Important

Academic Rules

Scheme of

Studies & Syllabus

B.Tech. Degree Programme
Electronics & Communication Engg.
(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/tests.
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.
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 in any form whatsoever, including possible misinformation etc., the matter will be reported to the AC, recommending revoking the admission of the candidate.
- The minimum credit requirement for the B.Tech. Degree Programme is 190. However, considering a case for award of honours the minimum credits will be 195.
- The project will be assigned in tenth term. It may be extended to Major Project. The Major Project shall comprise of Phase-I and Phase-II, spread over eleventh and twelfth terms respectively. Appropriate double-letter grade is awarded as per the evaluation scheme which will be considered for TGPA and CGPA calculations. It is recommended that an external expert from industry/academia may be a member of the evaluation team of four persons (two professors, external expert and respective project guide).
- MLC must be completed by a student at appropriate time or at his convenience. The 'S' grade is awarded for satisfactory completion of the course and 'N' grade is awarded for non-satisfactory completion of the course. In case 'N' grade is awarded, the student has to re-register for the same course if no alternative options are available. However, one can opt for other courses if provided with multiple options. The 'S' and 'N' grades do not carry grade-points and, hence, are not included in the TGPA and CGPA computations.

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 schedule of academic activities for 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 with less attendance in a course during a term, in lectures, tutorials and practicals taken together as applicable, shall be awarded 'FF' grade in that course, irrespective of his academic performance, and irrespective of the nature of absence.
- If the period of leave is more than three days and less than two weeks, prior application for leave shall have to be submitted to the HOD concerned, with the recommendation of the Faculty-Advisor, stating fully the reasons for the leave requested, along with supporting documents.
- If the period of leave is two weeks or more, prior application for leave shall have to be made to the DAA with the recommendations of the Faculty-Advisor and HOD concerned stating fully the reasons for the leave requested, along with the supporting documents. The DAA may, on receipt of such application, grant leave or decide whether the student be asked to withdraw from the course for that particular term because of long absence.
- If a student fails to apply and get sanction for absence as in the above two cases, his parent/guardian may apply to the VC with reasons duly recommended by the Faculty Advisor, HOD and DAA and explain in person to the VC the reasons for not applying in time. The VC will consider on merit and decide to grant the leave or withdraw the student from the course(s) concerned. The student may be asked to withdraw from the course for that particular term based on the merits.
- If a student is absent from ETE of a course(s) on medical ground and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes scheduled in each course to appear in the examination.

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 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 in awarding this highest 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

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>N</td>
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<td>Unsatisfactory</td>
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Activities, NCC/NSS activities, etc. and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes scheduled in each course to appear in the examination.

In case of absence from ETE of a course(s) on medical ground and/or any 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 be 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.

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.

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.

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

#### 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:

#### 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:

#### 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:

#### 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:

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 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:
  1. **TGPA** which is the Term Grade Point Average
  2. **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:
  1. 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.
  2. There shall be a minimum earned credit requirement on all Departmental Core courses, Elective courses and Major Project/Internship as specified by BOS.
  3. The CGPA at the end of programme is atleast 5.0.
  4. 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:

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<tr>
<th>CHECK POINT</th>
<th>CREDIT THRESHOLD**</th>
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<tr>
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<td>End of FOURTH year</td>
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</table>

* A student may be given one more chance to cover the shortfall in the threshold during the following summer term as follows:
  1. If a student earns 12 credits or more but less than 20 at the end of first year.
  2. 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 Electronics & Communication Engineering

DEGREE OBJECTIVE

The B. Tech. degree programme aims at providing a strong foundation in theoretical, practical and design aspects of Electronics and Communication Engineering (EC). The curriculum covers all areas of electronics and communication engineering under the broad categories of electronic circuits, electronic devices, signal processing and communication. The syllabus comprises of theory and laboratory courses under these categories. The theory course can be either a core or an elective course. Each theory course has a laboratory component, which provides a balanced mix of quality teaching of theoretical concepts and experimental verification of the learnt concepts.
# CATEGORY-WISE LIST OF COURSES

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# B.Tech. Electronics & Communication Engineering (Regular)

## Open Elective (OE)

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## Project/Internship, Seminar Training, CSOP

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# Scheme of Studies

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

## 1st Year

### TERM – I

#### THEORY

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#### PRACTICAL/DRAWING/DESIGN

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

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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

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### PRACTICAL/DRAWING/DESIGN

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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.

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

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

#### 1st Year

**TERM – III**

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

**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.

**Group TOTAL Contact Hours**

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Department of Electronics & Communication Engineering  
Scheme of Studies  
B. Tech. Degree Programme (Regular)

2nd Year

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** 20-3-6 (29)  ** 18

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** 20-1-6 (27)  ** 16

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** 20-3-8 (31)  ** 19+1*

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

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20-1-8 (30) 17

#### TERM – VIII

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<td>PD-391</td>
<td>Co-curricular Activities</td>
<td></td>
<td>1*</td>
</tr>
</tbody>
</table>

20-3-6 (29) 18+1*

### 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 Electronics & Communication Engineering  
Scheme of Studies  
B. Tech. Degree Programme (Regular)  
(PROJECT MODE)

**4th Year**

<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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</thead>
<tbody>
<tr>
<td>1</td>
<td>EC-401</td>
<td>Mobile Communication</td>
<td>5-0-0</td>
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<tr>
<td>2</td>
<td>EC-402</td>
<td>Microwave and Radar Engineering</td>
<td>5-0-0</td>
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<tr>
<td>3</td>
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<td>Dept. Elective-I</td>
<td>5-0-0</td>
<td>3</td>
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<tr>
<td>4</td>
<td>EC-491</td>
<td>Community Service Oriented Project (CSOP)*</td>
<td>0-0-2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>EC-492</td>
<td>Project (including Seminar)</td>
<td>0-0-4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>EC-451</td>
<td>Mobile Communication Lab</td>
<td>0-0-2</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>EC-452</td>
<td>Microwave &amp; Radar Engineering Lab</td>
<td>0-0-2</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>EC-493</td>
<td>Industrial Training/Field Training**</td>
<td>0-0-2</td>
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<tr>
<td>9</td>
<td>PD-454</td>
<td>Microprocessor and DSP Based Systems</td>
<td>0-0-2</td>
<td>1</td>
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<tr>
<td>10</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
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**TERM – X**  
15-0-14 (29)  
16

<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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</thead>
<tbody>
<tr>
<td>1</td>
<td>Dept. Elective-II</td>
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<td>5-0-0</td>
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<td>2</td>
<td>Open Elective</td>
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<td>5-0-0</td>
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<td>3</td>
<td>EC-453</td>
<td>Satellite &amp; Optical Communication Lab</td>
<td>0-0-2</td>
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<tr>
<td>4</td>
<td>EC-481</td>
<td>Major Project Phase-I***</td>
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<td>Seminar – I****</td>
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**TERM – XI**  
10-0-14 (24)  
13

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<th>Cr.</th>
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<tbody>
<tr>
<td>1</td>
<td>EC-404</td>
<td>Data Communication</td>
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<td>Dept. Elective-III</td>
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<td>5-0-0</td>
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<td>4</td>
<td>EC-454</td>
<td>Data Communication Lab</td>
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<tr>
<td>5</td>
<td>EC-482</td>
<td>Major Project Phase-II</td>
<td>0-0-6</td>
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<td>6</td>
<td>EC-495</td>
<td>Seminar – II*****</td>
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<td>7</td>
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<td>Co-curricular Activities</td>
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**TERM – XII**  
15-1-10 (26)  
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.  
*** 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.
Department of Electronics & Communication Engineering  
Scheme of Studies  
B. Tech. Degree Programme (Regular)  

(INTERNERNSHIP MODE)  

4th Year  

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course No.</th>
<th>Course Name</th>
<th>L-T-P</th>
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<tr>
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<td>EC-401</td>
<td>Mobile Communication</td>
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<td>2</td>
<td>EC-402</td>
<td>Microwave &amp; Radar Engineering</td>
<td>5-0-0</td>
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<td>5-0-0</td>
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</tr>
<tr>
<td>4</td>
<td>EC-491</td>
<td>Community Service Oriented Project (CSOP)*</td>
<td>0-0-2</td>
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<td>5</td>
<td>EC-492</td>
<td>Project (includes Seminar)</td>
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<td>6</td>
<td>EC-451</td>
<td>Mobile Communication Lab</td>
<td>0-0-2</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>EC-452</td>
<td>Microwave &amp; Radar Engineering Lab</td>
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<tr>
<td>8</td>
<td>EC-483</td>
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<tr>
<td>9</td>
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<td>Microprocessor and DSP Based Systems</td>
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<tr>
<td>10</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
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** 15-0-14 (29)  

<table>
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<th>Course No.</th>
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<th>L-T-P</th>
<th>Cr</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>EC-494</td>
<td>Seminar – I***</td>
<td>0-0-2</td>
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<tr>
<td>2</td>
<td>EC-484</td>
<td>Internship – II (in industry)</td>
<td>0-0-24</td>
<td>12</td>
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<td>PD-491</td>
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0-0-26 (26)  

<table>
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<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>EC-404</td>
<td>Data Communication</td>
<td>5-1-0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Dept. Elective-III</td>
<td>5-0-0</td>
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<td>3</td>
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<td>Dept. Elective-IV</td>
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<td>4</td>
<td>EC-454</td>
<td>Data Communication Lab</td>
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<td>EC-485</td>
<td>Internship Documentation</td>
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<td>6</td>
<td>EC-495</td>
<td>Seminar – II***</td>
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<td>7</td>
<td>PD-491</td>
<td>Co-curricular Activities</td>
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</table>

15-1-10 (26)  

FINAL EVALUATION IN GRADES  
(L-T-P-Cr) - Lectures-Tutorials-Practicals-Credits  
# CSOP is a mandatory learning course.  
* One credit to be earned in Term-XII through Co-Curricular Activities outside contact hours. However, a student is to register for this course in all the three terms of 4th year.  
** To be evaluated based on the work done during Summer Term after Term-IX.  
*** To be based on Internship-II and to be given in the beginning of Term-XII.  
**** To be based on Internship Documentation.
# LIST OF DEPT. ELECTIVES

## Dept. Elective - I
<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>EC-403</td>
<td>Optical Communication</td>
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<tr>
<td>2</td>
<td>EC-421</td>
<td>Advanced Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>IT-202</td>
<td>Computer Networks</td>
<td>3</td>
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## Dept. Elective - II
<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EC-431</td>
<td>Industrial Electronics and Application</td>
<td>3</td>
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<tr>
<td>2</td>
<td>EC-432</td>
<td>Advance Audio &amp; Video Tech.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>EC-433</td>
<td>Satellite Communication</td>
<td>3</td>
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</table>

## Dept. Elective - III
<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>1</td>
<td>EC-441</td>
<td>Nano Technology</td>
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</tr>
<tr>
<td>2</td>
<td>EC-442</td>
<td>RF Devices &amp; Circuits</td>
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</tr>
<tr>
<td>3</td>
<td>EL-303</td>
<td>Advanced Control System</td>
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## Dept. Elective - IV
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>EC-461</td>
<td>Biomedical Instrumentation</td>
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<tr>
<td>2</td>
<td>EC-462</td>
<td>Neural Networks &amp; Fuzzy Logic</td>
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<tr>
<td>3</td>
<td>CS-402</td>
<td>Artificial Intelligence</td>
<td>3</td>
</tr>
</tbody>
</table>
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/programs/exercises are to be performed in a term.
   b. It is expected that more experiments/programs/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/programs/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>
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<tbody>
<tr>
<td><strong>1st Year</strong></td>
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<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>
<td>0-0-2</td>
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<tr>
<td>PD-151N Basics of Computer Fundamentals</td>
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<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>
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<tr>
<td><strong>2nd Year</strong></td>
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<tr>
<td>PD-354 Embedded System Design (8051 Microcontroller)</td>
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<td>PD-391 Co-curricular Activities</td>
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<tr>
<td>PD-392 Problem Solving Skills</td>
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<td>PD-293 Intra &amp; Inter-personal Skills</td>
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<td>PD-454 Microprocessor and DSP Based Systems</td>
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<td>PD-491 Co-curricular Activities</td>
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</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

<table>
<thead>
<tr>
<th>Course</th>
<th>Objective</th>
</tr>
</thead>
</table>
| ECONOMICS| 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGEMENT</td>
<td>To acquaint the students with various concepts of management which will be very basic to appreciate the subject.</td>
</tr>
</tbody>
</table>

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

4. BIODIVERSITY AND ITS CONSERVATION: 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
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 Helmoltz 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 tautomeric form and mutarotation; lipids: definitions; classification of lipids; fatty acids; glycerol; building block of lipid; proteins and amino acid; classification and formulae; proteinous and non-proteinous; essential and non-essential amino-acids; primary, secondary, tertiary, quaternary structure of proteins; N and C terminal determination.

