

Important

# Academic Rules

Scheme of

# Studies & Syllabus



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



**LINGAYA'S  
UNIVERSITY**  
choose to know

(u/s 3 of UGC Act 1956)

# CONTENTS

| <b>Sr. No.</b> | <b>Description</b>                       | <b>Page No.</b> |
|----------------|--|-----------------|
| 1              | Abbreviations/Definitions                | 1               |
| 2              | Code of Conduct and Ethics for Students  | 2               |
| 3              | Important Academic Rules                 | 3               |
| 4              | Degree Objective                         | 10              |
| 5              | Category-wise List of Courses            | 11              |
| 6              | Suggested Plan of Studies                | 13              |
| 7              | Scheme of Studies                        | 14              |
| 8              | List of Dept. Electives                  | 21              |
| 9              | Important Notes                          | 22              |
| 10             | Detailed Syllabus                        |                 |
|                | – Gen., BSM, ESTA, Dept. Core & Elective | 23              |
|                | – Additional/Bridge Courses              | 61              |
|                | – Professional Development Courses       | 63              |
|                | – Open Elective Courses                  | 68              |





## ABBREVIATIONS/DEFINITIONS

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

## **CODE OF CONDUCT AND ETHICS FOR STUDENTS**

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

## IMPORTANT ACADEMIC RULES B.Tech. Degree Programme (Regular)

### GENERAL

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

### PROGRAMME

- The normal duration of the programme leading to B.Tech degree will be four years comprising twelve trimesters (or terms).
- The B.Tech. Degree programme consists of two modes i.e. (a) Project Mode and (b) with Internship.
- The total course package for a Regular B.Tech Degree Programme with Project Mode will typically consist of the following components.
  - (i) General courses
  - (ii) Basic Science and Mathematics
  - (iii) Engineering Science and Technical Arts
  - (iv) Core Courses
  - (v) Elective Courses  
An Elective Course can be any of the following:
    - a) Departmental Elective
    - b) Open Elective
  - (vi) Project/Internship (Supervised)
  - (vii) Major Project/Internship (Supervised)
  - (viii) Industrial Training
  - (ix) Mandatory Learning Courses
- The Regular B. Tech. Degree Programme with internship will typically consist of all the components of the Regular Project Mode as above, however with different weightage to industrial training and core courses.
- The student has to opt for the Internship Scheme in the ninth term which will not be revoked in any circumstances. In the absence of exercising the option, it will be presumed that option is for Project Mode.
- A student having registered for internship scheme of a programme cannot opt out of that scheme.
- The minimum credit requirement for the B.Tech.

Degree programme is 190. However, considering a case for award of honours the minimum credits will be 195.

- The project will be assigned in tenth term. It may be extended to Major Project. The Major Project shall comprise of Phase-I and Phase-II, spread over eleventh and twelfth terms. Appropriate double-letter grade is awarded as per the evaluation scheme which will be considered for TGPA and CGPA calculations. It is recommended that an external expert from industry/academia may be a member of the evaluation team of four persons (two professors, external expert and respective project guide).
- MLC must be completed by a student at appropriate time or at his convenience. The 'S' grade is awarded for satisfactory completion of the course and 'N' grade is awarded for non-satisfactory completion of the course. In case 'N' grade is awarded, the student has to re-register for the same course if no alternative options are available. However, one can opt for other courses if provided with multiple options. The 'S' and 'N' grades do not carry grade-points and, hence, are not included in the TGPA and CGPA computations.  
Courses that come under this category are the following:
  - (a) Environment Science and Ecology
  - (b) Community Service Oriented Project
  - (c) Professional Development Courses
- Students admitted to the University will be required to take suitable additional Courses in Mathematics (5-0-0) and or Communication Skills (3-0-0), if found deficient.

### ASSOCIATION

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

### PRE-REGISTRATION

- In order to facilitate proper planning of the academic activities of a term, it is essential for the students to declare their intent to register for a course well in advance, before the actual start of the academic

session, through the process of Pre-Registration, which is mandatory for all those students of second or subsequent term who propose to deviate from recommended scheme of studies.

- Pre-registration is an expression of intention of a student to pursue particular course(s) in the next term. It is information for planning for next term. Every effort will be made to arrange for a course opted by the student. However, it is not obligatory on the part of the university to offer the course(s) and no course may be offered if the number of students opting for the course is less than 15 or 25 percent of the admission strength whichever is less.
- If a student fails to pre-register it will be presumed that he will follow suggested normal scheme of studies provided that he is progressing at a normal pace. For remaining students the HOD of the parent department will plan for courses as per the convenience of the department.

#### **REGISTRATION TO COURSES**

- Every Student after consulting his Faculty-Advisor is required to register for the approved courses with the HOD of parent department at the commencement of each term on the days fixed for such registration as notified in the academic calendar.
- A student shall register for courses from amongst the courses being offered in the term keeping in mind the minimum and maximum credits allowed for a degree and other requirements i.e. pre-requisite if any, TGPA and CGPA after consulting the Faculty Advisor. No registration will be valid without the consent of HOD of the parent department.
- A student will be permitted to register in the next term as per the suggested normal scheme only if he fulfills the following Conditions:
  - (a) Satisfied all the Academic Requirements to continue with the programme of studies without termination.
  - (b) Cleared all university, library and hostel dues and fines (if any) of the previous term.
  - (c) Paid all required advance payments of the university and hostel for the current term.
  - (d) Not been debarred from registering on any specific ground by the University.
- The students will be permitted to register for course(s) being offered in a term other than his normal suggested scheme provided that the time table permits.
- The registration in the critical cases will be done as per the priority given below:
  - (a) Fulfillment of minimum credit requirement for continuation,
  - (b) The completion of programme in minimum period needed for degree, (Those who need to improve TGPA/CGPA)
  - (c) The fulfillment of pre-requisite requirement of courses.
- Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.

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

#### **CREDIT LIMITS**

- A student of the B.Tech. degree programme must register for a minimum of 10 credits, and up to a maximum of 21 credits in a Term. However, the minimum / maximum credit limit can be relaxed by the DAA on the recommendation of the HOD, only under exceptional circumstances. The maximum credits that a student can register in a Summer Term are 8.
- Professional Development courses are one credit courses each, with multiple options, to be completed at student's convenience in each Term. Some of them may be mandatory and others two-letter grade category. However, registration has to be done for all courses.

#### **CHANGE IN REGISTRATION**

- A student has the option to ADD courses for registration till the date specified for late registration in the Academic Calendar.
- On recommendation of the Teaching Department as well as the Parent Department, a student has the option to DROP courses from registration until two weeks after the commencement of the classes in the term, as indicated in the Academic Calendar.
- A student can register for auditing a course, or a course can be converted from credit to audit or from audit to credit, with the consent of the Faculty Advisor and Course Instructor within two weeks after the commencement of the classes in the term as indicated in the Academic Calendar. However, CORE Courses shall not be available for audit.

#### **ATTENDANCE REQUIREMENTS**

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

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.

- A student with less attendance in a course during a trimester, 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, 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 (a) and (b) above, 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 withdrawal from the course for that particular term subject to any condition that he may like to impose. The decision of the VC shall be final and binding.

**ABSENCE DURING EXAMINATIONS**

- A student who has been absent during MTE due to illness and/or any exigencies may give a request for make-up examination within one week after the MTE to the HOD with necessary supporting documents in person. The HOD may consider such requests depending on the merits of the case, and after consultation with the Course Instructor, may permit the Make-up examination for the student concerned. However, no makeup examination will be permitted if the attendance in the course is less than 60% till the date of examination.
- In case of absence from ETE of a course(s) on Medical ground and/or other special circumstances, the student can apply for award of 'I' grade in the course(s) with necessary supporting documents and certifications by an authorized person to the HOD within one week after the ETE. The HOD may consider the request, depending on the merit of the case, and after consultation with the Course(s) Instructor(s)/ Faculty Advisor permit the MET Examination for the student concerned. The student may subsequently complete all course requirements within the date stipulated by BOS (which may possibly be extended till first week of term under special circumstances) and 'I' grade will then

converted to an appropriate Double-letter grade, as per Clause No: G5.9. All the details of such a decision with date of finalizing the grade shall be communicated to DAA. If such an application for the 'I' grade is not made by the student then a double-letter grade will be awarded based on his term performance.

**COURSE CREDIT ASSIGNMENT**

- Every course comprises of specific Lecture-Tutorial-Practical (L-T-P) schedule. The credits for various courses are shown in the Scheme of Studies & Syllabus.
- The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.
- The double-letter grade (AA, AB, BB, BC, CC, CD, DD, FF) indicates the level of academic achievement, assessed on a decimal (0-10) scale.

**Letter-Grades and Grade-Points:**

| LETTER-GRADE | GRADE-POINTS | REMARKS        |
|--------------|--------------|----------------|
| AA           | 10           |                |
| AB           | 9            |                |
| BB           | 8            |                |
| BC           | 7            |                |
| CC           | 6            |                |
| CD           | 5            |                |
| DD           | 4            |                |
| FF           | 0            | Fail           |
| I            | -            | Incomplete     |
| U            | -            | Audited        |
| W            | -            | Withdrawal     |
| S            | -            | Satisfactory   |
| N            | -            | Unsatisfactory |

**DESCRIPTION OF GRADES**

- An 'AA' grade stands for outstanding performance, relative to the class which may include performance with previous batches. The Course Instructor is supposed to take utmost care in awarding of this highest double-letter grade.
- The 'DD' grade stands for marginal performance and is the minimum passing double-letter grade.
- The 'FF' grade denotes very poor performance, i.e. failure in a course, and the Course Instructor is supposed to take utmost care while awarding this lowest double-letter grade.
- A student, who obtains 'FF' grade in a core course, has to repeat (re-register) that core course, in subsequent terms/sessions whenever the course is offered, until a passing grade is obtained. However, for an elective course in which 'FF' grade has been obtained, the student may either repeat the same course, or register for any other elective course.
- An 'I' grade denotes incomplete performance in any course due to absence at the end term examination (see also Clause No: G7.4). When the 'I' grade is converted to a regular double

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

- 'U' grade is awarded in a course that the student opts to register for audit. It is not mandatory for the student to go through the entire regular process of evaluation in an audit course. However, the student has to go through some process of minimal level of evaluation and also the minimum attendance requirement, as stipulated by the Course Instructor and approved by the corresponding BOS, for getting the 'U' grade awarded in a course, failing which that course will not be listed in the Grade Card.
- A 'W' grade is awarded when the student withdraws from the course. Withdrawal from a course is permitted only under extremely exceptional circumstances (like medical emergencies, family tragedies and/or other unavoidable contingencies) and has to be recommended by the HOD and approved by the DAA. However, no withdrawal is permitted after the finalization of the grades in the term.
- 'S'/'N' grades are awarded for the Mandatory Learning Courses. The 'S' grade denotes satisfactory performance and completion of a course. The 'N' grade is awarded for non-completion of course requirements and the student will have to register for the course until he obtains the 'S' grade.

#### FEEDBACK TO STUDENTS

- A student requires feedback on the progress of his learning. For this purpose, the Instructor will conduct at least two quizzes for a theory course in a term-one before MTE and the other there after. The quizzes will form a component of class work, the other components being tutorials, home assignments or any other mode.
- For a laboratory course, the continuous assessment's feed back will be given through the laboratory records which are required to be submitted after performing the experiment in the next laboratory class.
- The continuous feedback on project/major project will be through project diary and interim report.
- For Internship stream, the continuous assessment and feedback is to be through seminars, professional diary and interim reports at the place of work.

#### EVALUATION

##### Theory Course:

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

|  |   |      |
|--|---|------|
| End-term Examination   | : | 50%  |
| Mid-term Examinations  | : | 30%  |
| Quizzes, Tutorials, Assignments, etc.<br>(Several over the term) | : | 20%  |
| Total  | : | 100% |

##### Laboratory Course:

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

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

##### Project (Including Seminar):

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

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

##### Major Project:

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

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

##### Internship:

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

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

The continuous assessment and feedback is to be through seminars, professional diary and entering report at the place of work.

**Seminar:**

- The double letter grade awarded to the student in Seminar i.e. 0-0-P course will be based on his performance in oral presentation with emphasis on technical contents, presentation and ability to answer questions. The weightage of the components of continuous evaluation may be as follows:

|                       |   |      |
|-----------------------|---|------|
| Technical Contents    | : | 40%  |
| Presentation          | : | 30%  |
| Questions and answers | : | 30%  |
| Total                 | : | 100% |

**Industrial/Field Training/Internship-I:**

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

|                       |   |      |
|-----------------------|---|------|
| Training report       | : | 40%  |
| Presentation          | : | 30%  |
| Questions and answers | : | 30%  |
| Total                 | : | 100% |

**Professional Development:**

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

**SCHEME OF EXAMINATION**

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

**Theory Courses:**

The University shall conduct the ETE for all theory courses being taught in the term.

- 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.
- Part-A will be short answer type with multiple parts covering all the units in the syllabus, which will be compulsory.
- 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.
- 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:**

- 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.
- The student will be given randomly an experiment to perform from within the list of experiments in the course.
- No change in the experiment will be permitted after the draw, if the student had performed the same in the class.

**Mid-Term Examination:**

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

*B.Tech. Mechanical Engineering (Regular)*

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 using malpractice in the examination;
  - (b) A mistake is found in his result;
  - (c) He is found ineligible to appear in the examination

**AWARD OF DIVISIONS**

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

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

$$TGPA = \sum C_i G_i / \sum C_i$$

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:**

$$CGPA = \sum C_i G_i / \sum C_i$$

Where,

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

For CGPA calculation, the following grades are to be counted:

- (i) Grades in all core courses,
  - (ii) The best grades in the remaining eligible courses to fulfill the minimum credits requirement for a programme.
- The degree will be awarded only upon compliance of all the laid down requirements for programme as under:
    - (i) There shall be University requirement of earning a minimum credits for a degree, satisfactory completion of mandatory learning courses and other activities as per the course structure.
    - (ii) There shall be a minimum earned credit requirement on all Departmental Core Courses, Elective courses and Major Project as specified by BOS.
    - (iii) There shall be a maximum duration for complying to the degree requirement.
    - (iv) The candidate will be placed in First Division

with Honours/First Division with Distinction/First Division/Second Division which will be mentioned on the degree certificate as under:

| DIVISION                        | CONDITIONS TO BE FULFILLED   |
|---------------------------------|--|
| First Division with Honours     | CGPA ≥ 8.5<br>No 'FF', N or W grade in any course during the programme and total 195 credits |
| First Division with Distinction | CGPA ≥ 8.5   |
| First Division                  | CGPA ≥ 6.75  |
| Second Division                 | CGPA ≥ 5.0 but < 6.75  |

**Note:**

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

**B. TECH. DEGREE REQUIREMENTS**

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

**GRADE IMPROVEMENT**

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

**TERMINATION FROM THE PROGRAMME**

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

| CHECK POINT        | CREDIT THRESHOLD** |
|--------------------|--------------------|
| End of FIRST year  | 20*                |
| End of SECOND year | 50*                |
| End of THIRD year  | 85                 |
| End of FOURTH year | 125                |

**Note 1:**

\* A student may be given one more chance to cover the shortfall in the threshold during the following summer term as follows:

- (i) if a student earns 12 credits or more but less than 20 at the end of first year.
- (ii) if a student earns 42 or more credits but less than 50 at the end of second year.

In case he fails to clear the threshold even after the summer term he has to leave the course.

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

**Note 2:**

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 Mechanical Engineering**

### **DEGREE OBJECTIVE**

All man-made physical items have contribution of mechanical engineering, from a simple toy car to supersonic jet plane, from a simple file to flexible machining systems, from a simple Potter's wheel and water wheel to huge power plants, and so on.

Mechanical Engineers conceive, design and operate devices for use of mankind. The objective therefore is based on the above three aspects. Broadly, the undergraduate programme has been classified into the following categories:

**i) DESIGN**

Engineering Mechanics, Strength of Materials, Theory of Machines, Machine Design, Vibrations and Higher Applications

**ii) MANUFACTURING**

Engineering Graphics, Machine Drawing, Manufacturing Techniques, Manufacturing Science, Industrial Engineering, Operation Research and higher applications

**iii) THERMAL**

Thermodynamics, Fluid Mechanics, Heat Transfer, Energy Conversion and higher applications

**iv) GENERAL & ENGG. SCIENCE**

Mathematics, Physics, Chemistry, Economics, Management, Electrical & Electronics, Computer Programming, Optimization, Automatic Control, Measurement & Instrumentation

Additionally, for being a good citizen, the student is trained through Professional Development courses where the student will understand the significance of Personal Ethics, Personal Character, Environmental awareness, Community obligations, etc. The obligation of the student to the community is further strengthened through an audit course Community Service Oriented Project (CSOP). The student will also be aware of the contributions in the area of Mechanical Engineering at national and global level through seminars and invited lectures. In the final year, the student is expected to take up four elective courses as a part of limited specialization that would help him keep abreast of the latest developments globally.

Keeping the designing and production aspects in view, that are critical to Mechanical Engineers, the curriculum has been designed to meet the requirements in developing the requisite competencies in the students. The programme would enable a student to work in teaching, in manufacturing concern, a power plant, refrigeration and air conditioning or automotive industry, a design/consultancy organization, or take up higher studies.

