectors; thermodynamic limits to concentration; solar thermal energy storage.

3. **SOLAR PHOTOVOLTAIC SYSTEM:**
   Photon energy; photo voltaic effect; efficiency of solar cell; limits to cell efficiency; semi-conductor materials for solar cells; solar photovoltaic system (SPS); standards for SPS; applications of PV system; solar photo voltaic in India.

4. **WIND ENERGY:**
   Basic principles of wind energy conversion; wind data and energy estimation; site selection considerations; basic components of a Wind Energy Conversion System (WECS); advantages of WECS; types of wind machines; performance of wind machines; applications of wind energy.

5. **BIOMASS ENERGY:**
   Biomass resources; liquid fuel (ethanol); biomass conversion technologies; bi-chemical conversion; biomass gasification; bio-gas; biogas plants; energy recovery from urban waste.

6. **GEO-THERMAL ENERGY:**
   Resources of geothermal energy; thermodynamics of geo-thermal energy conversion – electrical conversion and non-electrical conversion; environmental consideration.

7. **MAGNETO – HYDRODYNAMICS (MHD):**
   Principle of working of MHD power plant, performance and limitations.

**TEXT BOOK**


**REFERENCE BOOKS**


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**EE-443**

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<th>ARTIFICIAL INTELLIGENCE &amp; ROBOTICS</th>
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**OBJECTIVE**

The basics of Artificial Intelligence (AI) viz, search process, logic, knowledge representation and non-monotonic reasoning systems are included in the course. The topics of expert systems, knowledge engineering and ANN are designed to enable the students to make them familiar the applications of AI.

1. **INTRODUCTION TO AI:**
   Definition of Intelligence; Features of Intelligence; Difference between AI & human intelligence; AI problems; Characteristics of AI problems.
2. **AI PROBLEMS, PROBLEMS SPACES AND SEARCH:** Defining the problem as a state space search; Problem characteristics; Production system and its characteristics; Heuristic search technique – Hill climbing; Best-First Search; Constraint Satisfaction; Means end analysis.

3. **STRUCTURES AND STRATEGIES FOR STATE SPACE SEARCH:** Introduction; Graph Theory; Strategies for stable space search; Control and Implementation of state space search – Recursion Based Search; Pattern – Directed search.

4. **KNOWLEDGE REPRESENTATION:** Significance & issues in knowledge representation; Approaches to knowledge representation–Predicate logic; Semantic Net and Frame based representation.

5. **EXPERT SYSTEM:** Definition; Characteristics; Architecture and description of modules application areas; Software Tools used in expert System.

6. **REASONING UNDER UNCERTAINTY:** Fuzzy logic in Bayesian Networks; Dumpster-Shafer Theory as a tool for handling Uncertainty and probabilistic reasoning.

7. **INTRODUCTION TO ANN:** Overview of ANN – Characteristic Features of ANN; Artificial Neuron Models; Basic Building Blacks of ANN; Network Architecture Learning in Neural Networks Application of ANN.

**TEXT BOOK**

**REFERENCE BOOKS:**

**OBJECTIVE**
The field of digital image processing generally requires simulation and testing with large sets of sample images. The course contents are designed to enable the students to make them familiar with basics of image processing algorithms using modern tools. The mathematical analysis in image processing is also provided.

1. **INTRODUCTION:** Digital image; Steps of digital image processing system; Elements of visual perception; connectivity and relations between pixels; Image sampling and quantization; Representing Digital Image.

2. **IMAGE TRANSFORMS:** 2D orthogonal and unitary transforms-properties and examples. 2D DFT; FFT; DCT; Hadamard transform; Haar Transform; Slant transform; KL Transform-properties and examples.

3. **IMAGE ENHANCEMENT:** Point processing; Spatial filtering-in space and frequency; Nonlinear filtering; Color image processing fundamentals.