TEXT BOOK

REFERENCE BOOKS


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

REFERENCE BOOKS

OBJECTIVE
To provide sound conceptual understanding of the fundamental concepts of computing hardware, software, networking and services; build programming logic and developing skills in problem solving using C/C++; Introduce the concept of object orientation and on how to handle data in different forms; Emphasize the concepts and constructs rather than on language features.
1. **AN OVERVIEW OF COMPUTER SYSTEM:**
   Anatomy of a digital computer; memory units; main and auxiliary storage devices; input devices; operation 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, interpreter, linker and loader, and their inter-relationship; debuggers, IDE; programming fundamentals – problem definition, algorithms, flow charts and their symbols.

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

6. **DATA HANDLING:** Pointers – Pointer variables, pointer operators, pointer expressions, pointers and arrays, multiple indirection, initializing pointers, C's dynamic allocation functions, restrict-qualified pointers, problems with pointers; functions: the general form of a function, scope of a function, argument functions, 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 preprocessors and comments – the preprocessor, conditional compilation directives, using defined, the # and ## preprocessor operators, predefined macro names, comments.

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**OBJECTIVE**
To relay the theoretical and practical fundamental knowledge of most commonly used algorithms.
PRE-REQUISITES
Knowledge of basic computer programming

1. **INTRODUCTION TO DATA STRUCTURES:**
   - Definition of data structures and abstract data types; polymorphic data types; linear vs. non-linear data types; primitive vs. non-primitive data types; static and dynamic implementations; arrays, 2, 3 and multi-dimensional arrays; examples and real life applications.

2. **RUNNING TIME:**
   - Time complexity; Big Oh notation; running times; best case, worst case, average case; factors depends on running time; introduction to recursion; divide and conquer algorithm; evaluating time complexity.

3. **STACKS AND QUEUES:**
   - Stacks: definition, array based implementation of stacks, linked list based implementation of stacks; examples: infix, postfix, prefix representation; conversions, applications; definition of queue; array based implementation of queue

4. **LINKED LISTS:**
   - Lists; linked list implementation of stacks and queues; circular implementation of queues and singly linked lists; straight / circular implementation of doubly linked queues; priority queues; applications.

5. **TREES:**
   - Definition of trees and binary trees; properties of binary trees and implementation; binary traversal pre-order, post-order, in-order traversal; binary search trees; implementations; threaded trees; balanced multi way search trees; AVL trees; implementations

6. **GRAPHS:**
   - Definition of undirected and directed graphs and networks; array based implementation of graphs; adjacency matrix; path matrix implementation; linked list representation of graphs; shortest path algorithm, graph traversal; breadth first traversal, depth first traversal; hash tables, hash function; implementations and applications.

7. **SORTING AND SEARCHING ALGORITHMS:**
   - Introduction, sorting by exchange, selection, insertions, bubble sort, straight selection sort, efficiency of above algorithms; shell sort, performance of shell sort, merge sort, merging of sorted arrays and algorithms; quick sort algorithm analysis, heap sort: heap construction, heap sort, bottom – up, top – down heap sort approach; searching algorithms: straight sequential search, binary search (recursive & non–recursive algorithms)

**WEB REFERENCES**


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

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

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

2. **KNOWLEDGE REPRESENTATION ISSUES:**
   - Predicate logic; logic programming; constraint propagation; representing knowledge using rules.

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

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

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

6. **OTHER KNOWLEDGE STRUCTURES:**
   - Semantic nets, partitioned nets, parallel implementation of semantic nets; frames, common sense reasoning and thematic role frames; architecture of knowledge based system; rule based systems; forward and backward chaining; frame based systems.
7. APPLICATIONS OF ARTIFICIAL INTELLIGENCE: Principles of natural language processing; rule based systems architecture; expert systems, knowledge acquisition concepts; AI application to robotics, and current trends in intelligent systems; parallel and distributed AI; psychological modeling, parallelism in reasoning systems, distributed reasoning systems and algorithms.

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES

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<th>EC-201</th>
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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-l 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; THYRISTORS: 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

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<th>EC-202</th>
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OBJECTIVE
The objective of this course is to introduce the student to basic concept of semiconductor device operation based on energy bands and carrier statistics. It also provides the operation of p-n junctions and metal-semiconductor junctions. It extends this knowledge to descriptions of bipolar and field effect transistors, and other microelectronic basic devices. This course is intended for students who plan to study in the area of microelectronics or just have an interest in that area. This course emphasizes the fundamentals of materials and device operation. It is expected that the students taking this course will include ECE and non-EE majors. In this course, one will study semiconductor devices from a fundamental point of view emphasizing a thorough understanding of the mechanisms of device operation. It is expected that students who successfully complete the course will have an understanding of basic semiconductor devices sufficient to design transistors and diodes to particular specifications.
1 CONDUCTING MATERIALS: Drift velocity, collision time; Mean free path; mobility; conductivity; relaxation time; factors affecting conductivity of materials; types of thermal conductivity; Wiedemmann-Franz law; Super conductivity; applications.

2 DIELECTRIC MATERIALS: Behavior of dielectric materials in static electric field; Dipole moments; Polarization; Dielectric constant; Polarizability; Susceptibility; mechanisms of polarization; behavior in alternating field; dielectric loss; loss tangent types of dielectric and insulating materials; electrostriction; Piezo-electricity.

3 MAGNETIC MATERIALS: Permeability; Magnetic susceptibility; magnetic moment; origin of magnetic dipole moment; angular momentum; Magnetization; Classification of magnetic materials-Para; Dia, ferro, antiferro; and ferri; Langevin’s theory of dia; Curie-Weiss law; spontaneous magnetism; domain theory; Magnetoresriction; eddy current and hysteresis losses; applications.

4 SEMICONDUCTORS: Review of Si and Ge as semi-conducting materials; Continuity Equation; P-N junction; Drift and Diffusion; Diffusion and Transition capacitances of P-N junction; breakdown mechanisms; ZENER diode.

5 OPTICAL PROPERTIES OF MATERIALS: Optical properties of metals; semiconductors and insulators; Phosphorescence; Luminiscense; Phosphors for CRO; display material for LCD; LED; solar cells and photo-detectors.

6 SEMICONDUCTOR DEVICES: Brief introduction to Planar Technology for device fabrication; BJT; JFET; MOSFETS.

7 POWER DEVICES: Thyristor; IGBT; VMOS; UJT; GTO; their working principles and characteristics.

TEXT BOOK

REFERENCE BOOKS

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

INTRODUCTION: Vector Relation in rectangular; Cylindrical; Spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient; Divergence and curl; Gauss’s Divergence and Stoke’s theorems.

1 ELECTROSTATICS - I: Electric field intensity; flux density and polarization; Electric field due to various charge configurations. Potential functions and displacement vector.

2 ELECTROSTATICS- II: Gauss’s law; Poisson’s and Laplace’s equation and their solution in rectangular coordinates; Uniqueness theorem; Capacitance and electrostatics energy; methods of electrostatics images; boundary conditions.

3 MAGNETOSTATICS – I: Magnetic field vector; Magnetic field intensity; flux density and magnetization.

MAGNETOSTATICS –II: Bio-Savart’s law; Ampere’s law; Magnetic vector potential; Energy stored in magnetic field; Boundary conditions; Analogy between electric and magnetic field.

TIME VARYING FIELDS: Faraday’s law; Displacement currents and equation of continuity. Maxwell’s equations; Uniform plane wave in free space; Reflections; refraction and polarization of UPW; surface impedance; standing wave ratio. Poynting theorem and power considerations.

5 ELECTROMAGNETIC FIELDS: EM wave in Dielectrics; Conductors and Magnetic Materials and Skin effect.

TEXT BOOK

REFERENCE BOOKS
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. **TRANSUDCERS**: 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**

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<th>EC-205</th>
<th>ANALOG ELECTRONICS</th>
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**OBJECTIVE**
To show the students the physical picture of the internal behaviour of semiconductor diode and its different type of circuit. Among these are rectifier; clipper; clamper; and filter. also gives knowledge of internal behaviour of transistor; FET and its application. regulated power supplies. Step knowledge from semiconductor physics to devices; model; circuit and system is.

1. **SEMICONDUCTOR DIODE**: Diode as a rectifier; switching characteristics of diode; Diode as a circuit element; the load-line concept.
2. **SEMICONDUCTOR DIODE CIRCUITS**: Half-wave and full wave rectifiers; clipping circuits; clamping circuits; filter circuits; peak to peak detector; voltage doublers and voltage multiplier circuits.
3. **TRANSISTOR AT LOW FREQUENCIES**: Bipolar junction transistor: π characteristics; 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; Effect of Emitter by pass capacitor on low frequency response; Step response of an amplifier; frequency response of R-C coupled amplifier; pass band of cascaded stages; Multi stage CE Amplifier.
4. **TRANSISTOR BIASING**: Operating point; bias stability; collector to base bias; self-bias; emitter bias; bias compensation; thermistor and sensistor compensation; thermal runaway.
5. **TRANSISTOR AT HIGH FREQUENCIES**: Hybrid model; CE short circuit current gain; frequency response; alpha; cutoff frequency; gain bandwidth product; emitter follower at high frequencies.
6. **FIELD EFFECT TRANSISTORS**: Junction field effect transistor; MOSFET Enhancement and Depletion mode; V-MOSFET; Common source amplifier; source follower; biasing of FET; applications of FET as a voltage variable resistor (V V R).
7. **REGULATED POWER SUPPLIES**: Series and shunt voltage regulators; power supply parameters; three terminal IC regulators; SMPS.

**TEXT BOOK**

**REFERENCE BOOKS**
Restrictions on pole and zero Locations for driving point functions and transfer functions; Time domain behavior from the pole-zero plot.

5. CHARACTERISTICS AND PARAMETERS OF TWO PORT NETWORKS: Relationship of two-port variables; short-circuit Admittance parameters; open circuit impedance; parameters; Transmission parameters; hybrid parameters; relationships between parameter sets; Interconnection of two port networks.

6. TYPES OF FILTERS AND THEIR CHARACTERISTICS: Filter fundamentals; high-pass; low-pass; band-pass; and band-reject Filters.

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

TEXT BOOKS

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.

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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-251 ELECTRONICS ENGINEERING LAB

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<th>EC-207</th>
<th>DIGITAL ELECTRONICS</th>
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OBJECTIVE
Modern world deals with digital conditioning of various signals. Digitally manipulating signals or using digital circuits have a lot of advantages in terms of accuracy etc. This subject introduces concept of basic digital electronics: gates; combinational and sequential circuits and their designing.

1. FUNDAMENTALS OF DIGITAL TECHNIQUES:
   Digital signal; logic gates: AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR; Boolean algebra. Review of Number systems. Binary codes: BCD; Excess-3; Gray; EBCDIC; ASCII; Error detection and correction codes.