## CATEGORY-WISE LIST OF COURSES

| <b>General (Humanities, Soc Sc. Man) (GEN.)</b> |        |                                 |       |   |
|---|--------|---------------------------------|-------|---|
| 1   | BA-225 | Economics                       | 5-0-0 | 3 |
| 2   | BA-226 | Principles of Management        | 5-1-0 | 4 |
| 3   | CE-101 | Environmental Science & Ecology | 5-0-0 | 3 |
| 4   | EN-101 | Communication Skills            | 5-0-0 | 3 |
| 5   | EN-151 | Language Lab                    | 0-0-2 | 1 |

| <b>Basic Science &amp; Mathematics including Computer (BSM)</b> |        |                               |       |   |
|---|--------|-------------------------------|-------|---|
| 1   | CH-101 | Applied Chemistry             | 5-0-0 | 3 |
| 2   | CH-151 | Applied Chemistry Lab         | 0-0-2 | 1 |
| 3   | CS-101 | Computer Programming          | 5-1-0 | 4 |
| 4   | CS-151 | Computer Programming Lab      | 0-0-2 | 1 |
| 5   | MA-101 | Applied Mathematics-I         | 5-1-0 | 4 |
| 6   | MA-102 | Applied Mathematics-II        | 5-1-0 | 4 |
| 7   | MA-202 | Applied Numerical Methods     | 5-1-0 | 4 |
| 8   | MA-252 | Applied Numerical Methods Lab | 0-0-2 | 1 |
| 9   | PH-101 | Physics                       | 5-1-0 | 4 |
| 10  | PH-102 | Applied Physics               | 5-1-0 | 4 |
| 11  | PH-151 | Physics Lab                   | 0-0-2 | 1 |
| 12  | PH-152 | Applied Physics Lab           | 0-0-2 | 1 |
| 13  | PH-152 | Applied Physics Lab           | 0-0-2 | 1 |

| <b>Engineering Science &amp; Technical Arts (ESTA)</b> |        |                             |         |   |
|--|--------|-----------------------------|---------|---|
| 1  | EC-201 | Electronics Engineering     | 5-1-0   | 4 |
| 2  | EC-251 | Electronics Engineering Lab | 0-0-2   | 1 |
| 3  | EL-101 | Electrical Engineering      | 5-1-0   | 4 |
| 4  | EL-151 | Electrical Engineering Lab. | 0-0-2   | 1 |
| 5  | ME-101 | Engineering Mechanics       | 5-1-0   | 4 |
| 6  | ME-151 | Engineering Mechanics Lab   | 0-0-2   | 1 |
| 7  | ME-152 | Workshop Practice           | 0-0-4   | 2 |
| 8  | ME-153 | Engineering Graphics        | 0-0-6** | 3 |

| <b>Department Core (DC)</b> |        |  |       |   |
|-----------------------------|--------|--|-------|---|
| 1                           | ME-201 | Computer Methods in Mechanical Engineering     | 4-0-0 | 2 |
| 2                           | ME-202 | Manufacturing Technology                       | 5-0-0 | 3 |
| 3                           | ME-203 | Thermodynamics                                 | 5-1-0 | 4 |
| 6                           | ME-204 | Strength of Materials                          | 5-1-0 | 4 |
| 7                           | ME-205 | Theory of Machines-I                           | 5-1-0 | 4 |
| 8                           | ME-206 | Machine Drawing and CAD                        | 1-0-0 | 1 |
| 12                          | ME-207 | Fluid Mechanics                                | 5-1-0 | 4 |
| 13                          | ME-208 | Engineering Materials                          | 5-0-0 | 3 |
| 14                          | ME-209 | Measurement and Instrumentation                | 5-0-0 | 3 |
| 4                           | ME-251 | Computer Methods in Mechanical Engineering Lab | 0-0-2 | 1 |
| 5                           | ME-252 | Manufacturing Technology Lab                   | 0-0-2 | 1 |
| 9                           | ME-254 | Strength of Materials Lab                      | 0-0-2 | 1 |
| 11                          | ME-256 | Machine Drawing and CAD Lab                    | 0-0-6 | 3 |
| 15                          | ME-257 | Fluid Mechanics Lab                            | 0-0-2 | 1 |
| 16                          | ME-258 | Engineering Materials Lab                      | 0-0-2 | 1 |

|    |        |  |       |   |
|----|--------|--|-------|---|
| 17 | ME-259 | Measurement and Instrumentation Lab    | 0-0-2 | 1 |
| 18 | ME-301 | Theory of Machines-II                  | 5-1-0 | 4 |
| 19 | ME-302 | Energy Conversion-I                    | 5-1-0 | 4 |
| 20 | ME-303 | Industrial Engineering                 | 5-0-0 | 3 |
| 23 | ME-304 | Manufacturing Science                  | 5-0-0 | 3 |
| 24 | ME-305 | Machine Design-I                       | 5-0-0 | 3 |
| 25 | ME-306 | Automatic Control                      | 5-1-0 | 4 |
| 26 | ME-307 | Fluid Machines                         | 5-1-0 | 4 |
| 30 | ME-308 | Optimization Techniques                | 5-1-0 | 4 |
| 31 | ME-309 | Heat Transfer                          | 5-1-0 | 4 |
| 32 | ME-310 | Energy Conversion-II                   | 5-1-0 | 4 |
| 33 | ME-311 | Machine Design-II                      | 4-0-0 | 2 |
| 21 | ME-351 | Theory of Machines-II Lab              | 0-0-2 | 1 |
| 22 | ME-352 | Energy Conversion-I Lab                | 0-0-2 | 1 |
| 27 | ME-354 | Manufacturing Science Lab              | 0-0-2 | 1 |
| 28 | ME-355 | Machine Design-I Lab                   | 0-0-2 | 1 |
| 29 | ME-357 | Fluid Machines Lab                     | 0-0-2 | 1 |
| 34 | ME-359 | Heat Transfer Lab                      | 0-0-2 | 1 |
| 35 | ME-360 | Energy Conversion-II Lab               | 0-0-2 | 1 |
| 36 | ME-361 | Machine Design-II Lab                  | 0-0-2 | 1 |
| 37 | ME-401 | Refrigeration and Air conditioning     | 5-0-0 | 3 |
| 38 | ME-402 | Computer Aided Design                  | 5-0-0 | 3 |
| 42 | ME-404 | Mechanical Vibrations                  | 5-1-0 | 4 |
| 39 | ME-451 | Refrigeration and Air conditioning Lab | 0-0-2 | 1 |
| 40 | ME-452 | Computer Aided Design Lab              | 0-0-2 | 1 |
| 41 | ME-453 | Department Lab                         | 0-0-2 | 1 |
| 43 | ME-454 | Mechanical Vibrations Lab              | 0-0-2 | 1 |

| <b>Department Elective (DE)</b> |        |                                 |       |   |
|---------------------------------|--------|---------------------------------|-------|---|
| 1                               | ME-421 | Power Plant Engineering         | 5-0-0 | 3 |
| 2                               | ME-422 | Flexible Manufacturing Systems  | 5-0-0 | 3 |
| 3                               | ME-423 | Machine Tool Design             | 5-0-0 | 3 |
| 4                               | ME-431 | Automobile Engineering          | 5-0-0 | 3 |
| 5                               | ME-432 | Metrology                       | 5-0-0 | 3 |
| 6                               | ME-433 | Mechatronics                    | 5-0-0 | 3 |
| 7                               | ME-441 | Gas Dynamics and Jet Propulsion | 5-0-0 | 3 |
| 8                               | ME-442 | Ergonomics                      | 5-0-0 | 3 |
| 9                               | ME-443 | Finite Element Analysis         | 5-0-0 | 3 |
| 10                              | ME-461 | Renewable Sources of Energy     | 5-0-0 | 3 |
| 11                              | ME-462 | Maintenance Engineering         | 5-0-0 | 3 |
| 12                              | ME-463 | Total Quality Control           | 5-0-0 | 3 |

| <b>Open Elective (OE)</b> |        |  |       |   |
|---------------------------|--------|--|-------|---|
| 1                         | AE-411 | Transport Management                       | 5-0-0 | 3 |
| 2                         | BA-271 | Human Resource Management                  | 5-0-0 | 3 |
| 3                         | BA-272 | Entrepreneurship Development               | 5-0-0 | 3 |
| 4                         | CE-471 | Advanced Traffic Engineering               | 5-0-0 | 3 |
| 5                         | CE-472 | Elements of Town Planning and Architecture | 5-0-0 | 3 |

B.Tech. Mechanical Engineering (Regular)

|    |        |   |       |   |
|----|--------|---|-------|---|
| 6  | CH-471 | Advanced Applied Chemistry                      | 5-0-0 | 3 |
| 7  | CS-303 | Computer Graphics                               | 5-0-0 | 3 |
| 8  | CS-422 | Cryptography and Data Compression               | 5-0-0 | 3 |
| 9  | EC-305 | Embedded System Design                          | 5-0-0 | 3 |
| 10 | EC-401 | Mobile Communication                            | 5-0-0 | 3 |
| 11 | EE-401 | Programmable Logic Controllers & SCADA          | 5-0-0 | 3 |
| 12 | EE-431 | INDUSTRIAL ELECTRONICS                          | 5-0-0 | 3 |
| 13 | EL-421 | Renewable Energy Source and Energy Conservation | 5-0-0 | 3 |
| 14 | EL-422 | High Voltage Direct Current Transmission        | 5-0-0 | 3 |
| 15 | EL-423 | High Voltage Engineering                        | 5-0-0 | 3 |
| 16 | EN-471 | Professional Communication                      | 5-0-0 | 3 |
| 17 | EN-472 | Business Communication                          | 5-0-0 | 3 |
| 18 | IT-423 | Introduction to E-commerce & ERP                | 5-0-0 | 3 |
| 19 | IT-443 | Information Storage & Management                | 5-0-0 | 3 |
| 20 | MA-471 | Discrete Mathematics                            | 5-0-0 | 3 |
| 21 | MA-472 | Advanced Higher Engineering Mathematics         | 5-0-0 | 3 |
| 22 | MA-473 | Advanced Numerical Techniques                   | 5-0-0 | 3 |
| 23 | MA-474 | Operation Research                              | 5-0-0 | 3 |
| 24 | ME-442 | Ergonomics                                      | 5-0-0 | 3 |
| 25 | ME-443 | Finite Element Analysis                         | 5-0-0 | 3 |
| 26 | ME-461 | Renewable Sources of Energy                     | 5-0-0 | 3 |
| 27 | PH-471 | Non Destructive Testing Techniques              | 5-0-0 | 3 |
| 28 | PH-472 | Nano Technology                                 | 5-0-0 | 3 |
| 29 | PH-473 | Laser Technology                                | 5-0-0 | 3 |

| Project/Internship, Seminar Training, CSOP |        |   |        |    |
|--|--------|---|--------|----|
| 2  | ME-481 | Major Project Phase-I                     | 0-0-10 | 5  |
| 3  | ME-482 | Major Project Phase-II                    | 0-0-6  | 3  |
| 4  | ME-483 | Internship – I                            | 0-0-2  | 1  |
| 5  | ME-484 | Internship – II (in industry)             | 0-0-26 | 13 |
| 6  | ME-485 | Internship Documentation                  | 0-0-6  | 3  |
| 1  | ME-491 | Community Service Oriented Project (CSOP) | 0-0-2  | 1  |

|    |        |                                    |       |   |
|----|--------|------------------------------------|-------|---|
| 7  | ME-492 | Project (including Seminar)        | 0-0-4 | 2 |
| 8  | ME-493 | Industrial Training/Field Training | 0-0-2 | 1 |
| 9  | ME-494 | Seminar – I                        | 0-0-2 | 1 |
| 10 | ME-495 | Seminar – II                       | 0-0-2 | 1 |

| Professional Development (PD) – Gen. |        |  |       |   |
|--------------------------------------|--------|--|-------|---|
| 1                                    | PD-151 | Basics of Computer Fundamentals                | 0-0-2 | 1 |
| 2                                    | PD-191 | Co-curricular Activities                       |       | 1 |
| 3                                    | PD-192 | Personality Skills                             | 0-0-2 | 1 |
| 4                                    | PD-193 | Entrepreneurial & Professional Skills          | 0-0-2 | 1 |
| 5                                    | PD-251 | MATLAB   | 0-0-2 | 1 |
| 6                                    | PD-291 | Co-curricular Activities                       |       | 1 |
| 7                                    | PD-292 | Effective Communication                        | 0-0-2 | 1 |
| 8                                    | PD-293 | Intra & Inter-personal Skills                  | 0-0-2 | 1 |
| 9                                    | PD-358 | Mechanical Engineering – Aptitude Course       | 0-0-2 | 1 |
| 10                                   | PD-391 | Co-curricular Activities                       |       | 1 |
| 11                                   | PD-392 | Problem Solving Skills                         | 0-0-2 | 1 |
| 12                                   | PD-393 | Advanced Professional Development              | 0-0-2 | 1 |
| 13                                   | PD-458 | Computer Application in Mechanical Engineering | 0-0-2 | 1 |
| 14                                   | PD-491 | Co-curricular Activities                       |       | 1 |

| Mandatory Learning Course (MLC) |        |   |       |   |
|---------------------------------|--------|---|-------|---|
| 1                               | CE-101 | Environmental Science & Ecology           | 5-0-0 | 3 |
| 2                               | ME-491 | Community Service Oriented Project (CSOP) | 0-0-2 | 1 |
| 3                               | PD-292 | Effective Communication                   | 0-0-2 | 1 |
| 4                               | PD-393 | Advanced Professional Development         | 0-0-2 | 1 |

| Additional/Bridge Course |        |   |       |   |
|--------------------------|--------|---|-------|---|
| 1                        | EN-291 | Essentials of Communication Objective (Bridge Course) | 5-0-0 | 3 |
| 2                        | MA-191 | Mathematics (Makeup Course)                           | 5-0-0 | 3 |
| 3                        | MA-291 | Mathematics (Bridge Course)                           | 5-0-0 | 3 |

## SUGGESTED PLAN OF STUDIES

| Course→                          | 1                            | 2                            | 3                            | 4                            | 5      | 6                            | 7                 | 8                            | 9                            | 10     |
|----------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------|------------------------------|-------------------|------------------------------|------------------------------|--------|
| <b>Term-I</b>                    | PH-101/<br>EL-101/<br>PH-102 | MA-101/<br>ME-101/<br>MA-102 | CH-101/<br>CS-101/<br>CE-101 | EN-101/<br>ME-102/<br>ME-103 | ME-151 | PH-151/<br>PH-152/<br>EL-151 | CH-151/<br>CS-151 | EN-151/<br>ME-152/<br>ME-153 | PD-192/<br>PD-193/<br>PD-151 | PD-191 |
| <b>Term-II</b>                   | PH-101/<br>EL-101/<br>PH-102 | MA-101/<br>ME-101/<br>MA-102 | CH-101/<br>CS-101/<br>CE-101 | EN-101/<br>ME-102/<br>ME-103 | ME-151 | PH-151/<br>PH-152/<br>EL-151 | CH-151/<br>CS-151 | EN-151/<br>ME-152/<br>ME-153 | PD-192/<br>PD-193/<br>PD-151 | PD-191 |
| <b>Term-III</b>                  | PH-101/<br>EL-101/<br>PH-102 | MA-101/<br>ME-101/<br>MA-102 | CH-101/<br>CS-101/<br>CE-101 | EN-101/<br>ME-102/<br>ME-103 | ME-151 | PH-151/<br>PH-152/<br>EL-151 | CH-151/<br>CS-151 | EN-151/<br>ME-152/<br>ME-153 | PD-192/<br>PD-193/<br>PD-151 | PD-191 |
| <b>Term-IV</b>                   | ME-201                       | EC-201                       | ME-202                       | ME-203                       | ME-251 | EC-251                       | ME-252            | -                            | PD-292/<br>PD-293/<br>PD-251 | PD-291 |
| <b>Term-V</b>                    | ME-204                       | MA-202                       | ME-205                       | ME-206                       | ME-254 | MA-252                       | ME-256            | -                            | PD-292/<br>PD-293/<br>PD-251 | PD-291 |
| <b>Term-VI</b>                   | ME-207                       | ME-208                       | ME-209                       | BA-225                       | ME-257 | ME-258                       | ME-259            | -                            | PD-292/<br>PD-293/<br>PD-251 | PD-291 |
| <b>Term-VII</b>                  | BA-226                       | ME-301                       | ME-302                       | ME-303                       | ME-351 | ME-352                       | -                 | -                            | PD-392/<br>PD-393/<br>PD-393 | PD-391 |
| <b>Term-VIII</b>                 | ME-304                       | ME-305                       | ME-306                       | ME-307                       | ME-354 | ME-355                       | ME-357            | -                            | PD-392/<br>PD-393/<br>PD-393 | PD-391 |
| <b>Term-IX</b>                   | ME-308                       | ME-309                       | ME-310                       | ME-311                       | ME-359 | ME-360                       | ME-361            | -                            | PD-392/<br>PD-393/<br>PD-393 | PD-391 |
| <b>Term-X<br/>(Project)</b>      | ME-401                       | ME-402                       | Dept.<br>Elect.-I            | ME-451                       | ME-452 | ME-491                       | ME-492            | ME-493                       | PD-458                       | PD-491 |
| <b>Term-X<br/>(Internship)</b>   | ME-401                       | ME-402                       | Dept.<br>Elect.-I            | ME-451                       | ME-452 | ME-491                       | ME-492            | ME-483                       | PD-458                       | PD-491 |
| <b>Term-XI<br/>(Project)</b>     | Dept.<br>Elect.-II           | Open<br>Elect.               | ME-453                       | ME-481                       | ME-494 | -                            | -                 | -                            | -                            | PD-491 |
| <b>Term-XI<br/>(Internship)</b>  | ME-494                       | ME-484                       | -                            | -                            | -      | -                            | -                 | -                            | -                            | PD-491 |
| <b>Term-XII<br/>(Project)</b>    | ME-404                       | Dept.<br>Elect.-III          | Dept.<br>Elect.-IV           | ME-454                       | ME-482 | ME-495                       | -                 | -                            | -                            | PD-491 |
| <b>Term-XII<br/>(Internship)</b> | ME-404                       | Dept.<br>Elect.-III          | Dept.<br>Elect.-IV           | ME-454                       | ME-485 | ME-495                       | -                 | -                            | -                            | PD-491 |

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

**1<sup>st</sup> Year**

**TERM – I**

| THEORY                   |       |            |                                       |         |   |            |              |                        |             |       |
|--------------------------|-------|------------|---------------------------------------|---------|---|------------|--------------|------------------------|-------------|-------|
| Sl. No.                  | Group | Course No. | Course Name                           | Periods | Evaluation Scheme                           |            |              |                        | Cr          |       |
|                          |       |            |                                       |         | Components of Evaluation with Weightage (%) |            |              |                        |             |       |
|                          |       |            |                                       |         | L-T-P                                       | Class Work | MTE (1½ Hrs) | ETE (3 Hrs)            |             | Total |
| 1                        | A     | MA-101     | Applied Mathematics-I                 | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
|                          | B     | MA-101     | Applied Mathematics-I                 | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
|                          | C     | ME-101     | Engineering Mechanics                 | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
| 2                        | A     | PH-101     | Physics                               | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
|                          | B     | PH-101     | Physics                               | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
|                          | C     | EL-101     | Electrical Engineering                | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
| 3                        | A     | CH-101     | Applied Chemistry                     | 5-0-0   | 20  | 30         | 50           | 100                    | 3           |       |
|                          | B     | CS-101     | Computer Programming                  | 5-1-0   | 20  | 30         | 50           | 100                    | 4           |       |
|                          | C     | CE-101     | Environmental Science & Ecology***    | 5-0-0   | 20  | 30         | 50           | 100                    | 3           |       |
| 4                        | A     | EN-101     | Communication Skills                  | 5-0-0   | 20  | 30         | 50           | 100                    | 3           |       |
| PRACTICAL/DRAWING/DESIGN |       |            |                                       |         |   |            |              |                        |             |       |
| Sl. No.                  | Group | Course No. | Course Name                           | Periods | Evaluation Scheme                           |            |              |                        |             | Cr    |
|                          |       |            |                                       |         | Components of Evaluation With Weightage (%) |            |              |                        |             |       |
|                          |       |            |                                       |         | L-T-P                                       | EXPT.      | Lab Record   | MTE Quizzes/ Viva-voce | ETE (2 Hrs) |       |
| 1                        | C     | ME-151     | Engineering Mechanics Lab             | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
| 2                        | A     | PH-151     | Physics Lab                           | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | B     | PH-151     | Physics Lab                           | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | C     | EL-151     | Electrical Engineering Lab            | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
| 3                        | A     | CH-151     | Applied Chemistry Lab                 | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | B     | CS-151     | Computer Programming Lab              | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
| 4                        | A     | EN-151     | Language Lab                          | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | B     | ME-152     | Workshop Practice                     | 0-0-4   | 40  | 10         | 20           | 30                     | 100         | 2     |
|                          | C     | ME-153     | Engineering Graphics                  | 0-0-6** | 40  | 10         | 20           | 30                     | 100         | 3     |
| 5                        | A     | PD-192     | Personality Skills                    | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | B     | PD-193     | Entrepreneurial & Professional Skills | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
|                          | C     | PD-151     | Basics of Computer Fundamentals       | 0-0-2   | 40  | 10         | 20           | 30                     | 100         | 1     |
| 6                        | A/B/C | PD-191     | Co-curricular Activities              |         |   |            |              |                        |             | 1*    |