4. **IMAGE RESTORATION:** Image observation and degradation model; Circulant and block circulant matrices and its application in degradation model; Algebraic approach to restoration; Inverse by Wiener filtering; Generalized inverse-SVD and iterative methods; Blind deconvolution; Image reconstruction form projections.

5. **IMAGE COMPRESSION:** Redundancy and compression models loss less and lossy.

6. **IMAGE SEGMENTATION:** Edge detection; Line detection; curve detection; Edge linking and boundary extraction; boundary representation; region representation and segmentation; morphology-dilation; Erosion; Opening and closing.

7. **IMAGE UNDERSTANDING AND RECOGNITION:** Matching by templates; Classifiers-models; statistical; Neural network based; Matching shapes by contour and texture.

**TEXT BOOK**

**REFERENCE BOOKS**

**LIST OF EXPERIMENTS**
1. Familiarization with architecture & operation of 8 bit microcontroller
2. Study of functioning of different components of PLC in hardware.
3. To Interface the PLC with computer by using RS - 232.
4. To study the PLC software.
5. Write a ladder program in PLC software for basic stop/start circuit.
6. Write a ladder program in PLC software by using 5 digital inputs & one digital output & verify it by applying it on hardware.
7. Write a ladder program by using 4 digital inputs & one timer in series for a delay of 10 min. in output.
8. Write a ladder program by using counter Component.
9. Write ladder program in PLC software by using two timers in cascade.
10. Make a project by using PLC software and implement it on hardware.

**OBJECTIVE**
To provide an opportunity to the students to take up experiments/programs/exercises that would help strengthen their knowledge in the discipline in a broader sense.
A vast majority of unwanted equipment trips occur due to interruptions and voltage sags, which account for the phenomenon primarily affecting customer–power system interactions.

**OBJECTIVE**

This subject concentrates on the power quality phenomenon that primarily affects the customer–interruptions and voltage sags which account for the vast majority of unwanted equipment trips.

1. **OVERVIEW AND DEFINITION OF POWER QUALITY (PQ):** Sources of pollution, and regulations; power quality problems; rapid voltage fluctuations, voltage unbalance; voltage dips and voltage swells; Short duration outages.

2. **DEFINITIONS VOLTAGE SAG ANALYSIS AND MITIGATION:** Sag caused by motor starting; sag caused by utility fault clearing, sag mitigation, Sag magnitude and duration calculations; RMS voltage; peak examples of sag magnitude; calculation in single–phase systems; equipment performance in presence of sag; computers, AC and DC drives.

3. **HARMONICS:** Effects within the power system; interference with communication Harmonic Measurements; Harmonic elimination.

4. **HARMONICS DISTORTION:** Power system harmonics; harmonic analysis; Harmonic sources–the static converters; transformer magnetization and non-linearities; rotating machines; arc furnaces; fluorescent lighting; introduction to power converters; Fourier analysis; Total harmonic distortion; rms and average value calculations; Arching and saturable devices; effects of harmonic distortion; system response characteristic.

5. **PRINCIPLES FOR CONTROLLING HARMONICS:** Locating sources of harmonics; passive and active filters; Harmonic filter design.

6. **MONITORING POWER QUALITY:** Monitoring essentials; Power quality measuring equipment; current industry trends.

7. **POWER CONDITIONING:** Electric power conditioning; active and passive filters; IEEF, IEC, ANSI, standards; power acceptability curves; various standards.

**TEXT BOOK**


**REFERENCE BOOKS**


**OBJECTIVE**

Machine design through CAD is quite reliable and allows flexibility in designing of various types of electrical machines. It also contributes to improve the performance of electrical machine. Course has been designed to enable the students to make them familiar with new technology.


2. **MATERIALS:** Conducting, magnetic and insulating materials.

3. **MAGNETIC CIRCuits:** MMF calculation for air gap and teeth of electrical machines, Real and apparent flux densities, Iron Losses, field form, Leakage flux, Specific permeance.