2. COMBINATIONAL DESIGN USING GATES:
   Design using gates; Karnaugh map and Quine Mcluskey methods of simplification.

3. COMBINATIONAL DESIGN USING MSI DEVICES:
   Multiplexers and Demultiplexers and their use as logic elements; Decoders; Adders/Subtractors; BCD arithmetic circuits; Encoders; Decoders/Drivers for display devices.

4. SEQUENTIAL CIRCUITS:
   Flip Flops: S-R; J-K; T; D; master-slave; edge triggered; shift registers; sequence generators; Counters; Asynchronous and Synchronous Ring counters and Johnson Counter; Design of Synchronous and Asynchronous sequential circuits.

5. DIGITAL LOGIC FAMILIES:
   Switching mode operation of p-n junction; bipolar and MOS devices. Bipolar logic families:RTL; DTL; DCTL; HTL; TTL; ECL; MOS; and CMOS logic families. Tristate logic; Interfacing of CMOS and TTL families.

6. A/D AND D/A CONVERTERS:
   Sample and hold circuit; weighted resistor and R-2R ladder D/A Converters; specifications for D/A converters. A/D converters: successive approximation; counting type.

7. PROGRAMMABLE LOGIC DEVICES:
   ROM; PLA; PAL; PEEL; GAL; FPGA and CPLDs.

REFERENCES

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
LIST OF EXPERIMENTS

1. Measurement of displacement using LVDT.
2. Measurement of distance using LDR.
7. Measurement of distance using Inductive Pick up.

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 & Triac.
9. Study of loss factor in a dielectric by an impedance bridge.
10. Study of photo-resist in metal pattern for planar technology.

OBJECTIVE

Most of the signals in physical world are analog; thus requiring array of analog circuits for conditioning of such signals. This subject deals with the study of circuits designed using Transistors/FETs. It also aims to impart knowledge to the students about Operational Amplifiers and their various linear and non linear applications

1. FEEDBACK AMPLIFIERS: Revision of Amplifiers (AE); Feedback concept; transfer gain with feedback; general characteristics of negative feedback amplifiers; Feedback Topologies: voltage series feedback; current series feedback; current shunt feedback; voltage shunt feedback and their impact on input and output resistance
2. OSCILLATORS: Sinusoidal oscillators; Barkhausen criteria; R-C phase shift oscillator; Wien-bridge oscillator; crystal oscillator; General form of Oscillator Circuit; Hartley and Colpitt Oscillator
3. POWER AMPLIFIERS: Classification of Amplifiers; Distortions in Amplifiers; Class A large signal amplifiers; higher order harmonic distortion; efficiency; transformer coupled power amplifier; class B amplifier : efficiency and distortion; class A and class B push-pull amplifiers; Introduction to Class C and Class D power amplifiers
4. OPERATIONAL AMPLIFIERS: Emitter coupled differential amplifier; transfer characteristics of a differential amplifier; Ideal and practical operational amplifiers; Study of 741; inverting and
non-inverting and differential configuration; Instrumentation Amplifier; DC Imperfections
5. **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.
6. **NONLINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS:** Comparators; sample and hold circuits; Logarithmic/anti-log amplifier; logarithmic multiplier; Miller and Bootstrap sweep generators; multivibrators and waveform generators; Voltage Controlled Oscillators; Monolithic Timer – NE555 and its applications; ADC.
7. **FILTERS:** Active RC Filters: Idealistic and Realistic response of filters (LP; BP; and HP); Butter worth and Chebyshev filter functions all pass; Notch Filter; Operational transconductance amplifier (OTA)-C filters.

**EC-302**

**MICROPROCESSORS & INTERFACING**

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**OBJECTIVE**

This subject introduces the concept of Microprocessors to the students. It covers 8 bit (8085) and 16-bit (8086) Microprocessors: their architecture, assembly language programming and interfacing with peripheral devices

**PRE-REQUISITES**

Knowledge of Boolean algebra, number systems and basic digital circuitry

1. **THE 8085 PROCESSOR:** Introduction to microprocessor; 8085 microprocessor: Architecture; Pin Diagram; instruction set; interrupt structure; Addressing modes and assembly language programming.
2. **THE 8086 MICROPROCESSOR ARCHITECTURE:** Architecture; block diagram of 8086 with details of sub-blocks; memory segmentation and physical address computations; program relocation; addressing modes; pin diagram and description of various signals; Interrupt Structure.
3. **INSTRUCTION SET OF 8086:** Data transfer instructions; arithmetic instructions; branch instructions; looping instructions; NOP and HLT instructions; flag manipulation instructions; logical instructions; shift and rotate instructions; directives; programming examples.
4. **INTERFACING DEVICE:** The 8255 PPI chip: Architecture; control words and modes; interfacing and programming with 8085.
5. **DMA:** Introduction to DMA process; 8257 pin diagram; architecture; operation; command words; interfacing and programming with 8085.
6. **PROGRAMMABLE INTERRUPT CONTROLLER:** 8259 pin diagram; architecture; initialization command words; operational command words.
7. **PROGRAMMABLE INTERVAL TIMER:** 8253 pin diagram; architecture; modes.

**TEXT BOOK**


**REFERENCE BOOKS**


**OBJECTIVE**

The basic objective of Antenna and Wave Propagation is communication of information from source to destination and to understand the basic theory of electromagnetic waves traveling from transmitter to receiver. This course explains how antenna converts the electrical energy in the electromagnetic wave and vice versa. This course also explains the various types of transmitting and receiving antennas recently in use.

1. **ANTENNA PRINCIPLE:** Introduction to antenna; radiating system; vector potential; retarded vector potential; definition of various potentials used in antenna theory; radiation from an oscillating current elements; power radiated by a current element; short dipole antenna; effective length of short antenna; field strength of isotropic antenna in terms of power; radiation from a quarter wave monopole.
2. **ANTENNA PARAMETERS:** Isotropic radiators; radiation pattern antenna gain or directivity; beamwidth and polarization; antenna efficiency; radiating resistance; aperture of antenna; Reciprocity theorem for antenna; antenna impedance; antenna temperature and signal to noise ratio.
3. **THE ELECTRIC DIPOLE AND LINEAR ANTENNAS:** The short electric dipole; field of a short dipole; radiation resistance of short electric dipole; linear antenna; half wave antenna; antenna...
impedance; directivity; radiation resistance and directional properties of half wave dipole; effect of ground on antenna pattern; input impedance; broad band matching.

4. **ANTENNA ARRAYS:** Two element array; broad side; End fired pattern; Beam width pattern multiplication; multi element array and their properties; Synthesis of an array.

5. **PRACTICAL ANTENNAS:** Parabolic reflectors; cassergrain antennas; horn antennas; lens antennas; Yagi-Uda antennas; Yagi-Uda modifications; broad band antennas; microstrip antennas.

6. **ANTENNA MEASUREMENTS:** Radiation pattern measurements; gain measurements; phase measurements; measurements of antenna efficiency; impedance measurements.

7. **PROPAGATION:** Ground waves; Space waves; Effect of Earth; Duct formation; Ionosphere; and sky waves.

**TEXT BOOK**

**REFERENCE BOOKS**

**OBJECTIVE**
This course provide student with a foundation in digital system. The course will explore the essential topic related to the design of modern digital circuit and to go about designing complex, high speed digital system and implement such design using programmable logic.

1. **INTRODUCTION:** Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL; data objects; classes and data types; Operators; Overloading; logical operators. Types of delays Entity and Architecture declaration. Introduction to behavioural; dataflow and structural models.

2. **VHDL STATEMENTS:** Assignment statements; sequential statements and process; conditional statements; Generate statement; case statement; Array and loops; resolution functions; concurrent statements.

3. **ADVANCE VHDL STATEMENTS:** Packages and Libraries; Subprograms: Application of Functions and Procedures; Structural Modelling; component declaration; structural layout and generics; Configuration Statements

4. **COMBINATIONAL CIRCUIT DESIGN:** VHDL Models and Simulation of combinational circuits such as Multiplexers; Demultiplexers; encoders; decoders; code converters; comparators; implementation of Boolean functions etc.

5. **SEQUENTIAL CIRCUITS DESIGN:** VHDL Models and Simulation of Sequential Circuits Flip Flops; Shift Registers; Counters etc.

6. **ADVANCED TOPICS IN VHDL:** Introduction to FSM; Test Benches; ALIAS; Generate statement.

7. **DESIGN OF DIGITAL SYSTEM:** Basic components of a computer; specifications, architecture of a simple computer system; Design of ALU; Memory Unit; CPLDs and FPGAs. Design implementation using CPLDs and FPGAs.

**TEXT BOOK**

**REFERENCE BOOKS**

**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;
OBJECTIVE

To study about the behavior and noise performance characteristics of the various methods; processes involved in the communication equipments. It includes the mathematical analysis of various principles and processes; their merits and demerits. It also involves the coding and decoding of information to be transmitted.

1. INTRODUCTION TO SIGNALS: Classification of signals; basic operations of signals; Fourier-Series; Fourier Transforms;
2. INTRODUCTION TO SYSTEMS: Classifications of systems; LTI systems; convolution Theorem; Correlation; Cross-correlation and autocorrelation.
3. BASIC OF RANDOM VARIABLE: Representation of random signals; concepts of probability; probability of joint occurrence; conditional probability; discrete probability theory; continuous random variables; probability distribution function; probability density functions; joint probability density functions.
4. RANDOM PROCESSES: Statistical average and moments. Ergodic processes; correlation function; power spectral density. central limit theory; response of linear system to random signals. Error function; regularity; covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities; optimum filters.
5. MULTIPLE RANDOM VARIABLES: Introduction to multiple random variable; joint density function; joint distribution function; conditional mean and variance functions.
6. INFORMATION THEORY: Introduction to information and entropy; information rate; joint and conditional entropy and redundancy; mutual information; channel capacity for discrete and continuous channels; Shannon’s Theorem; Shannon-Hartley Theorem; Noisy-channels.
7. CODING THEORY: Source coding; fixed and variable length code wards; Shannon-Fano coding; minimum redundancy (Huffman) coding; Hamming Codes; Cyclic Codes; Cyclic Redundancy Code (CRC); maximization of entropy of a continuous message transmission rate; effect of medium on the information; selection of channels; effect of noise and its minimization.

REFERENCE BOOKS


EC-306 COMMUNICATION ENGINEERING

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EC-307 WIRELESS COMMUNICATION

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OBJECTIVE

To cover the entire concept behind the cellular technology, including, the standards like GSM; CDMA and various design parameters for wireless system. Going through these topics will help the students to face telecom sector and software companies.

1. INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS: Evolution of mobile radio communications; examples of wireless comm. systems; paging systems; Cordless telephone systems; comparison of various wireless systems.
2. MODERN WIRELESS COMMUNICATION SYSTEMS: Second generation cellular networks; third generation wireless networks; wireless in local loop; wireless local area networks; Blue tooth and Personal Area networks.
3. **INTRODUCTION TO CELLULAR MOBILE SYSTEMS**: Spectrum Allocation; basic Cellular Systems; performance Criteria; Operation of cellular systems; analog cellular systems; digital Cellular Systems.

4. **CELLULAR SYSTEM DESIGN FUNDAMENTALS**: Frequency Reuse; channel assignment strategies; handoff Strategies; Interference and system capacity; tracking and grade off service; improving coverage and capacity.

5. **MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION**: Introduction to Multiple Access; FDMA; TDMA; Spread Spectrum multiple Access; space division multiple access; packet ratio; capacity of a cellular systems.

6. **WIRELESS NETWORKING**: Difference between wireless and fixed telephone networks; development of wireless networks; fixed network transmission hierarchy; traffic routing in wireless networks; wireless data services; common channel signaling; ISDN (Integrated Services digital Networks); advanced intelligent networks.

7. **INTELLIGENT CELL CONCEPT AND APPLICATION**: Intelligent cell concept; applications of intelligent micro-cell Systems; in-Building Communication; CDMA cellular Radio Networks.