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

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

**FINAL EVALUATION IN GRADES**

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

MTE – Mid-Term Exam

CW - Class Work

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)**

| <b>1<sup>st</sup> Year</b>      |       |            |                                      |         |   |              |                        |             |     |       |
|---------------------------------|-------|------------|--------------------------------------|---------|---|--------------|------------------------|-------------|-----|-------|
| <b>TERM – II</b>                |       |            |                                      |         |   |              |                        |             |     |       |
| <b>THEORY</b>                   |       |            |                                      |         |   |              |                        |             |     |       |
| Sl. No.                         | Group | Course No. | Course Name                          | Periods | Evaluation Scheme                           |              |                        |             | Cr  |       |
|                                 |       |            |                                      |         | Components of Evaluation with Weightage (%) |              |                        |             |     |       |
|                                 |       |            |                                      | L-T-P   | Class Work                                  | MTE (1½ Hrs) | ETE (3 Hrs)            | Total       |     |       |
| 1                               | A     | MA-102     | Applied Mathematics-II               | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
|                                 | B     | ME-101     | Engineering Mechanics                | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
|                                 | C     | MA-101     | Mathematics-I                        | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
| 2                               | A     | PH-102     | Applied Physics                      | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
|                                 | B     | EL-101     | Electrical Engineering               | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
|                                 | C     | PH-101     | Physics                              | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
| 3                               | A     | CS-101     | Computer Programming                 | 5-1-0   | 20  | 30           | 50                     | 100         | 4   |       |
|                                 | B     | CE-101     | Environmental Science & Ecology***   | 5-0-0   | 20  | 30           | 50                     | 100         | 3   |       |
|                                 | C     | CH-101     | Applied Chemistry                    | 5-0-0   | 20  | 30           | 50                     | 100         | 3   |       |
| 4                               | C     | EN-101     | Communication Skills                 | 5-0-0   | 20  | 30           | 50                     | 100         | 3   |       |
| <b>PRACTICAL/DRAWING/DESIGN</b> |       |            |                                      |         |   |              |                        |             |     |       |
| Sl. No.                         | Group | Course No. | Course Name                          | Periods | Evaluation Scheme                           |              |                        |             | Cr  |       |
|                                 |       |            |                                      |         | Components of Evaluation With Weightage (%) |              |                        |             |     |       |
|                                 |       |            |                                      | L-T-P   | EXPT.                                       | Lab Record   | MTE Quizzes/ Viva-voce | ETE (2 Hrs) |     | Total |
| 1                               | B     | ME-151     | Engineering Mechanics Lab            | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
| 2                               | A     | PH-152     | Applied Physics Lab                  | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
|                                 | B     | EL-151     | Electrical Engineering Lab           | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
|                                 | C     | PH-151     | Physics Lab                          | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
| 3                               | A     | CS-151     | Computer Programming Lab             | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
|                                 | C     | CH-151     | Applied Chemistry Lab                | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
| 4                               | A     | ME-152     | Workshop Practice                    | 0-0-4   | 40  | 10           | 20                     | 30          | 100 | 2     |
|                                 | B     | ME-153     | Engineering Graphics                 | 0-0-6** | 40  | 10           | 20                     | 30          | 100 | 3     |
|                                 | C     | EN-151     | Language Lab                         | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
| 5                               | A     | PD-193     | Enterpreneural & Professional Skills | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
|                                 | B     | PD-151     | Basics of Computer Fundamentals      | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
|                                 | C     | PD-192     | Personality Skills                   | 0-0-2   | 40  | 10           | 20                     | 30          | 100 | 1     |
| 6                               | A/B/C | PD-191     | Co-curricular Activities             |         |   |              |                        |             |     | 1*    |

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

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

**FINAL EVALUATION IN GRADES**

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

MTE-Mid-Term Exam

CW - Class Work

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)**

**1<sup>st</sup> Year**

**TERM – III**

| THEORY                   |       |            |                                       |         |   |            |              |                        |     |             |
|--------------------------|-------|------------|---------------------------------------|---------|---|------------|--------------|------------------------|-----|-------------|
| Sl. No.                  | Group | Course No. | Course Name                           | Periods | Evaluation Scheme                           |            |              |                        | Cr  |             |
|                          |       |            |                                       |         | Components of Evaluation with Weightage (%) |            |              |                        |     |             |
|                          |       |            |                                       |         | L-T-P                                       | Class Work | MTE (1½ Hrs) | ETE (3 Hrs)            |     | Total       |
| 1                        | A     | ME-101     | Engineering Mechanics                 | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
|                          | B     | MA-102     | Applied Mathematics-II                | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
|                          | C     | MA-102     | Applied Mathematics-II                | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
| 2                        | A     | EL-101     | Electrical Engineering                | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
|                          | B     | PH-102     | Applied Physics                       | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
|                          | C     | PH-102     | Applied Physics                       | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
| 3                        | A     | CE-101     | Environmental Science & Ecology***    | 5-0-0   | 20  | 30         | 50           | 100                    | 3   |             |
|                          | B     | CH-101     | Applied Chemistry                     | 5-0-0   | 20  | 30         | 50           | 100                    | 3   |             |
|                          | C     | CS-101     | Computer Programming                  | 5-1-0   | 20  | 30         | 50           | 100                    | 4   |             |
| 4                        | B     | EN-101     | Communication Skills                  | 5-0-0   | 20  | 30         | 50           | 100                    | 3   |             |
| PRACTICAL/DRAWING/DESIGN |       |            |                                       |         |   |            |              |                        |     |             |
| Sl. No.                  | Group | Course No. | Course Name                           | Periods | Evaluation Scheme                           |            |              |                        | Cr  |             |
|                          |       |            |                                       |         | Components of Evaluation With Weightage (%) |            |              |                        |     |             |
|                          |       |            |                                       |         | L-T-P                                       | EXPT.      | Lab Record   | MTE Quizzes/ Viva-voce |     | ETE (2 Hrs) |
| 1                        | A     | ME-151     | Engineering Mechanics Lab             | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
| 2                        | A     | EL-151     | Electrical Engineering Lab            | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | B     | PH-152     | Applied Physics Lab                   | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | C     | PH-152     | Applied Physics Lab                   | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
| 3                        | B     | CH-101     | Applied Chemistry                     | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | C     | CS-151     | Computer Programming Lab              | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
| 4                        | A     | ME-153     | Engineering Graphics                  | 0-0-6** | 40  | 10         | 20           | 30                     | 100 | 3           |
|                          | B     | EN-101     | Language Lab                          | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | C     | ME-152     | Workshop Practice                     | 0-0-4   | 40  | 10         | 20           | 30                     | 100 | 2           |
| 5                        | A     | PD-151     | Basics of Computer Fundamentals       | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | B     | PD-192     | Personality Skills                    | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
|                          | C     | PD-193     | Entrepreneurial & Professional Skills | 0-0-2   | 40  | 10         | 20           | 30                     | 100 | 1           |
| 6                        | A/B/C | PD-191     | Co-curricular Activities              |         |   |            |              |                        |     | 1*          |

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

| GROUP | TOTAL CONTACT HOURS | TOTAL CREDITS |
|-------|---------------------|---------------|
| A     | 15-2-12 (29)        | 17+1*         |
| B     | 20-2-8 (30)         | 18+1*         |
| C     | 15-3-10 (28)        | 17+1*         |

**FINAL EVALUATION IN GRADES**

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

MTE – Mid-Term Exam

CW – Class Work

ETE – End-Term Exam

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

\*\* One hour for explanation/demonstration.

\*\*\* CE-101 is a Mandatory Learning Course.

**Department of Mechanical Engineering**  
**Scheme of Studies**  
**B. Tech. Degree Programme (Regular)**

**2<sup>nd</sup> Year**

| <b>TERM – IV</b>   |                              |  |       |           |
|--------------------|------------------------------|--|-------|-----------|
| SN                 | Course No.                   | Course Name  | L-T-P | Cr        |
| 1                  | ME-201                       | Computer Methods in Mechanical Engineering                               | 4-0-0 | 2         |
| 2                  | EC-201                       | Electronics Engineering  | 5-1-0 | 4         |
| 3                  | ME-202                       | Manufacturing Technology   | 5-0-0 | 3         |
| 4                  | ME-203                       | Thermodynamics   | 5-1-0 | 4         |
| 5                  | ME-251                       | Computer Methods in Mechanical Engineering Lab                           | 0-0-2 | 1         |
| 6                  | EC-251                       | Electronics Engineering Lab  | 0-0-2 | 1         |
| 7                  | ME-252                       | Manufacturing Technology Lab   | 0-0-2 | 1         |
| 8                  | PD-292/<br>PD-293/<br>PD-251 | Effective Communication**/<br>Intra and Inter-personal Skills/<br>MATLAB | 0-0-2 | 1         |
| 9                  | PD-291                       | Co-curricular Activities   |       | 1*        |
| <b>19-2-8 (29)</b> |                              |  |       | <b>17</b> |

| <b>TERM – V</b>     |                              |  |       |           |
|---------------------|------------------------------|--|-------|-----------|
| SN                  | Course No.                   | Course Name  | L-T-P | Cr        |
| 1                   | ME-204                       | Strength of Materials  | 5-1-0 | 4         |
| 2                   | MA-202                       | Applied Numerical Methods  | 5-1-0 | 4         |
| 3                   | ME-205                       | Theory of Machines-I   | 5-1-0 | 4         |
| 4                   | ME-206                       | Machine Drawing and CAD  | 1-0-0 | 1         |
| 5                   | ME-254                       | Strength of Materials Lab  | 0-0-2 | 1         |
| 6                   | MA-252                       | Applied Numerical Methods Lab  | 0-0-2 | 1         |
| 7                   | ME-256                       | Machine Drawing and CAD Lab  | 0-0-6 | 3         |
| 8                   | PD-292/<br>PD-293/<br>PD-251 | Effective Communication**/<br>Intra and Inter-personal Skills/<br>MATLAB | 0-0-2 | 1         |
| 9                   | PD-291                       | Co-curricular Activities   |       | 1*        |
| <b>16-3-12 (31)</b> |                              |  |       | <b>19</b> |

| <b>TERM – VI</b>   |                              |  |       |              |
|--------------------|------------------------------|--|-------|--------------|
| SN                 | Course No.                   | Course Name  | L-T-P | Cr           |
| 1                  | ME-207                       | Fluid Mechanics  | 5-1-0 | 4            |
| 2                  | ME-208                       | Engineering Materials  | 5-0-0 | 3            |
| 3                  | ME-209                       | Measurement and Instrumentation  | 5-0-0 | 3            |
| 4                  | BA-225                       | Economics  | 5-0-0 | 3            |
| 5                  | ME-257                       | Fluid Mechanics Lab  | 0-0-2 | 1            |
| 6                  | ME-258                       | Engineering Materials Lab  | 0-0-2 | 1            |
| 7                  | ME-259                       | Measurement and Instrumentation Lab                                      | 0-0-2 | 1            |
| 8                  | PD-292/<br>PD-293/<br>PD-251 | Effective Communication**/<br>Intra and Inter-personal Skills/<br>MATLAB | 0-0-2 | 1            |
| 9                  | PD-291                       | Co-curricular Activities   |       | 1*           |
| <b>20-1-6 (27)</b> |                              |  |       | <b>17+1*</b> |

**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.

**Department of Mechanical Engineering**  
**Scheme of Studies**  
**B. Tech. Degree Programme (Regular)**

**3<sup>rd</sup> Year**

| <b>TERM – VII</b>  |                              |   |              |           |
|--------------------|------------------------------|---|--------------|-----------|
| <b>SN</b>          | <b>Course No.</b>            | <b>Course Name</b>  | <b>L-T-P</b> | <b>Cr</b> |
| 1                  | BA-226                       | Principles of Management  | 5-0-0        | 3         |
| 2                  | ME-301                       | Theory of Machines-II   | 5-1-0        | 4         |
| 3                  | ME-302                       | Energy Conversion-I   | 5-1-0        | 4         |
| 4                  | ME-303                       | Industrial Engineering  | 5-0-0        | 3         |
| 5                  | ME-351                       | Theory of Machines-II Lab   | 0-0-2        | 1         |
| 6                  | ME-352                       | Energy Conversion-I Lab   | 0-0-2        | 1         |
| 7                  | PD-392/<br>PD-393/<br>PD-358 | Problem Solving Skills/<br>Advanced Professional Development**/<br>Mechanical Engineering – Aptitude Course | 0-0-2        | 1         |
| 8                  | PD-391                       | Co-curricular Activities  |              | 1*        |
| <b>20-2-6 (28)</b> |                              |   |              | <b>17</b> |

| <b>TERM – VIII</b> |                              |   |              |           |
|--------------------|------------------------------|---|--------------|-----------|
| <b>SN</b>          | <b>Course No.</b>            | <b>Course Name</b>  | <b>L-T-P</b> | <b>Cr</b> |
| 1                  | ME-304                       | Manufacturing Science   | 5-0-0        | 3         |
| 2                  | ME-305                       | Machine Design-I  | 5-0-0        | 3         |
| 3                  | ME-306                       | Automatic Control   | 5-1-0        | 4         |
| 4                  | ME-307                       | Fluid Machines  | 5-1-0        | 4         |
| 5                  | ME-354                       | Manufacturing Science Lab   | 0-0-2        | 1         |
| 6                  | ME-355                       | Machine Design-I Lab  | 0-0-2        | 1         |
| 7                  | ME-357                       | Fluid Machines Lab  | 0-0-2        | 1         |
| 8                  | PD-392/<br>PD-393/<br>PD-358 | Problem Solving Skills/<br>Advanced Professional Development**/<br>Mechanical Engineering – Aptitude Course | 0-0-2        | 1         |
| 9                  | PD-391                       | Co-curricular Activities  |              | 1*        |
| <b>20-2-8 (30)</b> |                              |   |              | <b>18</b> |

| <b>TERM – IX</b>   |                              |   |              |              |
|--------------------|------------------------------|---|--------------|--------------|
| <b>SN</b>          | <b>Course No.</b>            | <b>Course Name</b>  | <b>L-T-P</b> | <b>Cr</b>    |
| 1                  | ME-308                       | Optimization Techniques   | 5-1-0        | 4            |
| 2                  | ME-309                       | Heat Transfer   | 5-1-0        | 4            |
| 3                  | ME-310                       | Energy Conversion-II  | 5-1-0        | 4            |
| 4                  | ME-311                       | Machine Design-II   | 4-0-0        | 2            |
| 5                  | ME-359                       | Heat Transfer Lab   | 0-0-2        | 1            |
| 6                  | ME-360                       | Energy Conversion-II Lab  | 0-0-2        | 1            |
| 7                  | ME-361                       | Machine Design-II Lab   | 0-0-2        | 1            |
| 8                  | PD-392/<br>PD-393/<br>PD-358 | Problem Solving Skills/<br>Advanced Professional Development**/<br>Mechanical Engineering – Aptitude Course | 0-0-2        | 1            |
| 9                  | PD-391                       | Co-curricular Activities  |              | 1*           |
| <b>19-3-8 (30)</b> |                              |   |              | <b>18+1*</b> |

**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 3<sup>rd</sup> year.

\*\* PD-393 is a Mandatory Learning Course.

**Department of Mechanical Engineering**  
**Scheme of Studies**  
**B. Tech. Degree Programme (Regular)**

**(PROJECT MODE)**

**4<sup>th</sup> Year**

| <b>TERM – X</b>     |                   |  |              |            |
|---------------------|-------------------|--|--------------|------------|
| <b>SN</b>           | <b>Course No.</b> | <b>Course Name</b>                                     | <b>L-T-P</b> | <b>Cr.</b> |
| 1                   | ME-401            | Refrigeration and Air conditioning                     | 5-0-0        | 3          |
| 2                   | ME-402            | Computer Aided Design                                  | 5-0-0        | 3          |
| 3                   |                   | Dept Elective-I  | 5-0-0        | 3          |
| 4                   | ME-451            | Refrigeration and Air conditioning Lab                 | 0-0-2        | 1          |
| 5                   | ME-452            | Computer Aided Design Lab                              | 0-0-2        | 1          |
| 6                   | ME-491            | Community Service Oriented Project (CSOP) <sup>#</sup> | 0-0-2        | 1          |
| 7                   | ME-492            | Project (including Seminar)                            | 0-0-4        | 2          |
| 8                   | ME-493            | Industrial Training/Field Training**                   | 0-0-2        | 1          |
| 9                   | PD-458            | Computer Application in Mechanical Engineering         | 0-0-2        | 1          |
| 10                  | PD-491            | Co-curricular Activities                               |              | 1*         |
| <b>15-0-14 (29)</b> |                   |  |              | <b>16</b>  |

| <b>TERM – XI</b>    |                   |                          |              |           |
|---------------------|-------------------|--------------------------|--------------|-----------|
| <b>SN</b>           | <b>Course No.</b> | <b>Course Name</b>       | <b>L-T-P</b> | <b>Cr</b> |
| 1                   |                   | Elective-II              | 5-0-0        | 3         |
| 2                   |                   | Open Elective            | 5-0-0        | 3         |
| 3                   | ME-453            | Deptment Lab             | 0-0-2        | 1         |
| 4                   | ME-481            | Major Project Phase-I*** | 0-0-10       | 5         |
| 5                   | ME-494            | Seminar-I*****           | 0-0-2        | 1         |
| 6                   | PD-491            | Co-curricular Activities |              | 1*        |
| <b>10-0-14 (24)</b> |                   |                          |              | <b>13</b> |

| <b>TERM – XII</b>   |                   |                           |              |              |
|---------------------|-------------------|---------------------------|--------------|--------------|
| <b>SN</b>           | <b>Course No.</b> | <b>Course Name</b>        | <b>L-T-P</b> | <b>Cr</b>    |
| 1                   | ME-404            | Mechanical Vibrations     | 5-1-0        | 4            |
| 2                   |                   | Elective-III              | 5-0-0        | 3            |
| 3                   |                   | Elective-IV               | 5-0-0        | 3            |
| 4                   | ME-454            | Mechanical Vibrations Lab | 0-0-2        | 1            |
| 5                   | ME-482            | Major Project Phase-II    | 0-0-6        | 3            |
| 6                   | ME-495            | Seminar-II*****           | 0-0-2        | 1            |
| 7                   | PD-491            | Co-curricular Activities  |              | 1*           |
| <b>15-1-10 (26)</b> |                   |                           |              | <b>15+1*</b> |

**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 4<sup>th</sup> 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 Mechanical Engineering**  
**Scheme of Studies**  
**B. Tech. Degree Programme (Regular)**