4. **DESIGN OF TRANSFORMERS:** Output equations, Types of transformer windings, Design of core, windings and tank, Performance calculations.

5. **CONCEPTS AND CONSTRAINTS IN DESIGN OF ROTATING MACHINES:** Specific loading, output equation and output coefficient, Effect of variation of linear dimension, Winding for DC & AC machines and their layout.

6. **DESIGN OF ROTATING MACHINES:** Calculation of D & L for DC, Introduction of synchronous
machines, length of air gap, design of field coils for DC and synchronous machines, Selection of rotor slots of squirrel cage induction motor, design of bars and ends, Design of rotor for wound rotor for induction motors, design of commutator and inter poles for DC machines, Windings

7. COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES: Analysis and synthesis approaches, design algorithms, introduction to Optimization techniques, implementing computer program for design of three phase induction motor.

TEXT BOOKS

REFERENCE BOOKS

EE-463 CONTROL SYSTEM DESIGN

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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.

1. REVIEW OF SYSTEMS: Review of first and higher order systems closed and open loop response; response to step, impulse and sinusoidal disturbances.

2. STABILITY ANALYSIS IN FREQUENCY DOMAIN: Frequency response; correlation between time & frequency response; Design specifications in frequency domain – gain margin; phase margin, resonance frequency; bandwidth; PID controller design in frequency domain.

3. SYSTEM STABILITY: Stability analysis from impulse response; Routh-Hurwitz Criteria; Nyquist stability criteria; bode plot; system with time delays.


5. COMPENSATION DESIGN: Necessity of compensation; effects of compensations; compensation networks such as lag; lead, lead-lead compensation design using root locus techniques.

6. POLE – PLACEMENT DESIGN & STATE OBSERVERS: Introduction; stability improvement by state feedback; conditions for pole – placement; state regulator design; Design of state observers.

7. DESIGN OF DIGITAL CONTROL ALGORITHMS:
Z-plane specifications of control system design; digital compensator design using frequency response plots; root locus plots.

TEXT BOOK

REFERENCE BOOKS

EE-481 MAJOR PROJECT

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PHASE-I

OBJECTIVE
The project involves in-depth study on the topic, design, development, analysis fabrication and/or experimental work – Hardware and/or Software. It is intended to give an opportunity to a student to apply his knowledge to solve real-life problem. The student has to select a project work based on a topic of interest.

OPERATION
Major Project shall comprise of Phase-I and Phase-II, spread over Term-XI and Terms-XII respectively. The students may work jointly (small group) or individually.

EE-482 MAJOR PROJECT

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PHASE-II

Refer to EE-481 for details.

EE-483 INTERNSHIP - I

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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.

Students shall be free to select any operating system, programming language and database tools for accomplishing the given problem successfully.

Marks of this course shall be given in the marks memorandum of next term.

Refer to EE-483 for details

EE-484
INTERNSHIP - II
L T P Cr
0 0 24 12

EE-485
INTERNSHIP DOCUMENTATION
L T P Cr
0 0 6 3

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.

Refer to EE-494 for details

EE-486
SEMINAR –I
L T P Cr
0 0 2 1

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.

EE-487
SEMINAR-II
L T P Cr
0 0 2 1

Refer to EE-494 for details

EE-491
COMMUNITY SERVICE ORIENTED PROJECT
L T P Cr
0 0 2 1

OBJECTIVE
The student(s), either individually or in groups, are expected to take up a project that uses engineering and/or technological principles related to the field of study and that should be useful for solving real life problems in their neighbourhood.

The student has to go through some process of minimal level of evaluation and also the minimum attendance requirement, as stipulated by the Course Coordinator/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.

EE-492
PROJECT (INCLUDING SEMINAR)
L T P Cr
0 0 4 2

A student may perform experimental/design task of relatively minor intensity and scope as compare to the major project. The project may be extended to Major Project.