**TEXT BOOK**

**REFERENCE BOOK**

**OBJECTIVE**
The objective of this course is to introduce the students to the concepts in VLSI circuits. The course also aims to provide students with the knowledge required to design, implement, and test digital VLSI circuits through nMOS, pMOS, and CMOS and BiCMOS technologies and to integrate those VLSI circuits in complex digital systems.

1. **FUNDAMENTALS OF MOS TECHNOLOGY**: Introduction to IC technology; MOS Transistor enhancement mode and depletion mode operations; fabrication of NMOS; CMOS and BiCMOS devices. Equivalent circuit for MOSFET and CMOS.
2. **VLSI FABRICATION - I**: Crystal growth; wafer preparation; epitaxy; oxidation; lithography; etching;
3. **VLSI FABRICATION - II**: Diffusion; dielectric and poly-silicon film deposition; ion implantation; yield and reliability; metallization.
4. **MOS TRANSISTOR THEORY**: MOS device design equations; MOS transistor; Evaluation aspects of MOS transistor; threshold voltage; MOS transistor transconductance and output conductance; figure of merit; determination of pull-up to pull-down ratio for an n-MOS inverter driven by another n-MOS inverter and by one or more pass transistor; alternative forms of pull-up; CMOS and BiCMOS-inverters. Latch up in CMOS circuitry and BiCMOS Latch up susceptibility.
5. **MOS CIRCUITS AND LOGIC DESIGN**: Basic physical design of simple logic gates using n-MOS, p-MOS and CMOS; CMOS logic gate design considerations; CMOS logic structures; clocking strategies.
6. **CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION**: Resistance estimation; capacitance estimation; inductance; switching characteristics; CMOS gate transistor sizing; power dissipation.
7. **DESIGN EXAMPLE USING CMOS**: Incrementer / decrementer; left/right shift serial/parallel register; comparator for two n-bit number; a two-phase non-overlapping clock generator with buffered output on both phases; design of an event driven element for EDL system.

**TEXT BOOK**

**REFERENCE BOOKS**

**EC-308 MOS IC’s AND TECHNOLOGY**

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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 techniques 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., Oppenheim, “Digital Signal Processing”, Prentice Hall of India

**OBJECTIVE**
To provide an insight of fundamentals of TV systems and get indepth knowledge of various applications of TV – Cable TV; Satellite TV; VCR; TV games; Digital TV; HDTV.

1. **ELEMENTS OF A TELEVISION SYSTEM**: Picture transmission; sound transmission; picture reception; sound reception; receiver controls. Aspect Ratio; Scanning; Number of Scanning Lines; Flicker; Fine Structure; Interface Scanning; Tonal gradation.

2. **COMPOSITE VIDEO SIGNAL**: Positive and Negative modulation; Video signal dimensions; horizontal sync details; vertical sync details; scanning sequence details; functions of vertical pulse train; sync details of 525 line system.

3. **SIGNAL TRANSMISSION AND CHANNEL BANDWIDTH**: Amplitude Modulation; channel bandwidth; vestigial side band transmission; Transmission efficiency; complete channel bandwidth; frequency modulation; FM channel bandwidth; channel bandwidth for color transmission; allocation of frequency bands for television signal transmission; television standards.

4. **CAMERA TUBE AND PICTURE TUBE**: Camera Tube- image orthicon; Vidicon; Monochrome picture tube; Beam deflection; screen phosphor; face plate; pincushion effect; implosion.

5. **COLOR TELEVISION FUNDAMENTALS**: Compatibility; the luminance signal; Chrominance Signal; Additive Mixing of Colours; Grassman’s Law; chromaticity diagram; bandwidth for color signal transmission; three color television camera.

6. **COLOR SIGNAL TRANSMISSION AND RECEPTION**: Basic block diagram of color transmitter and color receiver; color picture tube – Trinitron.

7. **TELEVISION APPLICATIONS AND MODERN TELEVISION**: Cable television; television via satellite; microprocessor controlled TV games; Introduction to LCD and Plasma TV.

**TEXT BOOK**

**REFERENCE BOOKS**

**LIST OF EXPERIMENTS**
1. Study the effect of voltage series; current series; voltage shunt; and current shunt feedback on amplifier using discrete components.
2. Design and realize inverting amplifier; non-inverting and buffer amplifier using 741 Op Amp.
3. Verify the operation of a differentiator (ideal and practical) circuit using 741 op amp and show that it acts as a high pass filter.
4. Verify the operation of an integrator circuit (ideal and practical) using 741 op amp and show that it acts as a low pass filter.
5. Design and verify the operations of op amp adder and subtractor circuits.
6. Plot frequency response of AC coupled amplifier using op amp 741 and study the effect of negative feedback on the bandwidth and gain of the amplifier.
7. Design and realize using op amp 741; Sine wave oscillator.
8. To design and realize using op amp 741; triangular wave generator.
9. To design and realize using op amp 741; logarithmic amplifier and VCCS.
10. Study of Timer circuit using NE555 and configuration for monostable and astable multivibrator.
12. To Study and construct class-A and class-B Power amplifier.
13. To study and construct Active filters using Op amps.
2. Write a program using 8085 for:
   a) Addition of two 8-bit numbers.
   b) Addition of two 16-bit numbers
3. Write a program using 8085 for:
   a) 8-bit subtraction
   b) 16-bit subtraction
4. Write a program using 8085 for
   a) Multiplication of two 8-bit numbers
   b) Division of two 8-bit numbers
5. Write a program using 8085 to arrange an array of 10 Nos in
   a) Ascending order
   b) Descending order
6. Familiarization with the operation of 8086 microprocessor kit
7. Write a program using 8086 for copying 12 bytes of data from source to destination.
8. Write a program using 8086 for:
   a) Finding the largest number from an array.
   b) Finding the smallest number from an array.
9. Write a program using 8086 for arranging an array of numbers in descending order and ascending order
10. Write a program for finding the square of a number using look-up table and verify.
11. Write a program to interface a two digit number using seven-segment LEDs. Use 8085 microprocessor and 8255 PPI.

LIST OF EXPERIMENTS
1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits; check the wave forms and the hardware generated
   a) half adder
   b) full adder
3. Write VHDL programs for the following circuits; check the wave forms and the hardware generated
   a) multiplexer
   b) demultiplexer
4. Write VHDL programs for the following circuits; check the wave forms and the hardware generated
   a) decoder
   b) encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated
6. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
7. Write a VHDL program for ALU.
8. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
9. Write a VHDL program for a counter and check the wave forms and the hardware generated
   a) register
   b) shift register
10. Implement any three (given above) on FPGA/CPLD kit

LIST OF EXPERIMENTS
8051 Micro Controller
1. Write an Assembly language Programme (ALP) to generate 10kHz square wave.
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.

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. MOBILE RADIO PROPAGATION: Mechanism; free space path loss; long distance path loss model; Okumara model; Hata model, PCS model; wideband PCS; Microcell model; indoor propagation model; Jake’s channel model
4. WIRELESS SYSTEMS: GSM: architecture; services; frame structure; signal processing Wireless data services:RAM; CDPD; GPRS
5. WI-FI AND THE IEEE STANDARD 802.11: 802.11 architecture; MAC layer; PHY layer; Bluetooth and the IEEE standard 802.15
6. 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
7. MOBILE TRANSPORT LAYER: Traditional TCP: classical TCP improvement; TCP over 2.5 G/3G wireless networks; performance enhancing proxies

TEXT BOOKS

REFERENCE BOOK

EC-402 MICROWAVE AND RADAR ENGINEERING

OBJECTIVE
- To understand theoretical principals underlying microwave devices and networks
- To study microwave components such as power dividers; hybrid junctions; cavity resonant ferrite devices; and a single stage microwave transistor amplifiers and various results of electromagnetic theory including Maxwell’s Equations.

1. TRANSMISSION LINE THEORY: Transmission line as a distributed circuit; transmission line equation and parameters; traveling and standing wave; characteristic impedance; VSWR; reflection coefficients; smith chart and applications.
2. WAVEGUIDES: Introduction; comparison with transmission lines; propagation in TE and TM mode; rectangular wave guide; TEM mode in rectangular wave guide; characteristic impedance; introduction to circular waveguides and planar transmission lines.
3. MICROWAVE COMPONENTS: S-parameters; Directional couplers; tees; hybrid ring; attenuators; cavity resonators; mixers and detectors; phase shifter; Ferrite devices: Isolators; circulators and gyrators.
4. MICROWAVE TUBES: Limitation of conventional tubes; Construction; operation and properties of Klystron amplifier; reflex Klystron; magnetron; TWT; BWO ; crossed field amplifiers.
5. MICROWAVE SOLID STATE DEVICES: Varactor diode; Tunnel diode; Schottky diode; GUNN diode; IMPATT; TRAPATT and PIN diodes. MASER; parametric amplifiers.
6. MICROWAVE MEASUREMENTS: Power measurement using calorimeter and bolometers; measurement of SWR; frequency; wavelength and impedance. Microwave bridges.
7. INTRODUCTION TO RADAR: Block Diagram and operation; Radar Frequencies; Simple form of Radar Equation; Prediction of Range Performance; Pulse Repetition frequency and Range Ambiguities; Applications of Radar

TEXT BOOK

REFERENCE BOOKS
B.Tech. Electronics & Communication Engineering (Regular)

EC-403 | OPTICAL COMMUNICATION | L T P | Cr
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**OBJECTIVE**

The aim of this course is to describe the various technologies, implementation, methodologies and performance measurement techniques that make optical fibre communication system possible.

1. **INTRODUCTION TO OPTICAL COMMUNICATION SYSTEMS**: Electromagnetic spectrum used for optical communication; block diagram of optical communication system. Basics of transmission of light rays. Advantages of optical fiber communication.

2. **OPTICAL FIBERS**: Optical fibers and their types; fiber characteristics: attenuation; scattering; absorption; fiber bend loss; dispersion; fiber couplers and connectors; splicing joining

3. **LED LIGHT SOURCE**: Light emitting diode : recombination processes; the spectrum of recombination radiation; LED characteristics; internal quantum efficiency; external quantum efficiency; LED structure; lens coupling to fiber; behavior at high frequencies.

4. **LASER LIGHT SOURCE**: Basic principles of laser action in semi conductors; optical gain; lasing threshold; laser structures and characteristics; laser to fiber coupling; comparison with LED source.

5. **AVALANCHE AND PIN PHOTODETECTORS**: Principles of optical detection; quantum efficiency; responsivity; general principles of PIN photodetector; intrinsic absorption; materials and designs for PIN photodiodes; impulse and frequency response of PIN photodiodes; no ise in PIN Photodiodes; multiplication process; APD Design; APD bandwidth; APD noise.

6. **OPTICAL AMPLIFIERS**: optical amplifier; optical cavity; Laser amplifiers; Doped fibre amplifiers; Noise Gain saturation Inhomogeneous broadening effects Polarization effects Erbium-doped fibre amplifiers Doped fibre amplifiers for other wavelength ranges Semiconductor optical amplifier (SOA) Vertical-cavity SOA Raman amplifier Optical parametric amplifier.

7. **OPTICAL MODULATORS and DEMODULATORS**: Optical modulator Electro-optic modulator ; Spatial light modulator Optical tweezers Modulating retro-reflector Optical DPSK demodulator Delay line interferometer Michelson interferometer Optical hybrid Phase detector (section Optical phase detectors) Laserdisc Phase-shift keying T-carrier Photoelastic modulator Superheterodyne receiver Symbol rate Lock-in amplifier Orthogonal frequency-division multiplexing (redirect Optical Orthogonal Code) Telecommunication

**TEXT BOOK**


**REFERENCE BOOKS**


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EC-404 | DATA COMMUNICATION | L T P | Cr
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**OBJECTIVE**

The subject focuses on the basic concepts involved in data communication particular attention is paid to be aspects of coding, modulation techniques, networks used, flow of data along with its security and multiplexing techniques.