**(INTERNSHIP MODE)**

**4<sup>th</sup> Year**

| <b>TERM-X</b>       |                   |  |              |           |
|---------------------|-------------------|--|--------------|-----------|
| <b>SN</b>           | <b>Course No.</b> | <b>Course Name</b>                                     | <b>L-T-P</b> | <b>Cr</b> |
| 1                   | ME-401            | Refrigeration and Air conditioning                     | 5-0-0        | 3         |
| 2                   | ME-402            | Computer Aided Design                                  | 5-0-0        | 3         |
| 3                   |                   | Dept Elective-I  | 5-0-0        | 3         |
| 4                   | ME-451            | Refrigeration and Air conditioning Lab                 | 0-0-2        | 1         |
| 5                   | ME-452            | Computer Aided Design Lab                              | 0-0-2        | 1         |
| 6                   | ME-491            | Community Service Oriented Project (CSOP) <sup>#</sup> | 0-0-2        | 1         |
| 7                   | ME-492            | Project (including Seminar)                            | 0-0-4        | 2         |
| 8                   | ME-483            | Internship-I**   | 0-0-2        | 1         |
| 9                   | PD-458            | Computer Application in Mechanical Engineering         | 0-0-2        | 1         |
| 10                  | PD-491            | Co-curricular Activities                               |              | 1*        |
| <b>15-0-14 (29)</b> |                   |  |              | <b>16</b> |

| <b>TERM-XI</b>     |                   |                             |              |           |
|--------------------|-------------------|-----------------------------|--------------|-----------|
| <b>SN</b>          | <b>Course No.</b> | <b>Course Name</b>          | <b>L-T-P</b> | <b>Cr</b> |
| 1                  | ME-494            | Seminar-I***                | 0-0-2        | 1         |
| 2                  | ME-484            | Internship II (in Industry) | 0-0-24       | 12        |
| 3                  | PD-491            | Co-curricular Activities    |              | 1*        |
| <b>0-0-26 (26)</b> |                   |                             |              | <b>13</b> |

| <b>TERM - XII</b>   |                   |                           |              |             |
|---------------------|-------------------|---------------------------|--------------|-------------|
| <b>SN</b>           | <b>Course No.</b> | <b>Course Name</b>        | <b>L-T-P</b> | <b>Cr</b>   |
| 1                   | ME-404            | Mechanical Vibrations     | 5-1-0        | 4           |
| 2                   |                   | Elective-III              | 5-0-0        | 3           |
| 3                   |                   | Elective-IV               | 5-0-0        | 3           |
| 4                   | ME-454            | Mechanical Vibrations Lab | 0-0-2        | 1           |
| 5                   | ME-485            | Internship Documentation  | 0-0-6        | 3           |
| 6                   | ME-495            | Seminar-II****            | 0-0-2        | 1           |
| 7                   | PD-491            | Co-curricular Activities  |              | 1*          |
| <b>15-1-10 (26)</b> |                   |                           |              | <b>15+1</b> |

**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 4<sup>th</sup> 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

| <b>Dept. Elective - I</b> |        |                                |       |   |
|---------------------------|--------|--------------------------------|-------|---|
| 1                         | ME-421 | Power Plant Engineering        | 5 0 0 | 3 |
| 2                         | ME-422 | Flexible Manufacturing Systems | 5 0 0 | 3 |
| 3                         | ME-423 | Machine Tool Design            | 5 0 0 | 3 |

| <b>Dept. Elective - II</b> |        |                        |       |   |
|----------------------------|--------|------------------------|-------|---|
| 1                          | ME-431 | Automobile Engineering | 5 0 0 | 3 |
| 2                          | ME-432 | Metrology              | 5 0 0 | 3 |
| 3                          | ME-433 | Mechatronics           | 5 0 0 | 3 |

| <b>Dept. Elective - III</b> |        |                                 |       |   |
|-----------------------------|--------|---------------------------------|-------|---|
| 1                           | ME-441 | Gas Dynamics and Jet Propulsion | 5 0 0 | 3 |
| 2                           | ME-442 | Ergonomics                      | 5 0 0 | 3 |
| 3                           | ME-443 | Finite Element Analysis         | 5 0 0 | 3 |

| <b>Dept. Elective - IV</b> |        |                             |       |   |
|----------------------------|--------|-----------------------------|-------|---|
| 1                          | ME-461 | Renewable Sources of Energy | 5 0 0 | 3 |
| 2                          | ME-462 | Maintenance Engineering     | 5 0 0 | 3 |
| 3                          | ME-463 | Total Quality Control       | 5 0 0 | 3 |

## IMPORTANT NOTES

1. Laboratory Courses are being offered as distinct courses (0-0-2) without being mixed with lecture components.
2. Conduct of Lab Courses:
  - a. At least ten experiments/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 Mechanical Engineering, Automobile Engineering, Civil Engineering & Bachelor of Architecture constitute one group for the purpose of deciding core courses.
11. For the students admitted in 2009-10 the sequence of PD Courses is given in the table below:

| <b>Professional Development (PD) – Gen.</b> |          |  |       |   |
|---|----------|--|-------|---|
| <b>1<sup>st</sup> Year</b>                  | PD-251   | MATLAB   | 0-0-2 | 1 |
|   | PD-191   | Co-curricular Activities                       |       | 1 |
|   | PD-292   | Effective Communication                        | 0-0-2 | 1 |
|   | PD-393   | Advanced Professional Development              | 0-0-2 | 1 |
| <b>2<sup>nd</sup> Year</b>                  | PD-151N* | Basics of Computer Fundamentals                | 0-0-2 | 1 |
|   | PD-291   | Co-curricular Activities                       |       | 1 |
|   | PD-192   | Personality Skills                             | 0-0-2 | 1 |
|   | PD-193   | Entrepreneurial & Professional Skills          | 0-0-2 | 1 |
| <b>3<sup>rd</sup> Year</b>                  | PD-358   | Mechanical Engineering – Aptitude Course       | 0-0-2 | 1 |
|   | PD-391   | Co-curricular Activities                       |       | 1 |
|   | PD-392   | Problem Solving Skills                         | 0-0-2 | 1 |
|   | PD-293   | Intra & Inter-personal Skills                  | 0-0-2 | 1 |
| <b>4<sup>th</sup> Year</b>                  | PD-458   | Computer Application in Mechanical Engineering | 0-0-2 | 1 |
|   | PD-491   | Co-curricular Activities                       |       | 1 |

\* 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 |
|        |           | 5 0 0 | 3  |

**OBJECTIVE**

The purpose of this course is to

- Acquaint the students in the basic economic concepts and their operational significance and
- Stimulate him to think systematically and objectively about contemporary economic problems.

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

**TEXT BOOK**

Hirschey M., "Managerial Economics", Thomson Learning, 2007

**REFERENCE BOOKS**

1. Monroe Kent B., "Pricing Making Profitable Decisions", McGraw Hill, New York, 2006
2. Keat Paul B., and Young Philip K. Y., "Managerial Economics - Economic Tools for Today's Decision Makers", Pearson Education, 2003

|        |                          |       |    |
|--------|--------------------------|-------|----|
| BA-226 | PRINCIPLES OF MANAGEMENT | L T P | Cr |
|        |                          | 5 0 0 | 3  |

**OBJECTIVE**

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

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

**TEXT BOOK**

Chhabra T. N., "Principles and Practice of Management", Dhanpat Rai Publishers, 2008

**REFERENCE BOOKS**

1. Aggarwal R. D., "Organization and Management", Tata McGraw Hill, 1995
2. Prasad L. M., "Principles and Practice of Management", Sultan Chand & Sons, 2005
3. Harold, Koontz and O'Doneell Cyril, "Management", McGraw Hill, 1968

4. Sherlekar S. A., "Marketing Management", Himalaya Publishing House, 2009
5. Pandey I. M., "Financial Management", Vikas Publishing House, New Delhi, 2005
6. Stoner James A. F. and Freemann R. Edward, "Management", 6th Edition, Prentice Hall of India, 2000
7. Prasad L. M., "Organizational Behavior", Sultan Chand & Sons, 2008
8. Singh & Chhabra, "Business Organization & Management", Dhanpat Rai Publishers

|        |                                      |       |    |
|--------|--------------------------------------|-------|----|
| CE-101 | ENVIRONMENTAL SCIENCE<br>AND ECOLOGY | L T P | Cr |
|        |                                      | 5 0 0 | 3  |

#### 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:** Bio-geographical classification of India; biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity; value of biodiversity-consumptive use, productive use, social, ethical aesthetic and option values; threats

- to biodiversity; conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.
5. **ENVIRONMENTAL POLLUTION:** Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, solid waste management, e-waste management; disaster management – floods, earthquake, cyclone and landslides.
  6. **SOCIAL ISSUES AND THE ENVIRONMENT:** Water conservation, rain water harvesting, watershed management; climate change, global warming, acid rain, ozone layer depletion; Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.
  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

Kaushik, Anubha, and Kaushik, C.P., "Perspectives in Environmental Studies", New Age International Publishers, 2004

#### REFERENCE BOOKS

1. Agarwal, K. C., "Environmental Biology", Nidhi Publ. Ltd., Bikaner, 2001
2. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., 2006
3. Brunner R. C., "Hazardous Waste Incineration", McGraw Hill Inc., 1989.
4. Clark R.S., "Marine Pollution", Clanderson Press Oxford, 1989
5. Cunningham, W.P., Cooper, T.H. Gorhani, E. & Hepworth, M.T., "Environmental Encyclopedia", Jaico Publ. House, 2001.
6. De A. K., "Environmental Chemistry", 2nd Edition, Wiley Eastern, 1989
7. Jadhav, H. and Bhosale, V.M., "Environmental Protection and Laws", Himalaya Pub. House, Delhi, 1995.
8. Mckinney, M.L. and Schocl. R.M., "Environmental Science Systems & Solutions", Web enhanced edition, 1996.
9. Rao M.N. and Datta, A.K., "Waste Water Treatment", Oxford & IBH Publ. Co., 1987.
10. Sharma B.K., "Environmental Chemistry", Goel Publ. House, Meerut, 2001
11. Trivedi R.K. and Goel, P.K., "Introduction to Air Pollution", Techno-Science Publications, 1996

|        |                   |       |    |
|--------|-------------------|-------|----|
| CH-101 | APPLIED CHEMISTRY | L T P | Cr |
|        |                   | 5 0 0 | 3  |

#### OBJECTIVE

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

- PHASE RULE:** Terminology of phases; components and degree of freedom; derivation of Gibbs phase rule equation; one component system (water system); application of reduced / condensed phase rule; two component system; eutectic (Pb-Ag) system; congruent (Zn-Mg) system; incongruent system (Na-K) system; merits and demerits of phase rule.
- 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 Gibbs free energy and work function; second law of thermodynamics; Gibbs Helmholtz equation; Its application and significance; chemical potential; Gibbs Duhem equation; Clausius Clapeyron equation and its application.
- 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; electro dialysis.
- 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.
- 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.
- 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.
- 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

Srivastava, H.C., "Engineering Chemistry", Pragati Prakashan Publishing House.

#### REFERENCE BOOKS

- Chawla, Shashi, "Engineering Chemistry", First Edition, Dhanpat Rai and Co., 2003
- Ambasta, B.K, "Engineering Chemistry", Laxmi Publications, 2007
- Singh, Devender and Vats Satish K., "Comprehensive Engineering Chemistry", I. K. International Publication, 2007
- Chatwal Gurdeep "Organic Chemistry on Natural Products", Vol. 1, Himalaya Publishing House, Reprint 2002.
- Chatwal Gurdeep, "Photochemistry", Himalaya Publishing House, 2003.
- Jain, P.C., and Jain, Monica, "Engineering Chemistry", Dhanpat Rai & Co.
- Morrison, R.T., and Boyd, R.N., "Organic Chemistry", 6th Edition, Pearson Education, 1994

|        |                       |     |    |
|--------|-----------------------|-----|----|
| CH-151 | APPLIED CHEMISTRY LAB | LTP | Cr |
|        |                       | 002 | 1  |

#### LIST OF EXPERIMENTS

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

#### REFERENCE BOOKS

- Dara, S. S. "A Text Book on Experimental and Calculation – Engineering Chemistry", S. Chand & Company.
- Chawla, Shashi, "Essential of Experimental Engineering Chemistry", 2nd Edition, Dhanpat Rai Publishing Company, 2006
- Virmani, O. P., and Narula, A. K., "Theory & Practice Applied Chemistry", New Age Publications.

|        |                      |   |   |   |    |
|--------|----------------------|---|---|---|----|
| CS-101 | COMPUTER PROGRAMMING | L | T | P | Cr |
|        |                      | 5 | 1 | 0 | 4  |

**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.

- AN OVERVIEW OF COMPUTER SYSTEM:** Anatomy of a digital computer; memory units; main and auxiliary storage devices; input devices; output devices; classification of computers; computer hardware; computer software; data representation – bits and bytes and operations of data; radix number system – decimal, binary, octal, hexadecimal numbers and their inter-conversions; representation of information inside the computers.
- 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.
- INTERNET BASICS:** Introduction to computer networks; what is internet and WWW; basic WWW concepts; surfing the web; web multimedia; internet applications and features.
- PROGRAMMING LANGUAGES:** Machine level language; assembly level language; high level language; system software: assembler, compiler, interpreters, linker and loader, and their inter-relationship, debuggers, IDE; programming fundamentals – problem definition, algorithms, flow charts and their symbols.
- 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
- DATA HANDLING:** Pointers – Pointer variables, pointer operators, pointer expressions, pointers and arrays, multiple indirection, initializing pointers, C's dynamic allocation functions, restrict-qualified pointers, problems with pointers; functions: the general form of a function, scope of a function, function arguments, argc and argv — arguments to main( ), the return statement, purpose of main( ), recursion, function prototypes, the "implicit int" rule; structures, unions, enumerations, and typedef – structures, arrays of structures, passing structures to functions, structure pointers, arrays and structures within structures, unions, bit-fields,

enumerations, using sizeof to ensure portability, typedef; important differences between C and C++.

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

**TEXT BOOK**

Schildt, Herbert "The Complete Reference C", 4th Edition, Tata McGraw Hill, 2004.

**REFERENCE BOOKS**

- Balagurusamy, E., "Computing Fundamentals and C Programming", Tata McGraw Hill, 5<sup>th</sup> Edition, 2010.
- Dennis, P. Curtin, Foley Kim, Sen Kunal and Morin Cathleen, "Information Technology", Tata McGraw Hill, 17 Edition, 2005.
- Dennis, M. Ritchie and Brian, W. Kernigham, "The C Programming Language, Prentice Hall of India, 1988.
- Nabajyoti, Barkakati, "Object Oriented Programming in C++", Prentice Hall of India, 3<sup>rd</sup> Edition, 1995.
- Jack, B. Rochester, "Using Computers and Information", Prentice Hall of India, 1996.
- Byron, C. Gottfried, "Theory and Problem of Programming with C", Tata McGraw Hill
- Press, Barry and Press, Marcia, "Teach Yourself all About Computers", IDG Books India, 2000.
- Schildt, Herbert, "C++: The Complete Reference", Tata McGraw Hill, 4<sup>th</sup> Edition, 2003
- Liberty, Jesse, "Programming C#", O'Reilly, 4<sup>th</sup> Edition, 2005.

**WEB REFERENCES**

- [http://www.physics.drexel.edu/courses/Comp\\_Phys/General/C\\_basics/c\\_tutorial.html](http://www.physics.drexel.edu/courses/Comp_Phys/General/C_basics/c_tutorial.html)
- <http://www.eskimo.com/~scs/c/class/notes/top.html>
- <http://www.lysator.liu.se/c/bwk-tutor.html>

|        |                          |   |   |   |    |
|--------|--------------------------|---|---|---|----|
| CS-151 | COMPUTER PROGRAMMING LAB | L | T | P | Cr |
|        |                          | 0 | 0 | 2 | 1  |

**LIST OF EXPERIMENTS/EXERCISES**

- Basic/Simple logic building
- Handling mathematical data
- Use of control structures
- Use of Function
- Handling mathematical problems
- Array and Pointer
- Searching and Sorting
- String Manipulation
- Use of Structure and Union
- File handling

**REFERENCE BOOKS**

- Dennis, M. Ritchie and Brian, W. Kernigham, "The C Programming Language", Prentice Hall of India, 1988.

- Byron, C. Gottfried, "Theory and Problem of Programming with C", Tata McGraw Hill
- Barkakati, Nabajyoti, "Object Oriented Programming in C++", Prentice Hall of India, 2001.
- Schildt, Herbert, "C++: The Complete Reference", Tata McGraw Hill, 4<sup>th</sup> Edition, 2003

|        |                            |       |    |
|--------|----------------------------|-------|----|
| EC-201 | ELECTRONICS<br>ENGINEERING | L T P | Cr |
|        |                            | 5 1 0 | 4  |

**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

- HISTORICAL BACKGROUND:** Vacuum tubes; working of vacuum tube and their characteristics; vacuum diode; triode; tetrode and pentode
- 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.
- 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.
- BIPOLAR JUNCTION TRANSISTOR:** Introduction; basic theory of operation of PNP and NPN transistor-I characteristics; CB; CE and CC configuration; different biasing techniques.
- 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
- 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.
- 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**

Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, Tata McGraw Hill, 2000

**REFERENCE BOOKS**

- Millman and Halkias, "Integrated Electronic", Tata McGraw Hill, 3rd Edition, 2001.

- Boylestad and Nashelsky, "Electronic Devices and Circuits", 4th Edition, Pearson Education, 1999.
- Malvino, "Electronic Principles", 5th Edition, Tata McGraw Hill, 2004.
- Bell David A., "Electronic Devices and Circuits", 3rd Edition, Prentice Hall of India, 2007
- Bhargave N. N., "Basic Electronics and Linear Circuits", Tata McGraw Hill, 2007
- Salivahan, "Electronics Devices and Circuits", Tata McGraw Hill, 3rd Edition, 2003.

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|--------|--------------------------------|-------|----|
| EC-251 | ELECTRONICS<br>ENGINEERING LAB | L T P | Cr |
|        |                                | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- Study V-I characteristics of diode; and its use as a capacitance.
- Study of the characteristics of transistor in Common Base configuration.
- Study of the characteristics of transistor in Common Emitter configuration.
- Study of V-I characteristics of a photo-voltaic cell.
- Study of characteristics of MOSFET/JFET in CS configuration.
- Plot characteristics of thyristor.
- Plot characteristics of UJT.
- Plot characteristics of diac and Triac.
- Introduction to Orcad PSPICE Software.
- Simulation of semiconductor device circuits using Orcad PSPICE.

**REFERENCE BOOKS**

- Boylestad and Nashelsky, "Electronic Devices and Circuits", 4th Edition, Pearson Education, 1999.
- Bell David A., "Electronic Devices and Circuits", 3rd Edition, Prentice Hall of India, 2007
- Bhargave N. N., "Basic Electronics and Linear Circuits", Tata McGraw Hill, 2007
- Salivahan, "Electronics Devices and Circuits", Tata McGraw Hill, 3rd Edition, 2003.

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

**OBJECTIVE**

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

- 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.
- 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**

1. Theraja, B.L. "Electrical Technology Vol I & II", S. Chand Publications, 2005
2. Kothari and Nagarath, "Basic Electrical Engg.", 2nd Edition, Tata McGraw Hill
3. Theodore, Wildi "Electrical Machines, Drives and Power Systems", 2nd Edition, Prentice Hall, 1991.
4. Edward, Hughes (revised by Ian McKenzie Smith), "Electrical Technology", 7th Edition, English Language Book Society, Publication with Longman, 1995.
5. Del Torro Vincent, "Electrical Engineering Fundamentals", 2nd Edition, Prentice Hall of India, 1994.
6. Cathey, J.J. and Naser, S.A. "Basic Electrical Engg.", 2nd Edition, Schaum Series, McGraw Hill Publ.

|        |                            |       |    |
|--------|----------------------------|-------|----|
| EL-151 | ELECTRICAL ENGINEERING LAB | L T P | Cr |
|        |                            | 0 0 2 | 1  |

**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.
11. Measurement of power by 3 voltmeter / 3 ammeter method.
12. Measurement of power in a 3 phase system by two watt meter method.
13. Connection and testing of a single-phase energy meter (unit power factor load only).