EE-493
INDUSTRIAL TRAINING/FIELD TRAINING
L T P Cr
0 0 2 1

OBJECTIVE
To carry out training for a period of two months i.e. Summer Term after Term-IX in industry (private or public)/ research laboratory/organization of repute, on platforms learnt till the completion of 3 years of bachelor degree.

METHODOLOGY
The students shall demonstrate their ability to understand a given problem and to innovatively bring out solution.

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, Thevenin’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; 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.

EE-494
SEMINAR-I
L T P Cr
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EE-495
SEMINAR-II
L T P Cr
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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, Thevenin'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; 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.


INDUCTION 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 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 sumpner’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.
LIST OF EXPERIMENTS:
1. To find turns ratio and polarity of a 1-phase transformer.
2. To perform open and short circuit tests on a 1-phase transformer.
3. To perform Sumpner's Back to back test on 1-phase transformers.
4. Parallel operation of two 1-phase transformers.
5. To convert three phase to 2-phase by Scott-connection.
6. To perform load test on DC shunt generator.
7. Speed control of DC shunt motor.
8. Swinburne's test of DC shunts motor.
9. Hopkinson's test of DC shunt M/Cs.
11. To plot o.c.c. Of D.C. Shunt generator.

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.

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; LVDTs; dc and ac servomotors; tacho-generators; electrohydraulic valves; hydraulic servomotors; electro pneumatic 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 crossover and phase crossover 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
Nagrath and Gopal, "Control System Engineering", New Age International, 2005

REFERENCE BOOKS
OBJECTIVE
Providing a sound understanding of the fundamental concepts of power electronics devices, their characteristics, 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 cks.; equalisation of current in parallel connected SCRs; string efficiency; derating factor; Devices used in control circuits; protection of SCRs against di/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; output 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; output 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-converters; 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.

REFERENCE BOOKS
1. Bimbhra P.S., “Power Electronics” Khanna Publisher, 2009

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

PRE-REQUISITES
Knowledge of electrical technology and electrical machines-1

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 n.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.; schrage motor; disc motors; printed circuit motors.

**TEXT BOOK**

**REFERENCE BOOKS**

**EL-351**
CONTROL SYSTEMS LAB

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**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**

**EL-352**
POWER ELECTRONICS LAB

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**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**

**EL-355**
ELECTRICAL MACHINES-II LAB

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**LIST OF EXPERIMENTS**
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

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<tr>
<th>EN-101</th>
<th>COMMUNICATION SKILLS</th>
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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
3. Remedial English Grammar; Common Errors and Rules of Concord
4. Phonetics; Basic Concepts; Vowels; Consonants; Syllables; Manner of Articulation and Place of Articulation; Speech Sounds; Transcription of Words ; Word Stress and Intonation
5. Comprehension; Interpretation of Seen/Unseen Passages
6. (A) Oral Communication: Practicing short dialogues; Group Discussions; and Debates (B) Technical Writing: (i) Business Letters (Format of Business Letters and Business Letter Writing) (ii) Email Writing (iii) Reports and types of reports and Press reports
7. Book Review (for internal assessment)
Language lab: Emphasis will be laid on accent, pronunciation, intonation, reading/ listening comprehension

TEXT BOOK

REFERENCE BOOKS

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<thead>
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<th>EN-151</th>
<th>LANGUAGE LAB</th>
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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.

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<th>MA-101</th>
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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 various engineering subjects.

1. MATRICES & ITS APPLICATIONS: Rank of a matrix; elementary transformations; elementary matrices; inverse using elementary transformations; normal form of a matrix; linear dependence and independence of vectors; consistency of linear
system of equations; linear and orthogonal transformations; Eigen values and Eigen vectors; properties of Eigen values; Cayley - Hamilton theorem and its applications.

2. **INFINITE SERIES**: Convergence and divergence; comparison; D’ Alembert’s ratio; Integral; Raobes; De Morgan’s & Bertrand’s; logarithmic and Cauchy root tests; alternating series; absolute and conditional convergence.