1. **DIGITAL COMMUNICATION**: Introduction; digital communication; Shannon limit for information capacity; digital radio; digital amplitude modulation; frequency shift keying (FSK); phase shift keying (PSK); quadrature amplitude modulation (QAM); band width efficiency; carrier recovery; differential phase shift keying (DPSK); clock recovery; probability of error and bit error rate; trellis encoding. NRZ Encoding Operation; Bandwidth; Use with synchronous and asynchronous circuits. Manchester Encoding Operation; Bandwidth; Use in Ethernet.

2. **DATA COMMUNICATIONS**: Introduction; history of data communication; standard organization for data communication; data communication circuits; data communication codes; error control; synchronization; data communications hardware.

3. **DATA COMMUNICATION INTERFACES**: Serial interfaces: RS-232; RS-449 and RS-530; CCITT X.21; parallel interfaces: centronics parallel interfaces. the telephone network: DDD network; private- line service; the telephone circuit; data modems: synchronous modems; asynchronous modems; modem synchronization.

4. **DATA COMMUNICATIONS PROTOCOLS AND NETWORK CONFIGURATIONS**: Introduction; open system interconnection (OSI); data transmission mode; asynchronous protocols; synchronous protocols; public data network; integrated services digital network (ISDN); local area networks; token pass ring; Ethernet. Packet headers; pipelining; datagram networks; (e.g. Internet) Communications between layers Protocols Peer to Peer Communication between Remote Layers Service Access Points Service Primitives and Communication Between Adjacent Layers

5. **MULTIPLEXING**: Introduction; time division multiplexing; T1 digital carrier system; CCITT time division multiplexed carrier systems; CODECS; COMBO chips; line encoding; T-CARRIERS; frame synchronization; Drawing Frame Transition Diagrams Time Axis; Effect of data rate; Effect of
propagation delay. Calculating Utilisation Size of frame headers; Transmission delay. Calculating Throughput bit interleaving VS word interleaving; frequency division multiplexing; ATandT's FDM hierarchy; composite base band signal; formation of a master group.

6. INTERNET AND TCP/IP: Introduction; history; use of Internet; accessing the Internet; Internet addresses; security on the internet; authentication; firewalls; intranet and extranet;

7. TCP/IP: Introduction to TCP/IP reference model; domain name service; World Wide Web. IP over EthernetEncapsulation; Protocol headers added on transmission. Hardware Address (i.e. MAC address) Difference between network address and link layer hardware address. Address Resolution (arp) arp server and client; Use of Broadcast address for request; Unicast reply; Information exchanged by arp request and reply.

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
This course aims to enable students to study advanced topics of digital signal processing which include DSP processors, Digital filters and Multirate Processing.

1. DIGITAL FILTER STRUCTURES: FIR digital filter structures; Direct form; Cascade form; Frequency Sampling structures; Lattice structure; IIR digital filter structure; Direct form; Cascade realization; Parallel realization; Lattice-Ladder filter structure.

2. DESIGN OF FIR FILTERS: Concept of Linear Phase; Design of Linear Phase FIR filters using Windows; Design of FIR filter using Frequency sampling methods; Design of FIR differentiators.

3. DESIGN OF IIR FILTERS: Design of IIR filters using Bilinear transformation method; Design of IIR filter using Impulse Invariant method.

4. QUANTIZATION OF FILTER COEFFICIENTS: Coefficient quantization effects in FIR and IIR filters; Round-off effects in digital filters; Statistical characterization of quantization effects.

5. SAMPLING AND RECONSTRUCTION OF SIGNALS: Representation of Band Pass signal; Sampling of Band Pass signal; A/D conversion; Sample and Hold; Quantization and Coding; Analysis of quantization error; White Noise model of quantization error; oversampling A/D converters; Sigma-Delta A/D converter.

6. MULTIRATE DIGITAL SIGNAL PROCESSING: Decimation by a factor D; Interpolation by a factor I; Sampling Rate conversion by a rational factor

I/D; Multistage Implementation of Sampling Rate conversion; Sampling Rate conversion by an arbitrary factor; First Order approximation; Second Order approximation; introduction to DSP processors.

7. DSP PROCESSORS: Architecture of DSP processors; DSP devices; Von-Neumann model; Harvard architecture.

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
Student will be able to:
- Choose a device for a specific application
- Describe the operation of various converters; invertors; choppers; regulator
- List applications of converters; invertors; choppers; regulator
- Select proper device for a given application

1. NON LATCHING DEVICES: Need for power transistor; power MOSFET and IGBT Constructional details; operating principle; characteristics; Study of above devices with reference to the parameters: Voltage and current rating; Turn on and turn off time; leakage current; Conduction loss and switching loss; Gate triggering requirements – drive; Gate; dissipation; List of applications of above devices; Introduction to SIT ; MCT ; FCT
2. CHOPPERS: Dc to dc converter (chopper);Basic block diagram; operating principle; Classification of choppers o the basis of: output voltage – step up and step down; Commutation method – series turn off and parallel turn Off; Quadrant of operation – single quadrant ; two quadrant; four quadrant; Jones chopper Circuit; operating principle; Applications of choppers;
3. INVERTERS: DC to AC converter (Inverter); Basic principle of inverter; Classification on the basis of Energy source – voltage source and current source; Commutation – series and parallel; Voltage source inverters; Series inverter; Parallel inverter with R and RL load; Bridge inverter : simple bridge inverter with R load
4. AC AND DC VOLTAGE REGULATOR: Ac voltage regulator; Need of ac voltage regulator (power line disturbances); Regulator types : Relay type ; servo type ; Resonant type; solid state type ( tap changing and phase control):
Circuit diagram; operating principle; applications of above types; Specifications; Switching regulator (SMPS): Need; Power supply requirements: (Regulated output; isolation; multiple outputs; efficiency; size; weight); Review of linear regulator; SMPS : Block diagram; Explanation of: Isolation transformer (it’s requirements and core properties); Converter circuits (Push-pull; half bridge and full bridge); PWM control; Specifications

5. UNINTERRUPTIBLE POWER SUPPLY: UPS (Need of UPS; Basic block diagram of UPS and operating principle; explanation of rectifier; battery; inverter; static switch); Types of UPS: Off line UPS; On line UPS; Line interactive UPS and their comparison; UPS specifications – Input voltage range; dc voltage range; Transient response; response time; total harmonic distortion; output frequency; output waveform; transient recovery; load power factor and types of protection; Other applications: Ac voltage controller; HVDC and transmission

6. ELECTRIC WELDING: SCR contactor; Electronic ballast; Battery charging regulator; emergency light; Temperature controller; Ac flasher; SCR; UJT time delay and ultra precise time delay circuit; dielectric and induction heating

7. PROTECTION CIRCUITS: Protection circuits: Need of protection circuits; Snubber circuits: Their functions; operating principle of unpolnared RC; Polarized RC and polarized LR snubbers; Over current protection and over voltage protection; Isolation circuits: pulse transformer and optoisolator; Crowbar protection; current fold back; spike suppressor; Circuit breaker

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE
Providing sound knowledge and in-depth concepts of various technology used in audio and video engineering. It covers the audio communication and methods of sound recording and reproduction. It provides in-sight knowledge of digital TV, and various modern TV systems. It also discusses the various audio and video coding techniques.

1. METHODS OF SOUND RECORDING AND REPRODUCTION: Microphones; Audio amplifiers; Audio mixers; Methods of sound recording and reproduction; optical magnetic recording; CD recording; CD DVD player; MP3 player; audio std. MPEG.

2. AUDIO COMMUNICATION: Studio Acoustics; reverberation; PA system for auditorium; Acoustic chamber; chord less microphone systems; special type of speakers/ cell phones. Introduction to satellite radio reception (world space)

3. DIGITAL TELEVISION: Introduction to Digital TV; Principle of Digital TV; Digital TV signals and parameters; MAC signals; advanced MAC signal transmission; Digital TV receivers; NTSC; DTV; MPEG 2; JPEG 4 MAC production tools.

4. MODERN TELEVISION SYSTEM-I: HDTV standards and systems; HDTV transmitter and receiver/encoder; satellite TV; video on demand; CCTV; CATV.

5. MODERN TELEVISION SYSTEM-II: Direct to home TV; set top box; conditional access system (CAS); introduction to 3D stereoscopic; DTV systems; IPTV system.

6. AUDIO CODING: Introduction to Audio Coding; Audio compression; MPEG – Block diagram of audio encoder and decoder; Digital Audio Broadcasting- Block schematic explanation.

7. VIDEO CODING: Video coding and compression; Need for compression; video image representation; quantization of image data intraframe compression techniques: DPCM; DCT based transform coding; Motion Compensation; H261 video conference coding standard; MPEG video compression; HDTV- DVBT

TEXT BOOKS

REFERENCES BOOKS

OBJECTIVE
The course aims to provide a comprehensive understanding of satellite communication to perform and verify link budget equations. It also discusses the modulation and multiplexing techniques for satellite, link and application areas of the satellite.

1. PRINCIPLES OF SATELLITE COMMUNICATION: Evolution and growth of communication satellite; Synchronous satellite;
Satellite frequency allocation and Band spectrum; Advantages of satellite communication; Active and Passive satellite; Modern and Codec. Applications of satellite communication.

2. **COMMUNICATION SATELLITE LINK DESIGN:**
   - Introduction; General link design equations; System noise temperature; C/N and G/T ratio; Atmospheric and Ionospheric effects on link design; Complete link design; Earth station parameters.

3. **ANALOG SATELLITE COMMUNICATION:**
   - Introduction; Baseband analog(Voice) signal; FDM techniques; S/N and C/N ratio in frequency modulation in satellite link; S/N ratio in FM with multiplexed telephone signal in satellite link; Single channel per carrier(SCPC) systems; Compressed single sideband (CSSB) systems; Analog FM/FDM TV satellite link; Intermodulation products and their effects in FM/FDM systems; Energy disposal in FM/FDM systems.

4. **DIGITAL SATELLITE COMMUNICATION:**
   - Advantages of digital communication; Elements of digital satellite communication systems; Digital baseband signals; Digital modulation techniques; Satellite digital link design; Time Division Multiplexing.

5. **MULTIPLE ACCESS TECHNIQUES:**
   - Introduction; TDMA; TDMA-Frame structure; TDMA-Burst structure; TDMA-Frame efficiency; TDMA-superframe; TDMA-Frame acquisition and Synchronization; TDMA compared to FDM; TDMA Burst Time Plan; Multiple Beam (Satellite switched) TDMA satellite system; Beam Hopping(Transponder Hopping) TDMA; CDMA and hybrid access techniques.

6. **SATELLITE ORBITS:**
   - Introduction; Synchronous orbit; Orbital parameters; Satellite location with respect to earth; Look angles; Earth coverage and slant range; Eclipse effect; Satellite placement in geostationary orbit; station keeping; Satellite stabilization.

7. **SPECIAL PURPOSE COMMUNICATION SATELLITES:**
   - BDS; INMARSAT; INTELSAT; VSAT (data broadband satellite); MSAT (Mobile Satellite Communication technique); Sarsat (Search and Rescue satellite) and LEOs (Lower earth orbit satellite); Satellite communication with respect to Fiber Optic Communication; LANDSAT; Defense satellite.

**TEXT BOOK**

**REFERENCE BOOKS**

**EC-441** | **NANO TECHNOLOGY** | L T P | Cr
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**OBJECTIVE**
- Explain the fundamentals of Nanotechnology; the relevance of its applications to modern civilization along with experimental techniques for measurements up to Nanotechnology level.

1. **INTRODUCTION TO NANO TECH:**
   - Crystalline Non-crystalline materials fundamental of Nanotechnology and Nanomaterials in Metals; other Materials and Biosystem; Molecular Recognition; Quantum Mechanics and Quantum ideas in Nanotechnology; Semiconductor Nanoparticles.