**REFERENCE BOOKS**

1. Theraja, B.L. "Electrical Technology Vol I & II", S. Chand Publications, 2005
2. Kothari and Nagarath, "Basic Electrical Engg.", 2nd Edition, Tata McGraw Hill
3. Del Torro Vincent, "Electrical Engineering Fundamentals", 2nd Edition, Prentice Hall of India, 1994.
4. Cathey, J.J. and Naser, S.A. "Basic Electrical Engg.", 2nd Edition, Schaum Series, McGraw Hill Publ.

|        |                      |       |    |
|--------|----------------------|-------|----|
| EN-101 | COMMUNICATION SKILLS | L T P | Cr |
|        |                      | 5 0 0 | 3  |

**OBJECTIVE**

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

1. Vocabulary; Use of Words; Synonyms; Homophones; Homonyms; Forms and Functions of Words
2. Sentence Structure; Verb patterns; Simple; Complex and Compound Sentences
3. Remedial English Grammar; Common Errors and Rules of Concord
4. Phonetics; Basic Concepts; Vowels; Consonants; Syllables; Manner of Articulation and Place of Articulation; Speech Sounds; Transcription of Words ; Word Stress and Intonation
5. Comprehension; Interpretation of Seen/Unseen Passages
6. (A) Oral Communication: Practicing short dialogues; Group Discussions; and Debates  
(B) Technical Writing:
  - (i) Business Letters (Format of Business Letters and Business Letter Writing)
  - (ii) Email Writing
  - (iii) Reports and types of reports and Press reports
7. Book Review (for internal assessment)  
Language lab: Emphasis will be laid on accent, pronunciation, intonation, reading/ listening comprehension

**TEXT BOOK**

Bansal, R.K. and Harrison, J.B., "Spoken English for India", Orient Longman, 2009

**REFERENCE BOOKS**

1. Tickoo M. L. and Subramanian, A. E., "Intermediate Grammar, Usage and Composition", Orient Longman, 1976
2. Thomson and Martinet, "A Practical English Grammar", Oxford University Press, 1986
3. Hornby, A. S., "Guide to Patterns and Usage in English", Oxford University Press
4. Balasubramanian T., "A Textbook of English Phonetics for Indian Students", MacMillan
5. D.O'Connor J., "Better English Pronunciation" Cambridge University Press
6. McCarthy, "English Vocabulary in Use Foundation Books", Cambridge University Press
7. Hashem Abul, "Common Errors in English", Ramesh Publishing House
8. Roach P., "English Phonetics & Phonology", Cambridge University Press
9. Ramesh M. S. and C.C. Pattanshetti, "Business Communication", R. Chand and Company
10. Wood F. T., "Remedial English Grammar for Foreign Students", The Macmillan Press Ltd., 1975
11. Hari Mohan Prasad and Uma Rani Sinha, "Objective English", Tata McGraw Hill Education, 2005

|        |              |       |    |
|--------|--------------|-------|----|
| EN-151 | LANGUAGE LAB | L T P | Cr |
|        |              | 0 0 2 | 1  |

**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) 1<sup>st</sup> syllable stress
  - (b) 2<sup>nd</sup> syllable stress
  - (c) 3<sup>rd</sup> syllable stress
2. Sentence intonation: Simple day to day sentences will be repeated by the students
3. Public speeches and debates: Recorded debates and public speeches will be heard by the students to enhance their knowledge on the pitch and tone.
4. Conversation: Regular conversations will be heard and later practiced in the lab.
5. Listening comprehension: Students will hear the text and answer the questions that follow.
6. Reading comprehension: Text at par with international standard will be read by the students. Questions will than be answered.
7. Speaking: Text conversation, debates & lectures 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.

|        |                       |       |    |
|--------|-----------------------|-------|----|
| MA-101 | APPLIED MATHEMATICS-I | L T P | Cr |
|        |                       | 5 1 0 | 4  |

**OBJECTIVE**

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

1. **MATRICES & ITS APPLICATIONS:** Rank of a matrix; elementary transformations; elementary matrices; inverse using elementary transformations; normal form of a matrix; linear dependence and independence of vectors; consistency of linear system of equations; linear and orthogonal transformations; Eigen values and Eigen vectors; properties of Eigen values; Cayley - Hamilton theorem and its applications.
2. **INFINITE SERIES:** Convergence and divergence; comparison; D' Alembert's ratio; Integral; Raobes; De Morgan's & Bertrand's; logarithmic and Cauchy root tests; alternating series; absolute and conditional convergence.
3. **APPLICATIONS OF DIFFERENTIATION:** Taylor's and Maclaurin's series; asymptotes; curvature.
4. **PARTIAL DIFFERENTIATION:** Functions of two or more variables; partial derivatives; total differential and differentiability; derivatives of composite and implicit functions; Jacobian's; higher order partial derivatives.
5. **APPLICATION OF PARTIAL DIFFERENTIATION:** Homogeneous functions; Euler's theorem; Taylor's series for functions of two variables (without proof); maxima-minima of function of two variables; Lagrange's method of undetermined multipliers; differentiation under integral sign.
6. **FOURIER SERIES:** Euler's formula; conditions for a Fourier expansion; change of interval; Fourier expansion of odd and even function; Fourier expansion of square wave; rectangular wave; saw-toothed wave; half and full rectified wave functions; half range sine and cosine series.
7. **ORDINARY DIFFERENTIAL EQUATIONS & ITS APPLICATIONS:** Exact differential equations; equations reducible to exact differential equations; applications of differential equations of first order and first degree to simple electric circuits; Newton's law of cooling; heat flow and orthogonal trajectories.

**TEXT BOOK**

Kreyszig F., "Advanced Engineering Mathematics", 9th Edition, John Wiley, 2006

**REFERENCE BOOKS**

1. Jeffery, "Engineering Mathematics", Academic Press/Elsevier.
2. Sastry, S. S., "Engineering Mathematics Part-I", 2nd Edition, Prentice Hall of India
3. Jain, R. K. and Iyengar, S. R. K., "Advanced Engineering Mathematics" 3rd Edition, Narosa Publishing House
4. Greenberg, D., Michael., "Advanced Engg. Mathematics", 2nd Edition, Dorling Kindersley India Pvt. Ltd.

|        |                           |       |    |
|--------|---------------------------|-------|----|
| MA-102 | APPLIED<br>MATHEMATICS-II | L T P | Cr |
|        |                           | 5 1 0 | 4  |

**OBJECTIVE**

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

- 1. DIFFERENTIAL EQUATIONS OF HIGHER ORDER AND ITS APPLICATION:** Linear differential equations of second and higher order; complete solution; complementary function and particular integral; method of variation of parameters to find differential particular integral; Cauchy's and Legendre's linear equations; simultaneous linear equations with constant coefficients; applications of linear differential equations to simple pendulum; oscillatory electric circuits.
- 2. LAPLACE TRANSFORMS AND ITS APPLICATIONS:** Laplace transforms of elementary functions; properties of Laplace transforms; existence conditions; transforms of derivatives; transforms of integrals; multiplication by t; division by t.
- 3. EVALUATION OF INTEGRALS BY LAPLACE TRANSFORMS:** Laplace transform of unit step function; unit impulse function and periodic function; Inverse transforms; convolution theorem; application to linear differential equations and simultaneous linear differential equations with constant coefficients.
- 4. FOURIER TRANSFORMS:** Fourier integral transforms; shifting theorem (both on time and frequency axes); Fourier transforms of derivatives; Fourier transforms of integrals; convolution theorem; Fourier transform of Dirac-delta function.
- 5. CURVE TRACING:** Applications of single integration to find volume of solids and surface area of solids of revolution; double integral; change of order of integration; double integral in polar coordinates.
- 6. APPLICATIONS OF MULTIPLE INTEGRALS:** Applications of double integral to find area enclosed by plane curves and volume of solids of revolution; triple integral; volume of solids; change of variables; beta and gamma functions and relationship between them.
- 7. VECTOR CALCULUS:** Differentiation of vectors; scalar and vector point functions; gradient of a scalar field and directional derivative; divergence and curl of a vector field and their physical interpretations; integration of vectors; line integral; surface integral; volume integral; Green's, Stoke's and Gauss' theorems (without proof) and their simple applications.

**TEXT BOOK**

Kreyszig F., "Advanced Engineering Mathematics", 9th Edition, John Wiley, 2006

**REFERENCE BOOKS**

- Ross, S. L., "Differential Equation", Wiley India Publishers
- Piaggio, H. T. H., "Differential Equations", 1st Edition, CBS Publishers and Distributors,

- Jain, R. K. and Iyengar, S. R. K. "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House
- Greenberg, D., Michael "Advanced Engg. Mathematics", 2nd Edition, Dorling Kindersley India Pvt. Ltd.

|        |                              |       |    |
|--------|------------------------------|-------|----|
| MA-202 | APPLIED NUMERICAL<br>METHODS | L T P | Cr |
|        |                              | 5 1 0 | 4  |

**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-Jordan method; UV factorization, Jacobi's method; Gauss-Seidal method.
- 4. INTERPOLATION & CURVE FITTING:** Introduction to interpolation; Newton's forward and backward formula; Sterling formula; Lagrangian polynomials; divided differences; least squares method.
- 5. NUMERICAL DIFFERENTIATION AND INTEGRATION:** Derivatives from differences tables; numerical differentiation formulas, Newton-Cotes integration formulae; trapezoidal rule; Simpson's rule; Bool's rule; Weddle's rule; Romberg's rule.
- 6. SOLUTION OF DIFFERENTIAL EQUATIONS:** Taylor's series method; Euler and modified Euler's method; Runge-Kutta method; Milne's prediction corrector method, Adams-Bashforth method.
- 7. SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS:** Finite difference approximation; solution of Laplace equation (standard 5 point formula) one-dimensional heat equation (Schmidt method, Cranck-Nicolson method; Dufort & Frankel method and wave equation.

**TEXT BOOK**

Grewal B. S., "Numerical Methods in Engineering and Sciences", Khanna Publisher

**REFERENCE BOOKS**

- Curtis F, Gerald and Patrick, "Applied Numerical Analysis", 7th Edition, Addison Wesley
- Balagurusamy E., "Numerical Methods", Tata McGraw Hill
- Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India

- Jain M. K., Iyenger S. R. K. and Jain R. K. "Numerical Methods for Scientific and Engg. Computations", Wiley Eastern
- Rao S. S., "The Finite Element Method in Engg.", 2nd Edition, Pregamon Press/McGraw Hill, 1989

|        |                               |       |    |
|--------|-------------------------------|-------|----|
| MA-252 | APPLIED NUMERICAL METHODS LAB | L T P | Cr |
|        |                               | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- To find the roots of non-linear equation using Bisection method.
- To find the roots of non-linear equation using Secant method.
- To find the roots of non-linear equation using Newton's method.
- To solve the system of linear equations using Gauss-Elimination method.
- To solve the system of linear equation using Gauss-Seidal iteration method.
- To find the values of function at a particular point using Newton's forward formula.
- To find the values of function at a particular point using Newton's backward formula.
- To find the values of function at a particular point using Lagrange's interpolation formula.
- To integrate numerically using Trapezoidal rule.
- To integrate numerically using Simpson's rule.
- To find the solution of o.d.e (ordinary differential equation) by Euler's method.
- To find the solution of o.d.e by Runge-Kutta method.
- To find the numerical solution of Laplace equation.
- To find the numerical solution of heat equation.
- To find the numerical solution of wave equation.

**REFERENCE BOOKS**

- Curtis F, Gerald and Patrick, "Applied Numerical Analysis", 7th Edition, Addison Wesley
- Balagurusamy E., "Numerical Methods", Tata McGraw Hill
- Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India
- Jain M. K., Iyenger S. R. K. and Jain R. K. "Numerical Methods for Scientific and Engg. Computations", Wiley Eastern

|        |                       |       |    |
|--------|-----------------------|-------|----|
| 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.

- 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.

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

Meriam, J. L. "Engineering Mechanics", John Wiley & Sons.

**REFERENCE BOOKS**

- Beer, F.P. and Johnston, E.R. "Mechanics of Materials", Tata McGraw Hill
- Shames, I.H. "Engineering Mechanics", 4th Edition, Pearson Education, 2003
- Pytel, A and Kiusalaas, J. Thomsom, "Mechanics of Materials", Brooks & Cole, 2003

**WEB REFERENCES**

www.eCourses.ou.edu

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

**LIST OF EXPERIMENTS**

- To study various forces and moments.
- Prove polygon law of coplanar forces, experiments with pulley systems.

*B.Tech. Mechanical Engineering (Regular)*

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

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

**OBJECTIVE**

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

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

Raghuwanshi, B.S., "A course in Workshop Technology, Vol. I & II", Dhanpatrai & Co.

**REFERENCE BOOK**

Hazra & Chaudhary, "Workshop Technology Vol. I & II", Asian Book Co.

**NOTES**

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

**JOBS TO BE DONE**

**A. Machine Shop**

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

**B. Sheet Metal Work**

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

**C. Foundry**

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

**D. Welding**

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

**E. Fitting and Maintenance Jobs**

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

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

**OBJECTIVE**

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

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.
- PROJECTIONS OF SOLIDS AND SOLIDS OF REVOLUTION:** In simple positions with axis perpendicular to a plane; with axis parallel to both planes; with axis parallel to one plane and inclined to the other.
  - SECTIONS OF SOLIDS:** Prisms; pyramids; cylinders and cones; section plane is parallel, perpendicular and inclined to both reference planes; true shape of sections.
  - DEVELOPMENT OF LATERAL SURFACES OF REGULAR SOLIDS:** Rectangular block; cylinder; cone; pyramid.
  - ISOMETRIC VIEWS OF PLANES:** circle, square, rectangle; Isometric views of solids- prisms, pyramids and cylinders; principle of perspective projection, perspective of planes and solids.

**TEXT BOOK**

Bhatt, N.D., and Panchal, V.M., "Engineering Drawing Plane and Solid Geometry", Forty-Fourth Edition, Charotar Publishing House, 2002.

**REFERENCE BOOKS**

- Gill, P. S., "Engineering Graphics and Drafting", Millennium Edition, S. K. Kataria and Sons
- Mathur, S.B., "A Text Book of Engineering Drawing", Second Revised and Enlarged Edition, Vikas Publishing House, 2000.
- SP 46-1988, Bureau of Indian Standards (BIS), New Delhi

**WEB REFERENCES**

- [www.technologystudent.com](http://www.technologystudent.com)
- [www.animatedworksheets.co.uk](http://www.animatedworksheets.co.uk)
- [www.ider.herts.ac.uk/school/courseware](http://www.ider.herts.ac.uk/school/courseware)

**LIST OF SHEETS TO BE MADE:**

| Sl. No. | Details of the sheet  | No. of sheets |
|---------|---|---------------|
| 1.      | Basic Geometrical Constructions including the curves, ellipse, parabola, Hyperbola, and cycloidal curves. | 1             |
| 2.      | Projection of Lines including traces.   | 2             |
| 3.      | Projection of Planes.   | 1             |
| 4.      | Projection of Solids.   | 2             |
| 5.      | Section of solids.  | 2             |
| 6.      | Developments of surfaces  | 1             |
| 7.      | Isometric and Perspective views.  | 2             |

**Notes:**

The students will Practice/Draw at least one sheet from each Unit. The Examiner will set one question from each unit and the student will attempt four questions in all.

| ME-201 | COMPUTER METHODS IN MECHANICAL ENGINEERING | L T P | Cr |
|--------|--|-------|----|
|        |  | 4 0 0 | 2  |

**OBJECTIVE**

To become familiar with programming in Mat Lab and its applications. At the end of the course, student will be able to write programs in Mat Lab for problems arising in his course work and in further studies.

**PRE REQUISITES**

Computer Programming CS-101

- PROGRAMMING ENVIRONMENT:** MATLAB Windows; A first Program; Expressions; Constants; variables and assignment statement; Arrays
- THE NUMERICAL TOOLBOX:** introduction; graph of a function; polynomials; zeroes; extrema; numerical integration; exercises; The symbolic toolbox; introduction; expression with variables; substitutions; differentiation and integration; numerical values; manipulation of expressions; symbols; strings and numbers; exercises
- LINEAR ALGEBRA:** introduction; matrices; matrices with symbolic elements; matrix operations in matlab; solving sets of linear equations; solving sets of equations with the symbolic tool box; Differential equations; solving differential equations numerically; sets of differential equations; the direction field; plotting of integral curves; solving differential equations symbolically; first and higher order differential equations; exercises
- PROGRAMMING IN MATLAB:** programming; some remarks about variables; writing programs; programming language constructs; for – loop; if statements; while – loop; creating programs; debugging; structure variables; exercises
- APPLICATIONS OF MATLAB:** Static and dynamical systems; Laplace and Fourier Transforms; Plotting 2D & 3D
- SOLUTION OF NON LINEAR EQUATIONS:** interpolation and polynomial approximation curve fitting; Numerical differentiation and integration (Trapezoidal & Simpson rule) Numerical optimization solution of differential equations; partial differential equations; Eigen values and Eigen vectors; Boundary value problems for ODE's
- INTRODUCTION TO TOOL BOXES:** curve fitting; optimization; control system; splines Introduction to Simulink – Simmechanics; Simhydraulics

**TEXT BOOKS**

Amos Gilat., "Matlab: An introduction with application", 3<sup>rd</sup> Edition, Wiley Publication

**REFERENCE BOOKS**

- Singeresu S Rao, "Applied Numerical Methods for Engineers & Scientists", 1<sup>st</sup> Edition, Pearson Education.
- John, H Mathews., Kurtis, K Fink., "Numerical Methods using Matlab", Pearson Education

**WEB REFERENCES**

- <http://www.maths.dundee.ac.uk/ftp/na-reports/MatlabNotes.pdf>
- [http://www.stanford.edu/wfsharpe/mia/mat/mia\\_mat3.htm](http://www.stanford.edu/wfsharpe/mia/mat/mia_mat3.htm)
- <http://www.math.siu.edu/matlab/tutorials.html>
- [http://www.mathworks.com/academia/student\\_center/tutorials/launchpad.html](http://www.mathworks.com/academia/student_center/tutorials/launchpad.html)

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|--------|--------------------------|-------|----|
| ME-202 | MANUFACTURING TECHNOLOGY | L T P | Cr |
|        |                          | 5 0 0 | 3  |

**OBJECTIVE**

The course provides knowledge on the different casting processes; metal forming processes and welding processes so as to select a proper process for a given job

**PRE REQUISITES**

ME 151A Manufacturing Practice

- SAND CASTING PROCESSES:** Advantages and limitations; sand mold making procedure; Patterns and cores; Pattern materials; pattern allowances; types of pattern; color coding; Molding materials; Molding sand composition; sand preparation; sand properties and testing; sand molding processes
- MOULD MAKING AND INSPECTION:** Types of cores; core prints; chaplets and chills; Gating system; Gates and risers; Melting practice; Cupola and Induction furnace; charge calculations; Casting cleaning and casting defects: Fettling; defects in castings and their remedies; methods of testing of castings for their soundness
- SPECIAL CASTING PROCESSES:** Shell molding; precision investment casting; permanent mold casting; die casting; centrifugal casting; and continuous casting
- METAL FORMING PROCESSES:** Nature of plastic deformation; hot working and cold working Principles of rolling; roll passes; roll pass sequences; Forging: Forging operations; smith forging; drop forging; press forging; forging defects
- EXTRUSION AND OTHER PROCESSES:** Extrusion principle; hot extrusion; cold extrusion; wire drawing; swaging; tube making; Sheet metal operations; Press tools operations; shearing action; drawing dies; spinning; bending; stretch forming; embossing and coining
- GAS AND ARC WELDING:** Classification; oxy-acetylene welding equipments and techniques; Electric arc welding: Electrodes; manual metal arc welding; inert gas shielded arc welding; tungsten inert gas welding (TIG); metal inert gas welding (MIG) submerged arc welding (SAW)
- RESISTANCE WELDING:** Principles; resistance spot welding; resistance seam welding; upset welding; flash welding  
Other Welding Processes: Introduction of thermit welding; electro slag welding; electron beam welding; forge welding; friction welding; diffusion welding; brazing and soldering

**TEXT BOOK**

- Rao PN., "Manufacturing Technology – Foundry, Forming and Welding", Tata McGraw Hill.