3. **APPLICATIONS OF DIFFERENTIATION**: Taylor’s and Maclaurin’s series; asymptotes; curvature.

4. **PARTIAL DIFFERENTIATION**: Functions of two or more variables; partial derivatives; total differential and differentiability; derivatives of composite and implicit functions; Jacobian’s; higher order partial derivatives.

5. **APPLICATION OF PARTIAL DIFFERENTIATION**: Homogeneous functions; Euler’s theorem; Taylor’s series for functions of two variables (without proof); maxima-minima of function of two variables; Lagrange’s method of undetermined multipliers; differentiation under integral sign.

6. **FOURIER SERIES**: Euler’s formula; conditions for a Fourier expansion; change of interval; Fourier expansion of odd and even function; Fourier expansion of square wave; rectangular wave; saw-toothed wave; half and full rectified wave functions; half range sine and cosine series.

7. **ORDINARY DIFFERENTIAL EQUATIONS & ITS APPLICATIONS**: Exact differential equations; equations reducible to exact differential equations; applications of differential equations of first order and first degree to simple electric circuits; Newton’s law of cooling; heat flow and orthogonal trajectories.

**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**

**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: Gaussian elimination method; Gauss-Jordan method; UV factorization; Jacobi's method; Gauss-Seidel 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
3. Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India

ME-101 ENGINEERING MECHANICS L T P Cr
5 1 0 4

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.

2 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.

3 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.

4 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.
5. **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.

6. **TORSION OF CIRCULAR SHAFTS, TORSION FORMULA POWER TRANSMISSION**

7. **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-flexure 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.

7. **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.

**TEXT BOOK**

**REFERENCE BOOKS**

**WEB REFERENCES**
www.eCourses.ou.edu

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<th>ME-152</th>
<th>WORKSHOP PRACTICE</th>
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**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.
7. **FITTING AND MAINTENANCE:** Study of fitting tools, marking tools and measuring instruments like micrometer, vernier calipers and height gauge; introduction to some basic maintenance techniques/processes.

**TEXT BOOK**

**REFERENCE BOOK**

**NOTES**
1. In all sections of workshop, students will study about the tools used, different operations performed and main parts of the machine
2. Term final evaluation will be done on the basis of doing a practical job and viva-voce. There will be no theory paper on this subject.

**JOBS TO BE DONE**
A. **Machine Shop**
1. To prepare a job on a lathe involving facing, turning, taper turning, step turning, radius making and parting off.
2. To prepare horizontal surface/ vertical surface/ curved surface/ slot or v-grooves on a shaper / planer.
3. To prepare a job involving side and face milling on a milling machine.
4. To prepare a job involving drilling and tapping of holes.

B. Sheet Metal Work
1. To draw layout, do marking and prepare a rectangular tray of sheet metal.
2. To draw layout, do marking and prepare a funnel of sheet metal.

C. Foundry
1. To prepare a single piece pattern mould, put metal in the mould and fettle the casting.
2. To prepare a split piece pattern mould.

D. Welding
1. To prepare joints (Lap and butt) by metal arc welding
2. To prepare welded joint by resistance welding

E. Fitting and Maintenance Jobs
1. Fitting jobs involving, chipping, filing, marking and measuring with precision instruments.
2. Maintenance and repair of common domestic appliances such as desert cooler, LPG stove, room heater, water tap, flush system, electric iron, scooter etc.

ME-153 ENGINEERING GRAPHICS

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<thead>
<tr>
<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>
<td>1</td>
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<tr>
<td>2.</td>
<td>Projection of Lines including traces.</td>
<td>2</td>
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<tr>
<td>3.</td>
<td>Projection of Planes.</td>
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<td>4.</td>
<td>Projection of Solids.</td>
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<tr>
<td>5.</td>
<td>Section of solids.</td>
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<tr>
<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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PH-101 PHYSICS

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<th>Sl. No.</th>
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<tbody>
<tr>
<td>1.</td>
<td>Interference: Interference by division of wave front; Fresnel's biprism 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.</td>
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<td>2.</td>
<td>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.</td>
<td>2</td>
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<tr>
<td>3.</td>
<td>Polarization: Polarised and unpolarized light; double refraction; Nicol prism; quarter and half</td>
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wave plates; optical activity; Dextro and Leavo rotary; specific rotation; biquartz and Laurent’s half-shade polarimeters.