2. **PREPARATION and CHARACTERIZATION OF NANO-PARTICLES:**
   - Preparation: Nanoscale Lithography; Dip Pen Lithography; E-Beam Lithography; Nanosphere Lift-off lithography; Molecular Synthesis; Nanoscale Crystal Growth; Polymerization; Nanobricks and Building blocks.

3. **TOOLS FOR MEASURING NANOSTRUCTURES:**
   - Scanning Probe Instrument; Spectroscopy; Electrochemistry; Election Microscope; Tools to make Nanostucture.

4. **PROPERTIES and APPLICATION OF NANO CRYSTALLINE MATERIALS:**
   - Application in Sensors; Nanoscale Biostucture Electronics; Magnets; Optics; Fabrication.

5. **BIOMEDICAL APPLICATIONS:**
   - Smart materials – Self Healing Structures; Heterogenous Nanostructure and composites; Encapsulation; Carbon Nanotubes.

6. **CHEMICAL SYNTHESIS and BUSINESS:**
   - Synthesis of Semiconductor Nanoclusters; Processing of Nanomaterials; Nanobusiness - Boom; Bust and Nano Tech; NanoEthics.

7. **Nano Materials:**
   - Nano composites; Nanofying electronics; Sensing the environment; Mechanising the micro world; Energy and cleaner environment with nano technology.

**TEXT BOOK**

**REFERENCE BOOKS**

**EC-442** | **RF DEVICES AND CIRCUITS** | L T P | Cr
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 | | 500 | 3

**OBJECTIVE**
- To learn fundamental of radio frequency transmitter and receiver and radio integrated circuit design and analysis technique.
- To acquire basic understanding of various radio frequency circuit block.

1. **INTRODUCTION TO RF ELECTRONIC:**
   - The electromagnetic spectrum; unit and physical
constant; Microwave band; RF component layout and construction; Cox cable transmission line; Tuned resonant circuit Tuned RF/IF Transformer; Variable capacitor in RF circuit; Measuring inductor and capacitor at RF frequency; Impedance matching.

2. LINEAR RF AMPLIFIER: Introduction; power gain; Neutralization; unilateral transducer gain; stability consideration; stability an active two port; stabilization of a bipolar transistor Transistor at radio frequency; RF power transistor characteristics; transistor biasing.

3. SMALL SIGNALS RF AMPLIFIER: Introduction to small signals RF amplifier; Bilateral RF amplifier design for maximum small signal gain; multistage amplifier; Broadband amplifier; Noise in RF.

4. ACTIVE RF DEVICE AND MODELING: The diode model; two port device model; the output terminal of at two port RF device The bipolar transistor; the heterojunction bipolar transistor; the GaAs MESFET High electron mobility transistor; Silicon LDMOS and CMOS technique.

5. HIGH POWER RF TRANSISTOR AMPLIFIER: Nonlinear concept; Quasi linear power amplifier design; categories of amplifier (class A; class B; class F); switching mode amplifier; cascade amplifier; distortion reduction.

6. RADIO SYSTEM APPLICATION: Mobile telephony system; software defined ratio; A 1.9 GHz radio chip set design overview; integrated system chip (RF receiver front end; RF up converter and Transistor driver amplifier; power amplifier modules)

7. DEVICE PARASITICS: RF modeling; Parasitics sensitive to RF. Issue in RF IC a brief review; Impedance matching; use and design of passive circuits; LNA Design; Matching Techniques using algebra techniques; Basic Bond circuits; UHF Mixer design.

TEXT BOOK

REFERENCE BOOK

LIST OF EXPERIMENTS
1. To identify and understand different selections and components of mobile phone units.
2. Study of GSM technology.
3. To observe and analysis input/output signals of different sections in mobile handset.
4. Study of GSM MODEM and its components.
5. Study of SIM identification.

6. To observed and understand the process of call connection and call release of mobile system.
7. Introduction to AT commands
8. Voice communication using AT commands.
9. Data communication using AT commands
10. Sending text message using flow code software
11. To understand handoff, frequency reuse, cell splitting in mobile communication system.
12. To understand & perform registration, activation & authentication of mobile phone.

LIST OF EXPERIMENTS
1. To study of wave guide component
2. To study the characteristics of reflex Klystron and determine its timing range
3. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength
4. To measure VSWR of unknown load and determine its impedance using a smith chart
5. To study the properties of E-Plane tee junction and to determine isolation and coupling coefficient
6. To measure coupling and directivity of direction couplers
7. To measure insertion loss, isolation of a three port circulator
8. To study the V-I characteristics of GUNN diode
9. To study isolation and coupling of a Magic tee
10. To plot a radiation pattern of Antenna
11. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator.
12. To understand the operation of pulsed RADAR system by using block diagram Optional Experiment
13. To calculate the Numerical Aperture (NA) of given optical fiber by using Trigonometric method (visual method)
14. To measure the bend loss in given FOC

REFERENCE BOOKS

EC-454 | DATA COMMUNICATION LAB  
| L T P Cr |
| 0 0 2 1 |

LIST OF EXPERIMENTS
1. To study different types of transmission media
2. To study Quadrature Phase Shift Keying Modulation.
3. To study Quadrature Amplitude Modulation.
4. To Study Quadrature Amplitude Multiplexing.
6. To study the Parallel Interface Centronics and its applications.
7. To configure the modem of a computer.
8. To make inter-connections in cables for data communication in LAN.
9. To install LAN using Tree topology.
10. To install LAN using STAR topology.
11. To install LAN using Bus topology.
12. To install LAN using Token-Ring topology
13. To install WIN NT
14. To configure a HUB/Switch.

REFERENCE BOOKS

EC-461 | BIOMEDICAL INSTRUMENTATION  
| L T P Cr |
| 5 0 0 3 |

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

1. INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: System in terms of range; linearity; hysteresis; frequency response; accuracy; signal to noise ratio; stability insolation simplicity; physiological system of Biometrics; basic design; specifications of biomedical instrumentation body; biochemical system; cardiovascular system; respiratory system; nervous system. Source of bioelectric potential resting and action potential and propagation of action potential.

EC-462 | NEURAL NETWORKS AND FUZZY LOGIC  
| L T P Cr |
| 5 0 0 3 |

OBJECTIVE
This course presents an overview of the theory and application of artificial neural network and fuzzy systems to engineering applications with emphasis on control systems.

1. NEURAL NETWORKS and FUZZY SYSTEMS: Neural and fuzzy intelligence; fuzziness as
Multivalence; the dynamical systems to machine intelligence.

2. **NEURAL NETWORKS THEORY**: Neurams as functions; signals monotonically; biological activation and signals; neuron fields; neuron signal functions;

3. **NEURON MODELS**: Types of activation models; neuron dynamical systems; additive neurons dynamics and additive neuronal feedback.

4. **UNSUPERVISED LEARNING**: Learning as encoding; charge and quantization; four unsupervised learning laws; probability spaces and random processor.

5. **SUPERVISED LEARNING**: Supervised function estimation; supervised learning as operant conditioning; supervised learning as stochastic approximation.

6. **ARCHITECTURES AND EQUILIBRIA**: Neural networks as stochastic gradient systems; global equilibria; aver algorithms; global stability of feedback neural networks; structural stability of unsupervised learning.

7. **FUZZY ASSOCIATIVE MEMORIES**: Fuzzy systems as between cube mappings; fuzzy and neural function estimators; fuzzy Hebb FAMS; Adaptive FAMS.

**TEXT BOOK**


**REFERENCE BOOKS**


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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 8-6 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.

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**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.

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

**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.

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.

**Prerequisite**

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

**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, DSBSC, 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.

   **Digital Modulation**

   ASK, FSK, BPSK, QPSK.

7. **Noise in Communication Systems**

   External noise; internal noise; S/N ratio-noise figure (Qualitative analysis).

**Text Books**


**Reference Books**

B.Tech. Electronics & Communication Engineering (Regular)

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.

**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; 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.

6. **ROTATING ELECTRICAL MACHINES**: DC MACHINES – construction, principle of operation and classification of dc machines, EMF equation and characteristics of dc generator, starting and speed control of dc motor.

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**


**NOTE:** At least ten experiments are to be performed by the students.

**LIST OF EXPERIMENTS**

1. To verify KCL and KVL.
2. To verify Thevenin's and Norton's Theorems.
3. To verify maximum power transfer theorem in D.C Circuit and A.C Circuit.
4. To verify Reciprocity and Superposition theorems.
5. To study frequency response of a series R-L-C circuit and determine resonant frequency and Q-Factor for various Values of R, L, C.
6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency and Q-Factor for various values of R, L, C.
7. To perform direct load test of a transformer and plot efficiency Vs load characteristic.
8. To perform open circuit and short circuit tests on a single-phase transformer determine the losses and efficiency.
9. To perform direct load test of a DC shunt generator and plot load voltage Vs load current curve.
10. To study various types of meters.
12. Measurement of power in a 3 phase system by two wattmeter method.
13. Connection and testing of a single-phase energy meter (unit power factor load only).

**REFERENCE BOOKS**

EL-301 CONTROL SYSTEMS

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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.

PRE-REQUISITES
Knowledge of Mathematics and Electrical Engineering

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

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

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

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

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

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

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

TEXTBOOK

REFERENCE BOOKS

EL-303 ADVANCED CONTROL SYSTEMS

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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.

PRE-REQUISITES
Knowledge of mathematics and control system-I

1. STATE VARIABLE TECHNIQUES:
   State variable representation of systems by various methods; Solution of state equations-state transition matrix; Transfer function from state variable model; Controllability and observability of state variable model.

2. SECOND ORDER SYSTEMS & STATE PLANE:
   Phase portrait of linear second systems; Method of isolines; phase portrait of second order system with non-linearities; limit cycle; singular points.

3. DESCRIBING FUNCTION ANALYSIS:
   Definition; limitations; use of describing function for stability analysis; describing function of ideal relay; relay with hysteresis and dead zone; saturation/Coulomb friction and backlash.

4. LINEAR APPROXIMATION OF NONLINEAR SYSTEMS:
   Taylor series; Liapunov’s 2nd method.

5. SAMPLED DATA SYSTEMS:
   Sampling process; impulse modulation; mathematical analysis of sampling process; application of Laplace transform; Shannon’s theorem; reconstruction of sampled signal zero order and first order hold; Z-transform; definition; evaluation of Z-transform; Inverse Z-transform; pulse transfer function; limitations of Z-transform; state variable formulation of discrete time systems; Solution of discrete time state equations; stability; definition; the Schur-Cohn stability criterion; Jury’s test of stability of extension of Routh-Hurwitz criterion to discrete time systems.

6. OPTIMAL CONTROL:
   Introduction; formation of Optimal Control problem; calculus of variation; minimization of function; constrained optimization; performance index; optimality principle; linear quadratic problems.

7. ADAPTIVE CONTROL:
   Introduction; model reference adaptive controls and systems; controller structure; various adaptive control systems.

TEXT BOOK

REFERENCE BOOKS

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 v/s 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 v/s 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

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.

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 then 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.

OBJECTIVE
To have a fundamental understanding of the design, performance and state of the art of wireless communication systems. Topics covered include state of the art wireless standards and research and thus changes substantially form one offering of this course to the next

PRE-REQUISITES
Knowledge of computers hardware and software

1. OSI REFERENCE MODEL AND NETWORK ARCHITECTURE: Introduction to computer networks, example networks: ARPANET, Internet, private networks; network topologies: bus-, star-, ring-, hybrid-, tree-, complete-, irregular--topology
2. TYPES OF NETWORKS: Local area networks, metropolitan area networks, wide area networks; layering architecture of networks, OSI model, Functions of each layer, services and protocols of each layer
3. TCP/IP: Introduction, history of TCP/IP; layers of TCP/IP; Protocols: Internet Protocol, Transmission Control Protocol, User Datagram Protocol; IP Addressing, IP address classes, subnet addressing; Internet control protocols: ARP, RARP, ICMP; application layer, domain name system; Email – SMTP, POP, IMAP; FTP, NNTP, HTTP; Overview of IP version 6.
4. LOCAL AREA NETWORKS: Introduction to LANs, Features of LANs, Components of LANs, Usage of LANs; LAN standards, IEEE 802 standards; Channel Access Methods: Aloha, CSMA, CSMA/CD, Token Passing, Ethernet; Layer 2 & 3 switching; fast Ethernet and gigabit Ethernet, token ring; LAN interconnecting devices: hubs, switches, bridges, routers, gateways.
5. WIDE AREA NETWORKS: Introduction of WANs, routing, congestion control, WAN Technologies; Distributed Queue Dual Bus (DQDB); Synchronous Digital Hierarchy (SDH)/ Synchronous Optical Network (SONET); Asynchronous Transfer Mode (ATM); frame relay; wireless links.