**REFERENCE BOOKS**

- Ghosh. A. Mallik A.K., "Manufacturing Science", Affiliated East West Press, 2005
- Sinha, K P, Goel D B., "Foundry Technology", Standard Publishing, New Delhi, 2005
- Richard, L Little., "Welding and Welding Technology", Tata McGraw Hill, 2000
- Rosenthal; "Principle of Metal Casting", Tata McGraw Hill, 2001

- Raghuwanshi B S., "Workshop Technology", Vol I., Dhanpat Rai, 2004

**WEB REFERENCES**

- www,ider,herts,ac,uk/school/courseware
- www,efunda,com
- www,technologylinks,org

|        |                |       |    |
|--------|----------------|-------|----|
| ME 203 | THERMODYNAMICS | L T P | Cr |
|        |                | 5 1 0 | 4  |

**OBJECTIVE**

This course introduces the student to the fundamental laws of thermodynamics, the interaction between energy and matter, the quantitative and qualitative aspects of energy and its transformations, the properties of the working substance and their relationship.

- BASIC CONCEPT:** Thermodynamic systems; Surrounding and Boundary; Thermodynamic Property – Intensive and Extensive; Thermodynamic Equilibrium; State; Path; Process and Cycle; Quasi-static; Reversible and Irreversible Processes; Working Substance; Concept of Thermodynamic Work and Heat; Equality of Temperature; Zeroth Law of Thermodynamics and its utility; Numericals
- FIRST LAW OF THERMODYNAMICS:** Internal Energy and 1st Law Applied to Non- flow process; PMMFK ; Enthalpy Steady flow energy equation; Steady and unsteady Flow Process; Throttling Process and Free Expansion Process; Numericals
- SECOND LAW OF THERMODYNAMICS:** Limitations of First Law; Heat Source and Heat Sink; Heat Engine; Refrigerator and Heat Pump; Kelvin- Planck and Clausius Statements and their Equivalence; PMMSK; Carnot Cycle; Carnot Theorem; and its Corollaries; Thermodynamic Temperature Scale; Entropy; Clausius Inequality; Principle of Entropy Increase; Entropy Change in Different Processes; Introduction to Third Law of Thermodynamics; Numericals
- AVAILABILITY AND IRREVERSIBILITY:** High and Low Grade Energy; Availability and Unavailable Energy; Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference; Dead state of a system; Availability of a Non-Flow or Closed System; Availability of a Steady Flow System; Helmholtz and Gibb's Functions; Effectiveness and Irreversibility; Numericals
- IDEAL AND REAL GASES:** Concept of an Ideal Gas; Basic Gas Laws; Characteristic Gas Equation; and Universal Gas Constant; Vander Waal's Equation of state; Reduced Co-ordinates; Compressibility factor and law of corresponding states; Mixture of Gases; Mass; Mole and Volume Fraction; Gibbs Dalton's law; Gas Constant and Specific Heats; Entropy for a mixture of non-reactive gases; Numericals
- PURE SUBSTANCE:** Pure Substance and its Properties; Phase and Phase Transformation; Vaporization; Evaporation and Boiling; Saturated and Superheat Steam; Solid – Liquid – Vapour

Equilibrium; T-V; P-V and P-T Plots; Properties of Dry; Wet and Superheated Steam; Property Changes During Steam Processes; Use of steam tables and Mollier Diagram for Process calculation; Throttling And Measurement of Dryness Fraction of Steam; Numericals

7. **THERMODYNAMIC RELATIONS:** Maxwell Relations; Clapeyron Equation; Relations for changes in Enthalpy and Internal Energy & Entropy; Specific heat capacity Relations; Joule Thomson coefficient & inversion curve;

#### TEXT BOOK

Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill.

#### REFERENCE BOOKS

1. Rao, Y VC., "Theory and Problems of Thermodynamics", Wiley Eastern Ltd, 2007
2. Arora C P., "Engineering Thermodynamics", Tata McGraw Hill; 2008
3. Domkundwar., "Thermal Engineering", Dhanpat Rai & Company, 2006
4. Estope, TD and Meconkey A., "Applied Thermodynamics for Engineers Technologists", AWL, 1999

#### WEB REFERENCES

1. [www.mdpo.org/entropy](http://www.mdpo.org/entropy)
2. [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

|        |                       |       |    |
|--------|-----------------------|-------|----|
| ME-204 | STRENGTH OF MATERIALS | L T P | Cr |
|        |                       | 5 1 0 | 4  |

#### OBJECTIVE

The strength of materials is one of the core subjects and aim is to provide a sound foundation to design various elements of mechanical equipment

#### PRE REQUISITES

Knowledge of Engineering Mechanics

1. **BENDING:** Bending stress in beams (straight members) with loading in the plane of symmetry (rectangular; circular; I. T. sections); Flexural formula; Unsymmetrical bending: Pure bending of a beam having an arbitrary cross section; Components of moment along principal axes; Generalized flexural formula; Curved beams: stresses in bars of initial small radius of curvature; (cross sections – circular; rectangular; trapezoidal)
2. **TRANSVERSE SHEAR:** The shear formula; shear stress in beams (rectangular cross section; I section); shear flow in thin-walled members (I. C. L sections); shear centre
3. **Bi-axial stress:** Thin walled pressure vessels; plane stress transformation; general equations; principal stresses; plane strain transformation; principal strains; Mohr's circle – plane stresses; plane strains; Stresses in shaft due to combined bending and axial loads; bending and torsion
4. **SLOPE AND DEFLECTION OF BEAMS & SHAFTS:** Relationship between bending moment; slope and deflection

Calculations of slope and deflection by method of integration; Macauley's method; moment area method; method of superposition

5. **STRAIN ENERGY:** expression for strain energy and various types of loadings; axial force; bending moment; transverse shear; torsional moment Castigliano's theorem to find slope; deflection of beams; rings; Theories of elastic failure with derivations and graphical representation
6. **COLUMNS AND STRUTS:** Column under axial load; concept of instability and buckling; slenderness ratio; Euler's formula for elastic buckling load; Rankine-Gordon Formula
7. **THICK CYLINDERS:** Derivations of Lamé's equations; radial and hoop stresses and strains in thick and compound cylinders; hub shrunk on solid shaft

#### TEXT BOOK

Ferdinand P Beer & Russel E Johnston; "Mechanics of Materials", Tata McGraw Hill; 2009

#### REFERENCE BOOKS

1. Hibbeler, R. C., "Mechanics of Materials", Pearson Education, 2005
2. Ryder, G H., "Strength of Materials", Macmillan, 2001
3. Srinath L S, "Strength of Materials", Macmillan, 2001
4. Andrew / Kiusalaas, Jaan., "Mechanics of Materials", Thomson, 2003

#### WEB REFERENCES

1. [www.mdsolids.com](http://www.mdsolids.com)
2. [www.ecourses.ou.edu](http://www.ecourses.ou.edu)

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|--------|----------------------|-------|----|
| ME-205 | THEORY OF MACHINES-I | L T P | Cr |
|        |                      | 5 1 0 | 4  |

#### OBJECTIVE

The primary purpose of this course is to make student understand and develop skill to predict the effect of force and motion while carrying out design function. It is foundation for design of various mobile devices

#### PRE REQUISITES

Knowledge of Engg Mechanics

1. **KINEMATICS OF PARTICLES:** Particle motion; velocity and acceleration in path and cylindrical coordinates; relative motion; motion of constrained particles
2. **KINETICS OF PARTICLES:** Force; mass and acceleration; Newton's Law for rectangular coordinates and cylindrical coordinates; Equations of motion and solution of problems; work energy equations; work energy equations for system of particles; linear and angular momentum equations for system of particles
3. **PLANE KINEMATICS OF RIGID BODIES:** Plane motion; translation and rotation of rigid bodies; Chasles theorem relative velocity; Instantaneous center of zero velocity; relative acceleration; Coriolis acceleration
4. **PLANE KINETICS OF RIGID BODIES:** Force; mass and acceleration; general equations of

motion; Translation; fixed axis rotation; general plane motion

- 5 **INTRODUCTION TO 3-DIMENSIONAL DYNAMICS OF RIGID BODIES:** Kinematics-translation; fixed axis rotation; parallel plane motion; general motion; Kinetics-angular momentum; gyroscopic motion
- 6 **STATIC & DYNAMIC FORCE ANALYSIS:** Static force analysis of planer mechanisms; dynamic force analysis including inertia and frictional forces of planar mechanisms
- 7 **DYNAMIC FORCE ANALYSIS** Dynamic force analysis of reciprocating engines

**TEXT BOOK**

Meriam, J. L., "Dynamics", Wiley India, 5<sup>th</sup> edition, 2006

**REFERENCE BOOKS**

1. Shames I H "Engineering Mechanics – Statics & Dynamics" Prentice Hall of India 4<sup>th</sup> ed; 2003
2. "Vector Mechanics for Engineers Dynamics" 8<sup>th</sup> ed; Ferdinand P Beer; E Russel Johnston

**WEB REFERENCES**

www.nptel.iitm.ac.in

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|--------|-------------------------|-------|----|
| ME-206 | MACHINE DRAWING AND CAD | L T P | Cr |
|        |                         | 1 0 0 | 1  |

**OBJECTIVE**

This course makes the student to learn the representation of components and assemblies into various views and vice versa. This will enable the student to learn to conceive an object and go for its production. Autocad is introduced to facilitate this process

**PRE REQUISITES**

Engg Graphics ME-152

- 1 **INTRODUCTION TO CAD:** Advantages of CAD; Starting Autocad program; Autocad screen; Autocad commands; Function key assignments; short cut key characters; VCS and VCS con; Coordinate system; units; Drawing Aids Object snap; Drawing basic entities; Correcting mistakes; object section; modify commands; modify properties; match properties
- 2 **SECTIONAL VIEWS:** Types of sections; conventions in sectioning; hatching; using Autocad; Isometric projections; Isometric Scale; Drawing isometric drawing of Circles; conversion of isometric to orthographic and vice versa; Isometric grid with CAD Examples;
- 3 **JOINTS AND COUPLINGS:** Riveted joints; Bolts and Nuts threads; welded joints; shafts; keys; cotter and pin joints; couplings
- 4 **TOLERANCES; LIMITS & FITS & MATERIAL SPECIFICATION:** Limits and fits; Geometrical Tolerances and surface finish; Material Specifications
- 5 **SPRINGS, BELTS & PULLEYS, BEARINGS, GEARS:**
- 6 **MACHINE PARTS AND ASSEMBLY DRAWINGS:** Assembly of a connecting rod; crank shaft of a four cylinder; Assembly of a screw Jack;

assembly drawing of a stop valve; assembly of a spring loaded safety Valve; assembly of Tail stock; assembly of shaper tool slide; Block diagrams

**TEXT BOOK**

Singh, Ajeet., "Machine Drawing", McGraw-Hill 2008

**REFERENCE BOOKS**

1. Gill, P. S., "Machine Drawing", S K Kataria and Sons, 2008
2. Bhatt, N. D, and Panchal, V. M., "Machine Drawing", Charotar Publishing House, 2008

|        |                 |       |    |
|--------|-----------------|-------|----|
| ME-207 | FLUID MECHANICS | L T P | Cr |
|        |                 | 5 1 0 | 4  |

**OBJECTIVE**

It imparts the basic concept; knowledge and laws of fluid flow; its dynamics and kinematics and idea of estimation of various losses encountered in fluid flow

- 1 **FLUID PROPERTIES AND FLUID STATICS:** Concept of fluid and flow; ideal and real fluids; Continuum concept; properties of fluids; Newtonian and non-Newtonian fluids; Pascal's Law; hydrostatic equation; hydrostatic forces on plane and curved surfaces; stability of Floating and submerged bodies; relative equilibrium; Problems
- 2 **FLUID KINEMATICS:** Eulerian and Lagrangian description of fluid flow; stream; streak and path lines; types of flows; flow rate and continuity equation; differential equation of Continuity; rotation; vorticity and circulation; stream and potential functions; Problems
- 3 **FLUID DYNAMICS:** Concept of system and control volume; Euler's equation; Bernoulli's equation; venturimeter; pitot tubes; orifice meter; kinetic and momentum correction factors; Impulse momentum relationship and its applications; Problems
- 4 **VISCOUS FLOW:** Flow regimes and Reynolds's number; Relationship between shear stress and pressure gradient; uni-directional flow between stationary and moving parallel plates; Couette flow; laminar flow through pipes – Hagen Poiseuille law; movement of piston in a dashpot; power absorbed in bearings; Problems
- 5 **FLOW THROUGH PIPES :**Friction loss in pipe flow; Darcy-Weisbach formula coefficient of friction and friction factor: Major and minor losses in pipes; hydraulic Gradient and total energy lines; series and parallel connection of pipes; branched pipes; Equivalent pipe; power transmission through pipes; Problems
- 6 **BOUNDARY LAYER FLOW:** Boundary layer concept; displacement; momentum and energy thickness; von-karman momentum integral equation; laminar and turbulent boundary layer flows; drag on a flat plate; boundary layer separation; Streamlined and bluff bodies; lift and drag on a cylinder and an airfoil; Problems
- 7 **COMPRESSIBLE FLOW** Introduction; Sonic Velocity; Mach Number; Isentropic flow stagnation properties; normal shock; flow through a converging – diverging nozzle; Problems

**TEXT BOOK**

Kumar, K. L., "Engineering Fluid Mechanics", Eurasia Publication House, 2002

**REFERENCE BOOKS**

1. Kumar, D. S., "Fluid Mechanics and Fluid Power Engineering", SK Kataria and Sons, 1998
2. Wylie, E. B, Streeter V L; "Fluid Mechanics"; McGraw Hill 1983
3. Som S K and Biswas G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 1998
4. Bansal R K, "A Text Book of Fluid Mechanics" Laxmi Publications
5. Agrawal, S. K., "Fluid Mechanics and Machinery", Tata McGraw Hill.

**WEB REFERENCES**

- 1 www.nptel.iitm.ac.in
- 2 www.ecourses.ou.edu

|        |                       |       |    |
|--------|-----------------------|-------|----|
| ME-208 | ENGINEERING MATERIALS | L T P | Cr |
|        |                       | 5 0 0 | 3  |

**OBJECTIVE**

The course provides the knowledge on the composition; testing and applications of materials; It also provides knowledge about the structure of materials and the effect of temperature; composition and time on various metallurgical processes. The study of this course will help the students to identify and select suitable materials for various engineering applications

**PRE REQUISITES**

Knowledge of Applied Physics; Applied Chemistry; Manufacturing Practice

- 1 **STRUCTURE OF MATERIALS:** Crystal structure; Crystal imperfections and their classifications; point defects; line defects; edge and screw dislocations; surface defects; volume defects and effects of imperfections on metal properties
- 2 **SOLID SOLUTIONS AND PHASE DIAGRAM:** Solid solution and its types; importance and objectives of phase diagram; systems; phase and structural constituents; cooling curves; Gibbs's phase rule; Lever rule; Iron Carbon equilibrium diagram and TTT diagram
- 3 **HEAT TREATMENT:** Principles; purpose; classification of heat treatment processes; annealing; normalizing; hardening; tempering; carburizing; nitriding; cyaniding; flame and induction hardening; Allotropy of iron; Martempering and Austempering
- 4 **DEFORMATION OF METALS :** Elastic and plastic deformation; mechanism of plastic deformation; yield point phenomena; strain ageing; work hardening; Bauschinger effect; season cracking; Recovery; re-crystallization and grain growth
- 5 **CORROSION CREEP & FATIGUE :** Phenomenon of Corrosion ; Creep concept and creep curve; mechanism of creep; creep testing and prevention against creep ; fatigue; fatigue limit; mechanism of fatigue; factors affecting fatigue; fatigue testing and SN curve

- 6 **METALS AND ALLOYS:** Ferrous Metals: Plain carbon steel; high speed steel and cast iron; Effect of alloying elements on steel and stainless steel; Properties and applications of non ferrous metals – Aluminium; Copper and their common alloys
- 7 **NON DESTRUCTIVE TESTING OF MATEIALS:** Purpose and challenges; techniques: visual aids – bioscopes; fibre optics scanner; magnetic particles inspection; liquid penetrants; eddy currents; ultrasonic; radiography; Selection of NDT techniques; Merits ; demerits

**TEXT BOOKS**

Narula, Narula and Gupta., "Material Science", Tata McGraw Hill, 2009

**REFERENCE BOOKS**

- 1 Budinski, K. G, & Budinski MK., "Engineering Materials Properties and Selection", PMI; 2010
- 2 VanVlack., "Elements of Material Science and Engineering", Wesley Pub Comp 1998
- 3 Raghuwanshi, B. S., "Workshop Technology", Vol I Dhanpat Rai & Co.

|        |                               |       |    |
|--------|-------------------------------|-------|----|
| ME-209 | MEASUREMENT & INSTRUMENTATION | L T P | Cr |
|        |                               | 5 0 0 | 3  |

**OBJECTIVE**

To enable students to understand the construction and operation of instruments for measurement of pressure; level; flow and temperature; describe a suitable calibration procedure for a particular measurement instrument; identify and quantify errors from calibration graphs and describe correction procedures for selected instruments; select a suitable measurement instrument for a given process measurement; solve numerical problems involving equations pertaining to pressure; level; temperature and flow measurements

- 1 **INTRODUCTION TO INSTRUMENTATION:** Role of instruments in industrial processes; block representation of measurement systems; Need for calibration and Standards; Instrument parameters: Sensitivity; accuracy; resolution; span; range; Static errors: zero error; proportionality error; hysteric; maximum non linearity error
- 2 **TRANSDUCERS:** Introduction; Analog and digital transducers: electromechanical: potentiometric; Inductive; Self generating and Non-self generating types; Electromagnetic; Electrodynamic; Eddy current; Magnetostrictive; variable inductance; LVDT; variable capacitance; piezo-electric transducer and associated circuits; unbonded and bonded strain gauges; strain gauge bridge circuits; single; double and four active arm bridge arrangements; Temperature; compensation; Balancing and calibration; Ionisation Transducers; Mechano-electronic transducers; Opto-electrical transducers; photo conductive transducers; photo voltaic transducers; digital transducers; frequency domain transducer; vibrating string transducer
- 3 **MOTION FORCE AND TORQUE MEASUREMENT:** Relative motion measuring devices; electromechanical; optical photo electric; Moire-Fringe; Absolute motion devices; calibration; hydraulic load cell; pneumatic load cell; elastic

force devices; separation of force components; electro mechanical methods; strain gauge; torque transducers