4. 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.

5. 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.

6. 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.

7. ULTRASONICS: Production of ultrasounds by magnetostriction and piezoelectric oscillator methods; detection of ultrasounds by Kundt’s tube and acoustic grating method.

TEXT BOOK

REFERENCE BOOKS
1. Sears, F.W., “Electricity and Magnetism”, Narosa
7. Wehr, Richards and Adair, “Physics of the Atom”, Narosa

**PH-102**

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<th>APPLIED PHYSICS</th>
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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 \( \frac{3}{2} kT \) of free electrons (3D); Fermi-Dirac distribution function; thermionic 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; liquification 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 paramagnetism; 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**

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**LIST OF EXPERIMENTS**

The experiments in 1st term will be based mainly upon optics, electrostatics, wave and oscilations 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 biprism 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 sonometer.
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 semiconductor.
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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<td>ESSENTIALS OF COMMUNICATION OBJECTIVE (BRIDGE COURSE)</td>
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<td>MATHEMATICS (MAKEUP COURSE)</td>
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<tr>
<td><strong>MA-291</strong></td>
<td>MATHEMATICS (BRIDGE COURSE)</td>
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### EN-291

**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”

### MA-191

**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 up gradation 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**

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>
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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:
3. Sandler, “Teach Yourself MS Office”, BPB Publications
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.

**REFERENCE BOOKS**


**PD-193**

**ENTREPRENEURIAL & PROFESSIONAL SKILLS**

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**OBJECTIVE**

To empower the students with entrepreneurial skills, behaviour, grooming and effective interaction at the workplace.

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; 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.

**PD-251**

**MATLAB**

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**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 body; comment lines; saving a function files; using a function file; programming in MATLAB.
B.Tech. Electrical & Electronics Engineering (Regular)

**TEXT BOOK**

**REFERENCE BOOK**

**CO-CURRICULAR ACTIVITIES**

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Refer to PD-191 for details.

**EFFECTIVE COMMUNICATION**

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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.

**INTRA & INTER-PERSONAL SKILLS**

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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.
BASIC PRINCIPLES OF BOOK-KEEPING AND ACCOUNTS

**OBJECTIVE**

Businesses own things such as motor vehicles, buildings, machinery and similar items etc. Customers also owe the business money, and the business also owes money to the suppliers for goods and for such items such as lighting bills. It would be impossible for the owner of the business to keep all these things in his memory. He will, therefore, have to make certain that details are written down. This Value Addition course concentrates on basic principles of book-keeping and accounts.

1. **NEED FOR BOOK-KEEPING:** Need for book-keeping; types of books required for accounting; statutory requirement for book keeping; importance of book of accounts for – obtaining bank finances, for joining partners or selling business; types of accounting information & their importance – operating information, financial accounting information and managerial accounting information.

2. **FUNDAMENTAL ACCOUNTING CONCEPTS:** Assets; liability; equity; the accounting equation; to analyse basic business transaction; revenue and expenses.

3. **RECORD KEEPING AND ACCOUNTING PROCESS:** Single entry and double entry system; preparation of accounts in T-form; balancing “off” accounts; division of ledger.

4. **TRIAL BALANCE, TRADING, AND PROFIT & LOSS ACCOUNT:** Need and uses of Trial balance; preparation of financial statement; importance of trading & profit and loss amount; importance & preparation of balance sheet; linking profit and loss account and balance sheet.

5. **DEPRECIATION OF FIXED ASSETS:** Concept of depreciation & its importance; calculation of depreciation; use of depreciation in calculation of profit.