6. INTRODUCTION TO NETWORK MANAGEMENT:

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES

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 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**

**MA-102** | **APPLIED MATHEMATICS-II** | **L T P Cr**
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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. **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 their simple applications.

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

**TEXT BOOK**

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

**MA-201** | **APPLIED MATHEMATICS – III** | **L T P Cr**
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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.
PRE-REQUISITES
Knowledge of mathematical operations such as integration, differentiation

1. PARTIAL DIFFERENTIAL EQUATIONS:
   Formation of partial differential equations; Lagrange’s linear partial differential equations; first order non-linear partial differential equation; Charpit’s method; method of separation of variables and its applications to wave equation and one dimensional heat equation, two dimensional heat flow, steady state solutions only.
2. SPECIAL FUNCTIONS:
   Special functions, Bessel’s equation and Legendre’s equation and its recurrence formulae.
3. TESTING OF HYPOTHESIS:
   Testing of hypothesis; tests of significance for large formulation; Student’s t-distribution (application only); Chi-Square test of goodness of fit.
4. LIMIT AND CONTINUITY:
   Limit and continuity of a complex function, differentiability and analyticity; Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic; polar form of Cauchy-Riemann equations; harmonic functions; application to flow problems.
5. COMPLEX FUNCTIONS:
   Integration of complex function; Cauchy-Integral theorem and formula; power series; radius and circle of convergence; Taylor’s, Maclaurin’s and Laurent’s series; zeros and singularities of complex functions.
6. RESIDUE THEOREM:
   Residue theorem, evaluation of real integrals using residues (around unit and semi circle only); bilinear transformation and conformal mapping.
7. LINEAR PROGRAMMING:
   Formulation of linear programming problems; solving linear programming problems using (i) graphical method (ii) simplex method (iii) dual simplex method.

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:
   Gauss elimination method; Gauss-Jorden method; UV factorization, Jacobi’s method; Gauss-Seidal method.
4. INTERPOLATION & CURVE FITTING:
   Introduction to interpolation; Newton’s forward and backward formula; Sterling formula; Lagrangian polynomials; divided differences; least squares method.
5. NUMERICAL DIFFERENTIATION AND INTEGRATION:
   Derivatives from differences tables; numerical differentiation formulas, Newton-Cotes integration formulae; trapezoidal rule; Simpson’s rule; Bool’s rule; Weddle’s rule; Romberg’s rule.
6. SOLUTION OF DIFFERENTIAL EQUATIONS:
   Taylor’s series method; Euler and modified Euler’s method; Runge-Kutta method; Milne’s predictor 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, Cranck-Nicolson method; Dufort & Frankel method and wave equation.

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

REFERENCE BOOKS

MA-252 APPLIED NUMERICAL METHODS LAB

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

REFERENCE BOOKS

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.

1. FORCE SYSTEMS: Basic concepts of space, time, mass, force, particle and rigid body; scalars and vectors; conventions for equations and diagrams; external and internal effects of a force; principle of transmissibility; force classification; rectangular components of two and three dimensional force systems; resultant of two and three dimensional and concurrent force systems; moment about a point and about an axis; Varignon’s theorem; resultant of non-concurrent force systems; couple; equivalent couples; force couple systems.

2. EQUILIBRIUM: Equilibrium in two and three dimensions; system isolation and the free-body-diagram; modeling the action of forces; equilibrium conditions; applications including plane trusses; frames and machines.

3. PROPERTIES OF SURFACES/CROSS SECTIONS: Centre of mass; determining the centre of gravity; centre of mass versus centre of gravity; centroids of lines, areas and volumes including composite sections; moments of inertia; MI of plane figures; MI with respect to axis in its plane and with respect to an axis perpendicular to the plane of figure; parallel axis theorem; moment of inertia of a rigid body – of a lamina and of three dimensional body; MI of composite figures.

4. SIMPLE STRESSES AND STRAINS: Resistance to deformation; Hook’s law and stress-strain diagram; types of stresses; stresses and strains in bars of varying sections; stresses in composite bars; lateral strain and Poisson’s ratio; volumetric strain, modulus of rigidity and bulk modulus; relation between elastic constants.

5. TORSION OF CIRCULAR SHAFTS, TORSION FORMULA POWER TRANSMISSION

6. SHEAR FORCE AND BENDING MOMENTS: Definitions: SF and BM diagrams for cantilevers, simply supported beams with or without overhang and calculation of max. BM and SF and point of contra-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

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

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

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<tr>
<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.

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OBJECTIVE
Engineering graphics is the primary medium for development and communicating design concepts. Through this course the students are trained in engineering Graphics concepts through manual drafting. The ISI code of practice is followed. With this course students can improve the visual concepts in all engineering streams.

1. INTRODUCTION: Need drawing instruments; geometrical drawing, conventional representation—indicating welds, Joints, surface texture, structural work etc.; various types of projections; first and third angle systems of orthographic projections.
2. SIMPLE PROJECTS: Projection of points in different quadrants; projections of, lines parallel to or inclined to one or both reference planes, true length of a line and its inclination with reference planes; traces of a line; concept of auxiliary plane.
3. PROJECTIONS OF PLANES: Parallel to one reference plane; inclined to one plane but perpendicular to the other, inclined to both reference planes.
4. PROJECTIONS OF SOLIDS AND SOLIDS OF REVOLUTION: In simple positions with axis perpendicular to a plane; with axis parallel to both planes; with axis parallel to one plane and inclined to the other.
5. SECTIONS OF SOLIDS: Prisms; pyramids; cylinders and cones; section plane is parallel, perpendicular and inclined to both reference planes; true shape of sections.
6. DEVELOPMENT OF LATERAL SURFACES OF REGULAR SOLIDS: Rectangular block; cylinder; cone; pyramid.
7. **ISOMETRIC VIEWS OF PLANES:** circle, square, rectangle; Isometric views of solids-prisms, pyramids and cylinders; principle of perspective projection, perspective of planes and solids.

**TEXT BOOK**

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

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

**LIST OF SHEETS TO BE MADE:**

<table>
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<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>
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<tr>
<td>2</td>
<td>Projection of Lines including traces.</td>
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<td>3</td>
<td>Projection of Planes.</td>
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<td>4</td>
<td>Projection of Solids.</td>
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<td>5</td>
<td>Section of solids.</td>
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<td>6</td>
<td>Developments of surfaces.</td>
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<tr>
<td>7</td>
<td>Isometric and Perspective views.</td>
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**PH-101 PHYSICS**

**OBJECTIVE**
To educate the students with the present day physical sciences through concepts like optics, acoustics, EM theory, etc.

1. **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.

2. **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.

3. **POLARIZATION:** Polarised and unpolarized light; double refraction; Nicol prism; quarter and half 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 ultrasonics by magnetostriction and piezoelectric oscillator methods; detection of ultrasonics by Kundt’s tube and acoustic grating method.

**TEXT BOOK**

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

**PH-102 APPLIED PHYSICS**

**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 dependent and time independent equations; significance of wave function; wave function for a particle in a box.

3. FREE ELECTRON THEORY: Elements of classical free electron theory and its limitations; Drude's theory of conduction; quantum theory of free electrons; Fermi level; Density of states (3D); average kinetic energy \( \frac{3}{5}kT \) 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; Carnot cycle; principle of equipartition of energy; specific heat of monatomic gases; Maxwell's velocity distribution; mean velocity; RMS velocity; most probable speed; Joule Thomson's expansion; liquidification 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 | PHYSICS LAB | L T P | Cr
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LIST OF EXPERIMENTS
The experiments in 1st term will be based mainly upon optics, electrostatics, wave and oscillations which are the parts of the theory syllabus of 1st term.

PH-152 | APPLIED PHYSICS LAB | L T P | Cr
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LIST OF EXPERIMENTS
1. To find the wavelength of sodium light by Newton's rings experiment.
2. To find the wavelength of sodium light by Fresnel's birefringence 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
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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### EN-291
**ESSENTIALS OF COMMUNICATION**

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<th>BRIDGE COURSE</th>
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**OBJECTIVE**

The objective of bridge course is to bring some of the students who are not up to the mark and are not able to pursue the technical education like their counter parts. This course has been devised to bring the students to that level from where they can do justice to the technical education they are going to pursue.

1. Advertisements; notices; formal and integral invitations.
2. Report writing; or factual description based on verbal input provided.
3. Letter writing; business letter; enquires; registering complaints; asking and giving information; placing orders and sending replies; letter to editor.
4. Parts of speech: noun; pronoun; verb; adverb; adjective; proposition; conjunction; exclamation 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
**MATHEMATICS**

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<th>MAKEUP COURSE</th>
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**OBJECTIVE**

Mathematics is a very essential part of all engineering courses. The students entering in the first year who are some how weak in concepts of Mathematics need 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 $\sum_{n=1}^{\infty} n, \sum_{n=1}^{\infty} n^2, \sum_{n=1}^{\infty} n^3$; 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**


### MA-291
**MATHEMATICS**

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**OBJECTIVE**

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

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

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

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

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

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

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

**TEXT BOOK**

**REFERENCE BOOKS**
PROFESSIONAL DEVELOPMENT

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

METHODOLOGY
To enable students become competent professionals and good citizens with moral and ethical values, a set of 14 courses of one credit each will be provided covering

(i) Value Added Courses,
(ii) Professional Development Courses, and
(iii) Co-curricular Activities.

### PD-151: BASICS OF COMPUTER FUNDAMENTALS

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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 TRACEROUT, 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
7. Bansal S. K., "Cyber Crime"
8. Ahmad Tabrez, “Cyber law , E-commerce & M-Commerce”

### PD-191: CO-CURRICULAR ACTIVITIES

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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.

### PD-192: PERSONALITY SKILLS

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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**


**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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**PD-193 | ENTREPRENEURIAL & PROFESSIONAL SKILLS | L T P | Cr**

**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; dining etiquette; party and wedding etiquette; sensitivity towards diverse cultures; respecting religions and traditions.

6. **BUSINESS ETIQUETTE**: Dealing with people at work place (peers, subordinates and superiors); international business; etiquette at meetings and conferences.

7. **COMMUNICATION MEDIA ETIQUETTE**: Telephone etiquette; email etiquette; media etiquette.

**REFERENCE BOOKS**


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

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**PD-251 | MATLAB | L T P | Cr**

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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. **TWODIMENSIONAL 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.
TEXT BOOK

REFERENCE BOOK

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

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

REFERENCE BOOKS

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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<th>PD-291</th>
<th>CO-CURRICULAR ACTIVITIES</th>
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Refer to PD-191 for details.
B.Tech. Electronics & Communication Engineering (Regular)

Notes: 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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<th>PD-354</th>
<th>EMBEDDED SYSTEM DESIGN (8051 MICROCONTROLLER)</th>
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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.

LIST OF EXPERIMENT
1. To study I/O Addresses, software and memory mapping.
2. To study serial interface with microcontroller.
3. To study various commands for e.g. fill, Move, constant.
4. Write a program to move a block of memory from one location to another location.
5. Write a program for splitting a byte into two nibble.
6. To study details of various connectors.
7. Write a program for interfacing of microcontroller with stepper motor.
8. To study in detail RISC pipelines in PIC microcontroller.
9. Write a program for any microcontroller application.
10. Write a program on any real time application using microcontroller.