- 4 **PRESSURE MEASUREMENT:** Definition and units; Relationship between absolute atmospheric and gauge pressures; use of manometers for pressure measurement; principle of operation of following pressure gauges; diaphragm gauges; bellow gauges; Bourdan gauges; strain gauges; Gauge calibration using manometers dead weight gauge; gauges for high pressure and low pressure measurement
- 5 **LEVEL MEASUREMENT:** Direct level measuring systems: dipsticks; float systems pressure measuring devices; capacitive devices; ultrasonic level gauges; radiation methods; vibrating level sensor; hot-wire elements; radar methods; laser methods; fiber optic level sensors  
Flow measurement: Volume and mass flow rate; Bernoulli equation and applications to differential pressure devices; differential pressure primary elements; Orifice plate; venturi tube; dall tube; flow nozzle and pitot tube; positive displacement flow meters; reciprocating piston; rotating impeller; calibration of flow meters
- 6 **TEMPERATURE MEASUREMENT:** Introduction; Non electrical methods: Bimetallic thermometer; liquid in glass thermometer; pressure thermometer; electrical resistance sensors; resistance thermometers and thermistors; thermocouple; radiation methods; pyrometry and pyrometers
- 7 **BASIC STATISTICAL CONCEPTS:** types of measure and quantities (discrete and continuous) central tendency of data; mode; median; arithmetic mean; best estimate of true value of data; measures of dispersion; range; mean deviation; variance; standard deviation; normal distribution; central limit theorem; significance test; method of least squares; graphical representations and curve fitting of data

**TEXT BOOK**

Nakra, Chaudary., "Instrumentation: Measurement and Analysis", Tata McGraw Hill, 2000

**REFERENCE BOOKS**

- 1 Ernest, O. Doebelin., "Measurement Systems Application and Design", Tata McGraw Hill, 2008
- 2 Alan, S. Morris., "Principles of Measurement and Instrumentation", Prentice-Hall of India, 2000

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|---------------|---|--------------|-----------|
| <b>ME-251</b> | <b>COMPUTER METHODS IN MECHANICAL ENGINEERING LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |   | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

1. To perform the operations of Interactive computing; Array and Matrix manipulation; saving loading data from excel sheets; saving m-files
2. To write simple programs for manipulation of arrays; matrices; solving polynomial expressions; differentiating and integrating simple equations
3. To perform plotting of different variables in 2D and 3D workspace

4. To perform exercises related to for-loop; if statements and while loop and understanding the variables and debugging in MatLab
5. To write programs for manipulation strings; symbols and numbers;
6. To perform the experiment no. 2 using symbolic tool box
7. To perform the experiment no. 3 using symbolic tool box
8. To write a program for solving a set of linear system of equations using different algorithms and compare with built in functions of MatLab
9. To perform experiment no. 7 using symbolic tool box
10. To write programs for solving differential equations numerically using different algorithms
11. To write programs to solve the set of differential equations using different algorithms
12. To perform experiment no. 11 using symbolic tool box

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| <b>ME-252</b> | <b>MANUFACTURING TECHNOLOGY LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                     | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

1. To make a pattern for a given casting with all the necessary allowances
2. To make a component involving gas welding joints and to study the welding defects and suggesting their remedies
3. To make a component involving MIG welding and study the welding defects and suggest their remedies
4. Development and manufacture of a Complex sheet metal component such as, five piece elbow
5. To make a casting of aluminium material
6. To study defects in a casting and suggest the remedial measures
7. To make a sand mould with a core for making a hollow job
8. To prepare a simple Engg; component by forging
9. To make a sheet metal job involving punching and blanking on a press
10. To prepare a job involving soldering / brazing

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|---------------|----------------------------------|--------------|-----------|
| <b>ME-254</b> | <b>STRENGTH OF MATERIALS LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                  | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

1. To perform the Brinell Hardness Test
2. To perform the Rockwell Hardness Test
3. To study the Impact Testing Machine and perform the Impact Tests (IZOD & CHARY)
4. To study UTM and Torsion Testing Machine
5. To perform the Tensile Test on UTM
6. To perform the Shear Test on UTM
7. To perform the torsion test on Torsion Testing Machine
8. To determine the Moment of Inertia of a Flywheel about its own axis of rotation
9. To study the Erichsen Sheet Metal Testing Machine and Perform the Erichsen Sheet Metal Test;
10. To verify support reactions for different types of loads at different locations on the beam

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|--------|--------------------------------|-------|----|
| ME-256 | MACHINE DRAWING<br>AND CAD LAB | L T P | Cr |
|        |                                | 0 0 6 | 3  |

**LIST OF EXERCISES**

1. Introduction of AUTOCAD and drawing simple figures by using Draw and Modify tools in AUTOCAD
2. To make complex / Engg; Objects by using Layers with proper dimensioning tools
3. Conversion of Isometric views to orthographic views
4. Conversion of Orthographic views to Isometric views
5. Objects are given in Isometric views and that are to be converted in sectional views
6. Excises on Threads; Bolts and nuts
7. Excises on Riveted Joints and welded joints
8. Excises on Shafts; keys cotter and pin joints
9. Excises on Couplings
10. Geometrical tolerance; Limits and fits
11. Excises on Springs; belts and Pulleys
12. Excises on Gears and bearings
13. Assembly drawing of Cylinder; Piston; rings and connected rod And part drawing of crank shaft
14. Assembly drawing of screw Jack
15. Block Diagrams; (Power plant; Civil; Electronics etc)
16. Assembly drawing of stop valve
17. Assembly drawing of spring loaded safety Valve
18. Assembly drawing of Tail stock of Lathe
19. Assembly drawing of Shaper tool slide
20. Conversion of Assembly drawing to part drawings and vice versa

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| ME-257 | FLUID MECHANICS LAB | L T P | Cr |
|        |                     | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

1. To determine the meta-centric height of a floating Body
2. To verify Bernoulli's theorem
3. To find critical Reynolds number for pipe flow
4. To determine the coefficient of discharge; contraction and velocity; of an orifice
5. To determine the coefficient of discharge of a venturimeter
6. To determine the coefficient of discharge of "V" notches
7. To determine the friction factor for pipes
8. To determine the minor losses due to sudden enlargement; sudden contraction and bends; in pipe flow
9. To determine the coefficient of impact of jet
10. To determine the velocity and pressure variation with radius in a forced vortex flow

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| ME-258 | ENGINEERING<br>MATERIALS LAB | L T P | Cr |
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**LIST OF EXPERIMENTS**

1. To study the creep deformation of the solder wire
2. To study the Bravais Lattices
3. To study the arrangement of atoms in simple crystal with the aid of models

4. To study the chemical methods of corrosion
5. To normalize a given specimen and check its toughness
6. To temper the given hardened steel specimen at 300°C and measure hardness
7. To temper the given hardened steel specimen at 500°C and measure hardness
8. To study the microstructure of heat treated steel
9. To harden a given specimen and check its hardness
10. To anneal a given specimen and check its hardness

|        |  |       |    |
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| ME-259 | MEASUREMENT AND<br>INSTRUMENTATION LAB | L T P | Cr |
|        |  | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

1. To study a linear variable differential transformer (LVDT) and use it in a simple experimental set up to measure small displacement
2. To measure strain using strain gauges mounted on a cantilever beam
3. To measure torque using strain gauge torque transducer
4. To measure temperature using a thermocouple
5. Temperature measurement by a resistance – temperature device and to draw its characteristic curve;
6. To draw the characteristic curve for the given thermister;
7. To measure the speed of a motor shaft with the help of (non contact type magnetic pick up)
8. To measure the speed of a motor shaft with the help of a proximity sensors;
9. To measure load using load cell
10. Measurement of pressure using pressure cell

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|--------|--------------------------|-------|----|
| ME-301 | THEORY OF<br>MACHINES-II | L T P | Cr |
|        |                          | 5 1 0 | 4  |

**OBJECTIVE**

The course aims to acquaint students with tools required to synthesize / analyze various mechanisms used in different mechanical devices

**PRE REQUISITES**

Knowledge of Theory of Machines - I

1. **INTRODUCTION:** Mechanisms and Machines: Kinematics links; pairs; chains; Kinematics inversions; Four bar planer mechanisms; mobility and range of movement; Miscellaneous mechanisms; (straight line; steering; pantograph)
2. **KINEMATIC SYNTHESIS OF MECHANISMS:** Type; number and dimensional synthesis; function generation /Path generation/position generation; two and three position synthesis of four bar/Slider crank mechanisms by graphical and analytical methods; Freudenstein's equation; precision positions; structural error; Chebychev's spacing; Transmission angle
3. **CAMS:** Classification of cams and followers; disc cam nomenclature; Construction of displacement/velocity/acc; for different types of follower motions; Synthesis of cam profile by

- graphical and analytical approaches; Cams with specified contours/ tangent and circular arc cams
- GEARS:** Fundamental law of gearing ; involute spur gears; characteristics of involute action; Interference and undercutting; center distance variation; Involutometry; Nomenclature of Helical/ Bevel/ Worm gears
  - GEAR TRAINS:** Synthesis of simple; compound and reverted gear trains; Analysis of epicyclic gear Trains
  - BALANCING OF ROTATING COMPONENTS:** Static/dynamic balancing; Balancing of rotating masses; Two plane balancing-graphical and analytical methods; balancing of rotors; field balancing; balancing machines
  - BALANCING OF RECIPROCATING PARTS:** Balancing of single cylinder engine; balancing of multicylinder - inline/radial/V-type engines; firing order

**TEXT BOOK**

Rattan, S. S., "Theory of Machines", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2007

**REFERENCE BOOKS**

- Shigley, J. E., "Theory of Machines and Mechanisms", Oxford, 3<sup>rd</sup> ed, 2009
- Rao, J. S, and Dukkippatti., "Mechanism and Machine Theory", New Age International
- Amitabha, Ghosh, and Malik , A. K., "Theory of Mechanisms and Machines", East West Press, 3<sup>rd</sup> ed, 1998

**WEB REFERENCE**

www.nptel.iitm.ac.in

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|--------|-----------------------|-------|----|
| ME-302 | ENERGY CONVERSION – I | L T P | Cr |
|        |                       | 5 1 0 | 4  |

**OBJECTIVE**

It enables the students to understand the use of thermodynamic laws in design and functioning of various equipment used in steam power systems and compressors

**PRE REQUISITES**

Knowledge of Thermodynamics

- FUELS AND COMBUSTION:** Classification of fuels- solid; liquid and gaseous fuels; Combustion equations; Stoichiometric air-fuel ratio; Excess air; Exhaust gas analysis; Orsat apparatus; Enthalpy and internal energy of combustion; Enthalpy of formation; Adiabatic flame temperature; Calorific values of fuel; Problems
- STEAM BOILERS AND DRAFT:** Classification; comparison between fire and water tube boilers; Essentials of a good boiler; Constructional and operational details of Babcock-Wilcox; Cochran; Locomotive and Lancashire Boilers; High pressure boilers- Benson; Lamont; Loeffler and Velox boilers; Boiler mountings and accessories; Boiler performance; Natural and Artificial Drafts; Chimney height; Maximum draft and chimney efficiency; Boiler heat balance Sheet; Problems

- VAPOUR POWER CYCLES:** Carnot and Rankine vapour cycles; effect of operating Conditions on thermal efficiency of Rankine cycle; Rankine cycle with superheat; reheat And regeneration; Binary vapour cycle; Problems
- FLOW THROUGH NOZZLES:** Velocity and heat drop; mass discharge through a nozzle; critical pressure ratio and its significance; effect of friction and nozzle efficiency; Supersaturated flow; design pressure ratio; Problems
- STEAM TURBINES:** Classification; Impulse Turbine- Flow through blades; velocity Diagram; power output and efficiency; maximum blade efficiency of single stage impulse Turbine; blade friction; compounding of impulse turbine; Reaction Turbine-Flow through Impulse reaction blades; degree of reaction; velocity diagram; power output; efficiency And blade height; comparison of impulse and impulse reaction turbines; Losses in steam Turbines; stage efficiency; overall efficiency and reheat factor; Governing of steam Turbines; Problems
- STEAM CONDENSERS:** Elements of a condensing plant; types of condensers and their studies reciprocating; comparison of jet and surface condensers; Condenser vacuum; sources of air leakage and its Disadvantages; vacuum efficiency and condenser efficiency; Problems
- AIR COMPRESSORS:** Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure; Problems

**TEXT BOOK**

Eastop, T. D, and McConkey., "Applied Thermodynamics for Engineering Technologists", Pearson Education.

**REFERENCE BOOKS**

- Domkundwar., "Thermal Engineering", Dhanpat Rai and Company.
- Vasandani, V. P., and Kumar, D. S., "Heat Engineering", Metropolitan Book Co
- Ballaney, P. L., "Thermal Engineering", Khanna Publishers,

**WEB REFERENCES**

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- ecourses.com
- nptel.iitm.ac.in

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|--------|------------------------|-------|----|
| ME-303 | INDUSTRIAL ENGINEERING | L T P | Cr |
|        |                        | 5 0 0 | 3  |

**OBJECTIVE**

The course provides knowledge of work study; work force management; cost analysis; PPC; MIS and product design. After going through the course; the student will be able to manage factory activities in a proper and efficient manner

- DEFINITION OF INDUSTRIAL ENGINEERING:** Objectives; Method study; Principle of motion

- economy; techniques of method study – various charts; THERBLIGS; Work measurement – various methods; time study PMTS; determining std time; work sampling; Numericals
- 2 **PRODUCTIVITY and WORKFORCE MANAGEMENT:** Productivity – Definition; various methods of measurement; Factors affecting productivity; Strategies for improving productivity; various methods of job evaluation and merit rating; Various incentive payment schemes; behavioral aspects; financial incentives
- 3 **MANUFACTURING COST ANALYSIS:** Fixed and variable costs; Direct; indirect and overhead costs; Process and Job costing; Recovery of overheads; Standard costing; cost control; cost variance Analysis ; Labour; material; overhead in volume; rate and efficiency; break even analysis; marginal costing and contribution; numericals
- 4 **MATERIALS MANAGEMENT:** Strategic importance of materials in manufacturing industries; relevant costs; inventory control models – economic order quantity (EOQ); Economic batch quantity (EBQ) with and without shortage; Purchase discounts; sensitivity analysis; inventory control systems – P; Q; Ss Systems; Service level; Stock out risk; determination of order point and safety stock; selective inventory control – ABC; FSN; SDE; VED and three dimensional; Numericals
- 5 **QUALITY MANAGEMENT:** Definition of quality; various approaches; concept of quality assurance systems; costs of quality; statistical quality control (SQC); Variables and Attributes; X; R; P and C – charts; Acceptance sampling; OC – curve; concept of AOQL; Sampling Plan – single; double and sequential; introduction to TQM and ISO 9000
- 6 **PRODUCTION PLANNING & CONTROL (PPC)** : Introduction to Forecasting – Simple and Weighted moving average methods; Objectives and variables of PPC; Aggregate planning – Basic concept; its relations with other decision areas; decision options – Basic and Mixed strategies; Master production schedule (MPS) Scheduling Operations Various methods for line and intermittent production systems; Gantt chart; sequencing – Johnson algorithm for n-Jobs-2 machines; n-jobs-3 machines; 2 jobs n-machines n-Jobs m-machines; various means of measuring effectiveness of PPC; Introduction to JIT; Numericals
- 7 **MANAGEMENT INFORMATION SYSTEMS (MIS)** What is MIS? Importance of MIS; Organizational information system structure; Role of analysis and design; Organizing information systems; Product Design and development: various approaches; product life cycle; Role 3S's – Standardisation; Simplification; Specialisation; Introduction to value engineering and analysis; role of Ergonomics in Product Design

**TEXT BOOK**

Chary., "Production and Operations Management", Tata McGraw Hill.

**REFERENCE BOOKS**

- 1 Buffa, S. S., "Modern Production Management", John Wiley
- 2 Sadagopan., "Management Information Systems", Prentice Hall of India.
- 3 Schroeder., "Operations Management", McGraw Hill ISE.
- 4 Monks., "Operation Management", McGraw Hill ISE.
- 5 Martinich., "Production and Operations Management", John Wiely SE
- 6 Turner, MIZE, CHASE., "Industrial and Systems Engineering", Prentice Hall of India.

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|--------|-----------------------|-------|----|
| ME-304 | MANUFACTURING SCIENCE | L T P | Cr |
|        |                       | 5 0 0 | 3  |

**OBJECTIVE**

The course provides knowledge on mechanism of metal cutting; different types of machine tools and special manufacturing processes like gear manufacturing and part programming on CNC machines; After the course completion; the students will be in a position to supervise work in a modern machine shop

**PRE REQUISITES**

Knowledge of Manufacturing Practice

1. **MECHANISM OF METAL CUTTING:** Deformation of metal during machining; mechanics of chip formation; built-up edges; mechanics of orthogonal and oblique cutting; merchant cutting force circle and shear angle relationship in orthogonal cutting; factors affecting tool forces; Cutting speed; feed and depth of cut; surface finish; Temperature distribution at tool chip interface; Numericals on cutting forces and merchant circle; Introduction to grinding and finishing operation
2. **CUTTING TOOLS:** Characteristics of tool materials; various types of cutting tool materials; coated tools; cutting tool selection; purpose and types of cutting fluids; selections of cutting fluid; Types of tool wear; tool life; factors governing tool life; Machinability: Definition and evaluation; Economics of machining; Numericals on tool life
3. **GEAR MANUFACTURING:** Introduction; methods of manufacture; Gear generation and forming: Gear cutting by milling; single point form tool; gear hobbing and shaping; Gear finishing operations: Gear shaving; gear burnishing; gear grinding; lapping
4. **UNCONVENTIONAL MACHINING PROCESSES:** Abrasive jet machining; Principles; applications; process parameters; Ultrasonic machining: Principles; applications; analysis of process parameters; Electro chemical machining and grinding; Principles; classifications; choice of electrolytes; applications; electric discharge machining: Principles; selection of tools materials and dielectric fluid; Electron beam machining: Generation of electron beam; relative merits and demerits; Laser beam machining; Principles and applications

- JIGS & FIXTURES:** Introduction; location and location devices; clamping and clamping devices; drill jigs; milling fixtures
- CONVENTIONAL MACHINE TOOLS:** Centre lathe; constructional features; Automatic and semi automatic lathes – capstan and turret lathes; Milling and grinding machines; Reciprocating machine tools and their driving mechanisms
- CNC MACHINE TOOLS:** Introduction; types of CNC systems; Numerical Control Machine tools; CNC types; constructional details; special features; Part programming fundamentals; manual programming and computer assisted part programming

**TEXT BOOK**

Rao P N, “Manufacturing Technology Metal Cutting and Machine Tools”; Tata McGraw Hill

**REFERENCE BOOKS**

- Grover, MP., “CAD/CAM”, Grover and Zimmer Prentice Hall
- Sen, G. C, and A Bhattacharya., “Principles of Machine Tools”, Tata McGraw Hill.
- Pandey, P. C, and Shan, H. S., “Modern Machining Processes”, Tata McGraw Hill.
- Raghuwanshi, B. S., “Workshop Technology”, Vol II
- Kempster, M. H. A., “Introduction to Jig and Tool Design”, Hodder and Stoughton, England
- Groover, M. P., “Fundamentals of Modern Manufacturing”, John Wiley and Sons Inc.