6. **ACCOUNTING RATIOS:** Different accounting ratios and their importance in understanding the business health.

7. **EFFECT OF COMPUTERS ON BOOK KEEPING & ACCOUNTS:**

**TEXT BOOK:**

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ADVANCED PROFESSIONAL DEVELOPMENT

**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.

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**REFERENCE BOOKS**


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**ADVANCED PROFESSIONAL CO-CURRICULAR ACTIVITIES**

**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.

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**ADVANCED PROFESSIONAL PROBLEM SOLVING SKILLS**

**OBJECTIVE**

To enable a student comprehend short and long passages from the perspective of solving questions based on the passage.

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.

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<thead>
<tr>
<th>PD-455</th>
<th>COMPUTER AND INFORMATION MANAGEMENT</th>
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**OBJECTIVE**
Today’s manager realizes that information is the driving force for any business. Management must take decisions that directly influence the goals of the business organization. Business that effectively use information to manage and impart decision making will decidedly have the competitive advantage. The aim of this subject is to provide not only the theoretical context and the typical case studies but also follow a pragmatics approach for a manager to effectively use the information systems. This Value-Addition-Subject covers all practical aspects of information system for managerial activities.

**OVERVIEW OF MANAGEMENT AND ORGANISATION:** Data, information and knowledges: latest trends in information technology.

**MANAGEMENT INFORMATION SYSTEM:** Information as a critical organization re-source; concept of information management; planning, organization control and management of information; decision support system (qualitative treatment).

**COMPUTER AND DATA MANIPULATION:** Database management; data communications; band width & information theory.

**MAJOR COMPUTERISED INFORMATION SYSTEM:** Financial application; Human resource development application; inventory application; marketing application.

**TEXT BOOK**

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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.

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<th>AE-411</th>
<th>TRANSPORT MANAGEMENT</th>
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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; Safely 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
B.Tech. Electrical & Electronics Engineering (Regular)

BA-271 | HUMAN RESOURCE MANAGEMENT | L T P | Cr
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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 QC 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 Egalitarianism; Testing alignment of the HR system-HR deliverables.

TEXT BOOK

REFERENCE BOOKS

BA-272 | ENTREPRENEURSHIP DEVELOPMENT | L T P | Cr
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| | 5 0 0 | 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 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

CE-471 | ADVANCED TRAFFIC ENGINEERING | L T P | Cr
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OBJECTIVE
To introduce the students about various modern traffic engineering and management problems and their solutions.

1. INTRODUCTION AND TRAFFIC CHARACTERISTICS: Objectives and scope of traffic engg. Organisational set up of traffic engg department in India. Importance of traffic.
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. syllabus.icbse.com/jntu/19-TRANSPORTATION%20ENGINEERING.pdf2.
2. www.nitkkr.ac.in/WebCivil/Civil_syllabus.doc

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; modem 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; topography; 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
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; inergranular 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

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.


7. **ILLUMINATION, SHADING, IMAGE MANIPULATION**: Illumination models, shading models for polygons, shadows, transparency; what is an image, filtering, image processing, geometric transformation of images.

**REFERENCES**

**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/p 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

**EC-401 | MOBILE COMMUNICATION | LTP | Cr | 5 | 0 | 0 | 3**

**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. **CDMA IN MOBILE COMMUNICATION SYSTEMS**: 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 BOOKS**