REFERENCE BOOKS

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<tr>
<th>PD-393</th>
<th>ADVANCED PROFESSIONAL DEVELOPMENT</th>
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OBJECTIVE
To equip the students with the basics of law, accounting, corporate policies, and ethics; the general awareness useful in leading a well informed life.

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

Refer to PD-191 for details.
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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<th>PD-454</th>
<th>MICROPROCESSOR AND DSP BASED SYSTEMS</th>
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**OBJECTIVE**
The course intends to cover the design issues involved in Microprocessor and DSP Based Systems development of microcontroller, DSP and microprocessor based systems. The topics include the hardware configuration for peripheral modules, layered software design and system development environment set up.

**PREREQUISITES**
C Programming

1. Introduction to Architecture and assembly instruction set of TMS370.
2. C language Review - pointers and Macros, Program development tools – compiler, linker, debugger and emulator.
3. Systems and digital I/O configuration, Serial peripheral interface
4. Interrupts and A/D Converter interfacing

5. Timers, Serial communication interfacing.
7. Interface C program with assembly program, Debugging techniques, and Timing Considerations, Real-time operating systems, floating point number computation On fixed point processors.
8. Architecture and development environment of DSP, Compare Microcontroller, microprocessor and DSP.
9. Instruction sets and addressing modes of TMS320c50.
10. Arithmetic and logic operations of TMS320c50 , Make file and integrated development environment for TMS320c50.

**TOOLS USED**
TMS370 microcontroller emulator and training board, EPROM programmer.

**TEXT BOOK**
TMS370 Family – User’s Guide 1996, Texas Instruments,

**REFERENCE BOOKS**

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<th>PD-491</th>
<th>CO-CURRICULAR ACTIVITIES</th>
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Refer to PD-191 for details.

********
OPEN ELECTIVE

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

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

AE-411 TRANSPORT MANAGEMENT L T P Cr

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

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

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

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

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

5. CONSTRUCTION; EQUIPMENT;

MAINTENANCE AND TRAFFIC REGULATION:
General provisions; Central Govt; rules and provisions regarding construction; maintenance of vehicle; emissions and safety provisions; Control of traffic: limits of speed; weight; length and height; power to restrict and erect traffic signs; design of traffic signs and its colour scheme; Signals; driving test; Driving regulations; signaling devices; Definitions– Pass; ticket; removal of vehicle obstructing traffic; Safety measures for drivers and pillion riders; Precautions at un guarded railway crossings; Schemes for investigation of accidents and wayside ammendities; 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 polices; Procedure to be followed for settlement of a claim after an accident; Surveyor and loss assessor; Surveyors report; Certificate of insurance transfer; Compensation to third party deaths; Motor accident claims tribunal (MACT); Transit insurance

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

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

1. INTRODUCTION: Meaning, scope, objective, functions, policies & roles and importance of Human Resource Management; Interaction with other functional areas; HRM & HRD - a comparative analysis, organizing the Human Resource Management department in the organization; Human Resource Management practices in India.
2. HUMAN RESOURCE PLANNING: Definition, objectives; process and importance job analysis; Description, specification and job evaluation.
3. DEVELOPING EFFECTIVE HUMAN RESOURCE: Recruitment, selection, placement and introduction process; human resource development: concept, employee training & development, career planning & development.
4. PERFORMANCE MANAGEMENT: Concept and process, performance appraisal, Potential appraisal, Job Compensation: Wage & salary administration, incentive plans & fringe benefits; Promotions, demotions, transfers, separation, absenteeism and turnover; Quality of work life (QWL): Meaning, origin, development and various approaches and; to QWL, techniques for improving QWL; Quality circles: concept, structure, role of management 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.

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. ENTREPRENEURAL 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

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.


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; metatals; 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 Greek; Roman; Medieval & Renaissance towns; history of town planning in India; modern town planning – industrial revaluation and its impact ; garden city concept new town and satellite towns.

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

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

6. ELEMENTS OF A TOWN / CITY PLAN: Planning attributes- physical infrastructure; social infrastructure; commerce; housing etc ; surveys for town planning ; importance of climate; 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

REFERENCE BOOKS

WEB REFERENCES
1. www.uniqueinstitutes.org/kuk/civilengg/38civilf.pdf
REFERENCE BOOKS

WEB REFERENCES
1. www.jadavpur.edu/academics/.../Architecture/arch_syl.htm
4. issuu.com/brentallpress/docs/adr3_vol3_1
6. www.jadavpur.edu/academics/.../Architecture/arch_syl.htm

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 and water and soil; toxic elements in waste water; carcinogenesis, impact of toxic chemicals on enzymes; biochemical effects of As, Cd, Pb, 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
2. Hutzinger, "Hand Book of Environmental Chemistry", Springer Verlag
3. Fristchen L. J. and Gay L. W., "Environmental Instrumentation", Springer Verlag

CS-303 COMPUTER GRAPHICS

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

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

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

2. TWO DIMENSIONAL VIEWING: The 2-D viewing pipeline, windows, viewports, window to view port mapping; clipping: point, clipping line (algorithms):
CS-402 | ARTIFICIAL INTELLIGENCE  |  L  | T  |  P  | Cr  |
|*********|*********|*****|*****|*********|
|ARTIFICIAL INTELLIGENCE  | 5 | 0 | 0 | 3 |

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

PRE-REQUISITES
Knowledge of neural networks, data structures

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

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

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

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

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

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

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

TEXT BOOK

REFERENCE BOOKS

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

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

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

TEXT BOOK

REFERENCE BOOKS

WEB REFERENCES

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

1. INTRODUCTION: Different types of microcontrollers: Embedded microcontrollers; External memory microcontrollers; Processor Architectures: Harvard VS Princeton; CISC VS 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
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

**TEXT BOOK**

**REFERENCES**


**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

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

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

7. **SCADA:** Introduction; Concept of Automatic Scada; Architecture of Scada; Hierarchical of Supervisory Control & Data Acquisition System; Technology Available; Data Acquisition Unit; Remote Technical Unit.

**TEXT BOOK**

**REFERENCES**


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

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

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

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

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

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

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

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

**TEXT BOOK**

**REFERENCE BOOKS**

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

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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  HVDC 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 of AC and DC transmission lines.

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

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

REFERENCE BOOKS

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

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

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

1. PRACTICAL ENGLISH: Parts of speech; noun; pronouns; adjective; verb, adverb, propulsion, conjunctional interjection; conjunctional 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

Cambridge University Press, London.

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.

Cambridge University Press, London.
6 Sarah Freeman, "Written Communication in English", Orient Longman.
7 Leo Jones and Riched Alexander, "International Business English", Cambridge University Press.

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<th>IT-423</th>
<th>INTRODUCTION TO E-COMMERCE &amp; ERP</th>
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**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.
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**


**REFERENCE BOOKS**


**WEB REFERENCES**

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

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**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

MA-471 DISCRETE MATHEMATICS

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

1. SET THEORY: Different types of sets; Set operations; Classes of sets; Relation; Types of relation; Functions; Types of functions and composition of functions and relation; Cardinality and inverse relations; Fuzzy sets; Basic operations of fuzzy sets.
2. BOOLEAN ALGEBRA & LATTICES: Definition of Boolean algebra; Basic operations of Boolean algebra; Partially ordered sets; Lattices; Sub Lattices; Different types of Lattices; Operations on Lattices.
3. NUMBER THEORY: Basic properties; Divisibility theory; Congruences; Chinese remainder theorem; Fermat's little theorem; r & μ functions.
4. COMBLNATORICES: Fundamental principal of counting; Pigeonhole principal; Multinomial coefficients; Recurrence relation; Generating functions.
5. ALGEBRAIC STRUCTURES: Binary operations; Group; Subgroup; Normal subgroup and their elementary properties; Order of element and group; Lagrange's theorem; Rings; Sub ring; Ideal; Integral domain; Field only definition and examples.
6. GRAPH THEORY: Introduction to graphs; Type of graphs; Sub graphs and isomorphic graphs; Representation of graphs; Properties of graphs; Euler's formula for planar graph; Eulerian and Hamiltonian graph; Ore's theorem.
7. TREES: Trees and their properties; Spanning trees; Kruskal's algorithm; Prim's algorithm; Binary tree.

TEXT BOOK

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

MA-472 ADVANCED HIGHER ENGINEERING MATHEMATICS

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; Functional; Euler's equation; solutions of Euler's equation; Geodesies; Isoperimetic 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
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

**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 & MULTICRITERIA DECISION MAKING:** Formulation of various industrial problems as integer and mixed integer programming problems; branch and bound algorithm; cutting plane methods for pure and mixed integer programming problems; Knapsack; 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. **QUETING 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 o 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 BOOKS**

**TEXT BOOK**

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**ME-443 FINITE ELEMENT ANALYSIS**

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

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

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

3. **EXTENSION OF THE METHOD TO FOURTH ORDER EQUATIONS AND THEIR SOLUTIONS:** time dependant problems and their solutions; example from heat transfer; fluid flow and solid mechanics.

4. **FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS:** Second order equations involving a scalar; valued function; model equation; Variational formulation – Finite element formulation through generalised
coordinates approach; Triangular elements and quadrilateral elements; convergence criteria for chosen models; Interpolation functions; Elements matrices and vectors; Assembly of element matrices; boundary conditions; solution techniques.

5. ISOPARAMETRIC ELEMENTS AND FORMULATION: Natural coordinates in 1, 2 and 3 dimensions; use of area coordinates for triangular elements in; 2 dimensional problems; Isoparametric elements in 1, 2 and 3 dimensions; Lagrangean 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

PH-471 NON DESTRUCTIVE TESTING TECHNIQUES

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

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

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

1. **NANOMATERIALS:** Introduction to nanomaterials; nano-scale in one dimension: thin films, layers and surfaces, nanoscale in two dimensions: carbon nano-tubes; inorganic nano-tubes, nano-wires, biopolymers; nano-scale in three dimensions: nano-particles, fullerenes (Carbon 60), dendrimers, quantum dots

2. **NANOMETROLOGY:** Introduction to nanometrology; length measurement; force measurement; measurement of single molecules; applications of metrology.

3. **ELECTRONICS, OPTOELECTRONICS AND INFORMATION AND COMMUNICATION TECHNOLOGY:** Introduction to electronics; optoelectronics and information and communication technology; nanoscience in electronics, opto-electronics and information and communication technology; current applications: computer chips, information storage, opto-electronics; applications anticipated in the future: sensors.

4. **NANO-BIOTECHNOLOGY AND 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, nano-technologies and cancer treatment, implants and Prosthetics.

5. **NANOFABRICATION:** Lithographic techniques for nano-printing; nano-manipulation techniques, self assembly.

6. **SYNTHESIS AND CHARACTERIZATION:** Metallic, semiconducting, magnetic and carbon based nano structures, nanocomposites and biological nanomaterials.

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

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

**REFERENCE BOOKS**

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

**CONDITIONS:** Conditions for producing laser, concept of coherence - spatial and temporal, population inversions

**GROWTH FACTOR:** Einstein coefficients, gain and gain saturation, saturation intensity, development and growth of a laser beam, exponential growth factor, threshold requirement for a laser.

**NORMAL INVERSION:** Inversions and two level systems, steady state inversions.

**POPULATION INVERSION:** Three and four level systems, transient population inversions, factors effecting population inversion, laser Amplifiers.

**EXCITATION AND PUMPING:** Excitation or pumping threshold requirements, pumping pathway and specific excitation parameters associated with optical and particle pumping.

**TYPES OF LASERS:** Helium-Neon Laser, CO₂ Laser, Ruby Laser, Semiconductor diode laser.

**LASER SPECTROSCOPY:** Introduction and applications

**TEXT BOOK**

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

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