**EE-401 | PROGRAMMABLE LOGIC CONTROLLERS & SCADA | LTP | Cr | 5 | 0 | 0 | 3**

**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.

8. **INTRODUCTION**: Programmable Logic Controller; advantages of PLCs Over Relay System; input output Section – Fixed input output, Modular input output, Discrete input output Modules, Analog input output Modules.
9. **PROCESSOR UNIT**: Processor; Memory types; Guarding against Electro Static Discharge; Peripherals; Memory Organization.
10. **PROGRAMMING DEVICES**: Programming Devices; Dedicated Desktop Programmes; Hard Held Programmes; Computer Programmes
11. **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
12. **Program Control Instructions**: Master Control Relay Instructions; Latching Relay instruction; immediate input output instruction; Jump and Label Instruction.
13. **PROGRAMMING TIMER & COUNTERS**: Pneumatic Timers; Cascading Timers; Allen Bradley PLCs Counters; Combining Timer & Counters.
14. **SCADA**: Introduction; Concept of Automatic Scada; Architecture of Scada; Hierarchical of Supervisory Control & Data Acquisition System; Technology Available; Data Acquisition Unit; Remote Technical Unit.

**EE-431 | INDUSTRIAL ELECTRONICS | LTP | Cr | 5 | 0 | 0 | 3**

**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 compensation; 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.

<table>
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<td>EL-421</td>
<td>RENEWABLE ENERGY SOURCES &amp; ENERGY CONSERVATION</td>
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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-REQUISITES  
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  
EL-422  HIGH VOLTAGE DC TRANSMISSION  L T P Cr  5 0 0 3

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.

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

EL-423  HIGH VOLTAGE ENGINEERING  L T P Cr  5 0 0 3

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; 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.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
Arrillaga, J., “High voltage D.C.Transmission”, Peter Peregrinus Ltd, 1996

TEXT BOOK

75
B.Tech. Electrical & Electronics Engineering (Regular)

REFERENCE BOOKS

EN-471 | PROFESSIONAL COMMUNICATION | L T P Cr
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| 5 0 0 | 3

EN-472 | BUSINESS COMMUNICATION | L T P Cr
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| 5 0 0 | 3

OBJECTIVE
The object 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

The following four lessons are prescribes for textual study:
1. The Year 2050
2. Human Environment
3. The Discovery

REFERENCE BOOKS

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
3 Ramesh M. S. and Pattanshetti C. C., “Effective Business English and Correspondence”, R. Chand & Co.
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

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.
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

<table>
<thead>
<tr>
<th>MA-472 ADVANCED HIGHER ENGINEERING MATHEMATICS</th>
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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 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; 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 coordinates; Tensor of order zero; Kronecker Delta; Contravariant and Co-variant tensors; Quotient law; Riemannian space; Conjugate

relations; Fuzzy sets; Basic operations of fuzzy sets.

1. 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.
2. NUMBER THEORY: Basic properties; Divisibility theory; Congruences; Chinese remainder theorem; Fermat's little theorem; & functions.
3. COMBNATORIC: Fundamental principal of counting; Pigeonhole principle; Multinomial coefficients; Recurrence relation; Generating functions.
4. 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.
5. 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.
6. 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.
REFERENCE BOOKS


OBJECTIVE

To acquaint the students with the various concepts and tools of advanced 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; Householder'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-474 | OPERATION RESEARCH | L T P | Cr
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5 0 0 | 3

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: 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 waiting 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; EQQ 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
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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 lead to changes in work activity; safety and product design; Case studies will include advanced computer application; work place assessment; accidents; analysis and industrial inspection.

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

REFERENCE BOOKS
1. Knoz Stephana, Johnson Steven, Halconts "Work Design - Industrial Ergonomics", Hathway, Scottsdagta, AZ
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; Largrangean 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**

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**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**
Tiwari G. N. and Ghosal M. K., "Renewable Energy Resources", Narosa Publishing House

**REFERENCE BOOKS**
4. Sharma P. C., “Power Plant Engineering”, S. K. Kataria and Sons

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<th>PH-471</th>
<th>NON Destructive Testing Techniques</th>
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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 imitations.
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.

**TEXT BOOK**

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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 nano-materials; 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 NANO-MEDICINE: 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, nanotechnologies and cancer treatment, implants and Prosthetics.

5. NANO-FABRICATION: 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
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

LINGAYA’S UNIVERSITY
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(u/s 3 of UGC Act 1956)

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