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|--------|------------------|-------|----|
| ME-305 | MACHINE DESIGN-I | L T P | Cr |
|        |                  | 5 0 0 | 3  |

**OBJECTIVE**

The objectives of this course are to cover basics of design process; engineering materials; failure prevention under static loadings and characteristics of a few types of mechanical elements like joints – temporary / permanent etc

**PRE REQUISITES**

Knowledge of Engineering Mechanics; Strength of Materials

- DESIGN PHILOSOPHY:** Problem identification-problem statement; specifications; constraints; feasibility study-technical/ economic and financial/societal and environmental; Generation of solution field (solution variants); brain storming; Systematic design procedure; Role of processing in design; Design considerations for casting forging and machining
- MECHANICAL JOINTS:** ISO Metric screw threads; Bolted joints in tension; Eccentrically Loaded bolted joints in shear and under combined stresses; Design of power screws; Design of cotter and knuckle joints; Design – case study
- Design of various types of welded joints under different static load conditions; eccentric loaded welded joints; Design of various types of riveted joints under different static loading conditions; eccentrically loaded riveted joints; Design – case study

- DESIGN OF CLUTCHES & BRAKES:** Types of clutches in use; Design of friction clutches-Disc; Multidisc; cone and centrifugal; Torque transmitting capacity; Various types of brakes; self energizing condition of brakes; design of shoe brakes- Internal and external expanding; band brakes; thermal considerations in brake designing; Design – case study
- DESIGN OF ROTATING RIMS (FLYWHEELS);** Turning moment diagram; coefficient of fluctuation of energy and speed; design of flywheel-solid disc and rimmed flywheel; Design – case study
- DESIGN OF POWER TRANSMISSION COMPONENTS:** Belts; chains; ropes; Design of belt drives; Flat and V belt drives; Condition for transmission of max; power; selection of belt; design of Rope drives; design of chain drives with sprockets; Design – case study

**TEXT BOOK**

Bhandari, V. B., “Design of machine elements”, Tata McGraw Hill, 2nd edition, 2007

**REFERENCE BOOKS**

- Chitale, A. K, & Gupta, R. C., “Product Design and Manufacturing”, Prentice Hall of India.
- Robert, L. Norton., “Machine Design An Integrated Approach”, Addison Wesley
- Robert, C. Juvinall., “Fundamentals of Machine Component Design”
- Shigley, J.E., “Mechanical Engg Design”, Tata McGraw Hill 8th edition.

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|--------|--------------------|-------|----|
| ME-306 | AUTOMATIC CONTROLS | L T P | Cr |
|        |                    | 5 1 0 | 4  |

**OBJECTIVE**

The main objective is to introduce the basic principles of modeling; analysis and control of dynamic systems; state space approach to control system design and understanding of the basic ideas behind the implementation of computer controlled systems

**PRE REQUISITES**

Knowledge of Applied Mathematics II

- DEFINITION:** Types of Control Systems; Open Loop and Closed Loop System and its application; Block diagram Representation of process and control elements – Laplace transform representation; Mathematical modeling; representation of system or processes; comparison element; Representation of Feedback control system – Block diagram and T F representation; Signal flow groups; Problems
- TYPES OF CONTROL ACTION:** hydraulic controllers; pneumatic controllers; Electronic controllers; system with proportional control; proportional cum derivative control; proportional cum Integral control; proportional cum derivative-cum-integral control; Problems

3. **FREQUENCY RESPONSE ANALYSIS:** Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots; Equivalent Unity Feed Back Systems; Problems
4. **STABILITY OF CONTROL SYSTEMS:** Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion; Bode Plot ; Gain and Phase Margins; Problems
5. **ROOT LOCUS METHOD:** Introduction; Root loci of a Second order System; General Case; rules for Drawing Forms of Root loci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems
6. **DIGITALCONTROL SYSTEM:** Representation of Sampled Signal; Hold Device; Pulse Transfer Function; Block Diagrams; Transient Response; Routh's Stability Criterion; Root Locus Method; Nyquists Criterion; Problems
7. **STATE SPACE ANALYSIS OF CONTROL SYSTEMS:** Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems

**TEXT BOOK**

Nakra, B.C., "Theory and Applications of Automatic Control", New Age Publishers.

**REFERENCE BOOKS**

1. Ogata, "Modern Control Engineering"; Prentice Hall of India
2. Kuo., "Automatic Control Systems", Prentice Hall of India.
3. Bakshi, U. A, and Bakshi, VU., "Control System", Technical Publication.

**WEB REFERENCE**

[www.contolguru.com](http://www.contolguru.com)

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|---------------|-----------------------|--------------|-----------|
| <b>ME-307</b> | <b>FLUID MACHINES</b> | <b>L T P</b> | <b>Cr</b> |
|               |                       | <b>5 1 0</b> | <b>4</b>  |

**OBJECTIVE**

On completion of this course; students will be able to know the construction; working; installation of hydraulic turbines; pumps and other hydraulic systems

**PRE REQUISITES**

Knowledge of Fluid Mechanics

1. **IMPACT OF FREE JETS:** Impulse – momentum principle; jet impingement - on a stationary flat plate; inclined plate and a hinged plate; at the center of a stationary vane; on a moving flat plate; inclined plate; a moving vane and a series of vanes; Jet striking Tangentially at the tip of a stationary vane and moving vane(s); jet propulsion of ships; Problems
2. **DIMENSIONAL ANALYSIS AND MODEL SIMILITUDE:** Dimensional homogeneity; Rayleigh's method and Buckingham's  $\pi$ -theorem; model studies and similitude; dimensionless numbers and their significance; Unit quantities;

- specific speed and model relationships for turbines; scale effect; cavitations – its causes; harmful effects and prevention; Thomas cavitation factor; permissible installation height; Problems
3. **IMPULSE TURBINES:** Classification – impulse and reaction turbines; water wheels; Component parts; construction; operation and governing mechanism of a Pelton wheel; Work done; effective head; available head and efficiency of a Pelton wheel; design aspects; speed ratio; flow ratio; jet ratio; number of jets; number of buckets and working Proportions; Performance Characteristics; governing of impulse turbines; Problems
  4. **REACTION TURBINES:** Francis Turbine-Component parts; construction and operation of a Francis turbine; governing mechanism; work done by the turbine runner; working proportions and design parameters; slow; medium and fast runners; degree of reaction; Performance Characteristics; Problems; Propeller and Kaplan turbines: Component parts; construction and operation of a Propeller; Kaplan turbine; draft tube- its function and different forms; Performance Characteristics; Governing of reaction turbine; Problems
  5. **CENTRIFUGAL PUMPS:** Classification; velocity vector diagrams and work done; manometric efficiency; vane shape; head capacity relationship and pump losses; pressure rise in impeller; minimum starting speed; design considerations; multi-stage pumps; net positive suction head; maximum suction lift; performance characteristics; Brief introduction to axial flow; mixed flow and Submersible pumps; Problems
  6. **RECIPROCATING PUMPS:** Construction and operational details; discharge coefficient; volumetric efficiency and slip; work and power input; effect of acceleration and friction on indicator diagram (pressure – stroke length plot); separation; air vessels and their utility; rate of flow into or from the air vessel; maximum speed of the rotating crank; characteristic curves; centrifugal vs; reciprocating pumps; brief introduction to screw; gear; vane and radial piston pumps; Problems
  7. **HYDRAULIC SYSTEMS:** Function; construction and operation of Hydraulic accumulator; hydraulic intensifier; hydraulic crane; hydraulic lift and hydraulic press; Fluid coupling and torque converter; Hydraulic ram; Problems;

**TEXT BOOK**

Modi and Seth; "Hydraulics and Fluid Machines" Standard Book House

**REFERENCE BOOKS**

1. Rattan, S. S., "Fluid Mechanics and Hydraulic Machines", Khanna Publishers.
2. Som, S. K, and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill
3. Kumar, D. S., "Fluid Mechanics and Fluid Power Engineering ", S K Kataria and Sons
4. Jagdish, Lal., "Hydraulic Machines", Metropolitan

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2. [ecourses.com](http://ecourses.com)

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|--------|----------------------------|-------|----|
| ME-308 | OPTIMIZATION<br>TECHNIQUES | L T P | Cr |
|        |                            | 5 1 0 | 4  |

**OBJECTIVE**

The objective of the course is to give the student experience in modeling; solving and analyzing problems using linear programming; Emphasis will be on theory and applications; By the end of the course; the student should have developed the skills to consider real world problems; develop linear programming models that consider the key elements of the real world problem; solve the models for their optimal solutions; interpret the models solutions and infer solutions to the real world problems

- 1. INTRODUCTION; DEFINITION, CONCEPT ON OR MODEL BUILDING:** Types and Methods; application in Industry Linear programming – Definition; formulation; solution – graphical; simplex method; BIG – M method; Computational Problems
- 2. DETERMINISTIC MODEL:** Transportation model-balanced and unbalanced; north west rule; Vogel's Method; least cost or matrix minimal; Stepping stone method; MODI methods; degeneracy; assignment; traveling salesman; problems
- 3. ADVANCED TOPIC OF LP:** Duality; PRIMAL-DUAL relations-its solution; shadow price; economic interpretation; dual-simplex; post optimality and sensitivity analysis; problems
- 4. WAITING LINE MODELS:** Introduction; queue parameters; M/M/1 queue; performance of queuing systems; applications in industries; problems
- 5. PROJECT LINE MODELS:** Network diagram; event; activity; defects in network; PERT and CPM; float in network; variance and probability of completion time; project cost – direct; indirect; total; optimal project cost by crashing of network; resources leveling in project; problems
- 6. CLASSICAL OPTIMIZATION THEORY:** Introduction unconstrained problems – Necessary and sufficient conditions; The Newton – Raphson Method; Constrained Problems – Equality constraints; Inequality constraints
- 7. NON LINEAR PROGRAMMING ALGORITHMS:** Unconstrained Non linear Algorithm – Direct search method; Gradient Method; Constrained Algorithms – Separable programming; Quadratic Programming; geometric programming; Stochastic programming; linear combinations method

**TEXT BOOK**

Taha, H. A., "Operation Research", Prentice Hall of India, Sixth/Seventh Edition

**REFERENCE BOOKS**

1. Rao, S.S., "Engineering Optimisation: Theory and Practice", New Age International, 3rd Edition
2. Gupta and Sharma., "Operation Research", National Publishers
3. Vohra., "Quantitative Techniques", Tata McGraw Hill
4. Wagher, H. M., "Principles of Operation Research", (with applications to Managerial Decisions), Prentice Hall of India

5. Philips., "Operation Research", Revindran, Solgeberg, Wiley ISE, 2<sup>nd</sup> Edition

**WEB REFERENCES**

1. www.ecourses.ou.edu
2. www.4shared.com

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|--------|---------------|-------|----|
| ME-309 | HEAT TRANSFER | L T P | Cr |
|        |               | 5 1 0 | 4  |

**OBJECTIVE**

This course imparts basic knowledge of heat transfer and the knowledge imparted will enable him to reduce or increase heat transfer in existing equipment as the need may be and be able to go for preliminary design of heat exchanger

**PRE REQUISITES**

Knowledge of Thermodynamics

- 1. BASICS AND LAWS:** Modes of heat transfer Steady State Heat Conduction: Boundary conditions in heat transfer; 1-D heat conduction through a plane wall; long hollow cylinder; hollow sphere and composite structures; Overall h t c. Conduction equation in Cartesian; polar and spherical co-ordinate systems; Initial and Boundary conditions; Numericals
- 2. STEADY STATE CONDUCTION WITH HEAT GENERATION:** Introduction; 1 – D heat conduction with heat sources; Plane wall; hollow cylinder and sphere; Current carrying conductor; Extended surfaces (fins); Fin effectiveness Numericals
- 3. TRANSIENT HEAT CONDUCTION:** Systems with negligible internal resistance; Transient heat conduction in plane walls; cylinders; spheres with convective boundary Conditions; Chart solutions only; Periodic heat transfer in one dimension; Numericals
- 4. CONVECTION:** Forced convection-Thermal and hydro-dynamic boundary layers; Equation of continuity; Momentum and energy equations; some results for flow over a flat plate and flow through tube; Fluid friction and heat transfer (Colburn analogy); Use of; Empirical relations for free convection from vertical and horizontal planes and cylinders; Numericals
- 5. THERMAL RADIATION:** Absorptivity; Reflectivity; Transmissivity; Black body; emissive power; radiosity; laws of thermal radiation; intensity of radiation; Shape factor and its properties; Hottel's Method; Radiation exchange between black and gray surfaces; Two body; three body enclosures; Radiation shielding; Numericals
- 6. HEAT EXCHANGERS:** Classification; Performance variables; Analysis of a parallel and counter flow heat exchanger using LMTD and NTU; Heat exchanger effectiveness; Use of charts for multipass exchanger; Numericals
- 7. HEAT TRANSFER WITH CHANGE OF PHASE:** Laminar film condensation on a vertical plate; Drop-wise condensation; Boiling regimes; Free convective; Nucleate and film boiling; Numericals

**TEXT BOOK**

NAG, P. K., "Heat Transfer", McGraw Hill

**REFERENCE BOOKS**

1. Arpasi, VS., "Conduction Heat Transfer", Addison Wesley
2. Domkundwar., "Heat Transfer",
3. Holman, J. P., "Heat Transfer", Tata McGraw Hill
4. Goshdastidar, P.S., "Heat Transfer", Oxford Univ Press
5. Lienhard, J.V, J. H. Lienhard. V., " A Heat Transfer Text Book

**WEB REFERENCES**

1. <http://web.mit.edu/lienhard/www/ahtt.html>
2. [nptel.iitm.ac.in](http://nptel.iitm.ac.in)

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|--------|-----------------------|-------|----|
| ME-310 | ENERGY CONVERSION -II | L T P | Cr |
|        |                       | 5 1 0 | 4  |

**OBJECTIVE**

It imparts the knowledge of proper functioning of basic systems used in IC engine and gas turbines and also in rotary compressors. It will enable a student to test and evaluate the performance of an internal combustion engine.

**PRE REQUISITES**

Knowledge of Thermodynamics

1. **AIR STANDARD CYCLES:** Classification of I;C;Engines; Cycles of operation in four stroke and two stroke I;C; Engines; Wankel Engines; Assumptions made in air standard cycle; Otto cycle; diesel cycle; dual combustion cycle; comparison of Otto; diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency; specific work output; specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle; Numericals
2. **CARBURATION; FUEL INJECTION AND IGNITION SYSTEMS:** Introduction to Carburation; Mixture requirements for various operating conditions in S;I; Engines; elementary carburetor; Requirements of a diesel injection system; types of inject systems; petrol injection; Requirements of ignition system; types of ignition systems; ignition timing; spark plugs; Numericals
3. **COMBUSTION IN I C ENGINES :** S I; engines; Ignition limits; stages of combustion in S.I; Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I;Engine combustion chambers; Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines; Cetane rating; C.I engine combustion chambers
4. **LUBRICATION AND COOLING SYSTEMS:** Functions of a lubricating system; Types of lubrication system; mist; wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants; engine performance and lubrication; Necessity of engine cooling; disadvantages of

overcooling; cooling systems; air-cooling; water cooling; radiators

5. **ENGINE TESTING AND PERFORMANCE:** Performance parameters: BP; IP; mechanical efficiency; brake mean effective pressure and indicative mean effective pressure; torque; volumetric efficiency; specific fuel consumption (BSFC; ISFC); thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption; brake power; indicated power and friction power; heat lost to coolant and exhaust gases; performance curves; Numericals
6. **ROTARY COMPRESSORS:** Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams; slip factor; ratio of compression; pressure coefficient; pre-whirl; Axial flow compressor- Degree of reaction; polytropic efficiency; surging; choking and stalling; performance characteristics; Numericals
7. **GAS TURBINES:** Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger; Applications of gas turbines; Combined Cycle Plant; Numericals

**TEXT BOOK**

Ganesan, V., "Internal Combustion Engines", Tata McGraw Hill

**REFERENCE BOOKS**

1. Willard, W. Pulkrabek., "Engineering Fundamental of the I C Engine", Prentice Hall of India
2. Ganesan., V., "Gas Turbines", Tata McGraw Hill
3. Mathur and Sharma., "Internal Combustion Engines",- Dhanpat Rai

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2. [ecourses.com](http://ecourses.com)
3. [nptel.iitmac.in](http://nptel.iitmac.in)

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|--------|-------------------|-------|----|
| ME-311 | MACHINE DESIGN-II | L T P | Cr |
|        |                   | 4 0 0 | 2  |

**OBJECTIVE**

The objectives are to study characteristics of principle types of mechanical elements under variable loading and to prevent their failure under static and variable loading;

**PRE REQUISITES**

Knowledge of Engineering Mechanics; Strength of Materials

1. **VARIABLE LOADING:** Different types of fluctuating/variable stresses; fatigue strength considering stress concentration factor; surface factor etc; fatigue design for finite/infinite life against combined variable stresses using Goodman and Soderberg's Criterion; fatigue design using Miner's equation; Design problems

2. **SHAFT & ASSOCIATED PARTS:** Detailed design of shafts for static and dynamic loading; Rigidity and deflection consideration; Design of keys/splines/Couplings – rigid and flexible Design – case study
3. **SPRINGS:** Types of springs and their uses; Stresses and deflections in helical springs and in leaf springs; Design for helical springs against tension / compression and fluctuating loads; Design of leaf springs; Design problems
4. **BEARINGS:** Selection of ball and roller bearings based on static and dynamic load carrying capacity using load-life relationship; Selection of Bearings from manufacturer's catalogue.  
Types of lubrication-Boundary; mixed and hydrodynamic lubrication; Design of journal bearings using McKee's equations; Raimondi and Boyd's charts; Lubricants and their properties; Selection of suitable lubricants; Design problems.
5. **GEARS:** Review of terminology of gears; Selection of materials for gears; Force analysis; Beam and wear strength of gear tooth; Form or Lewis factor for gear tooth; dynamic load on gear teeth-Barth equation and Buckingham equation and their comparison; Design of spur; helical; bevel and worm gear; Gear lubrication; Design problems

**TEXT BOOK**

Robert C Juvinall; "Fundamentals of Machine Component Design"

**REFERENCE BOOKS**

1. Chitale., A. K, and Gupta, R. C., "Product Design and Manufacturing", Prentice Hall of India
2. Kulkarni, S. G., "Machine Design", Tata McGraw Hill
3. Grover, O. P, Maleev and Hartman., "Machine Design", CBS Publication
4. George, Dieter., "Engineering Design", McGraw Hill

**WEB REFERENCES**

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|               |                                   |              |           |
|---------------|-----------------------------------|--------------|-----------|
| <b>ME-351</b> | <b>THEORY OF MACHINES- II LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                   | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

- 1 To study various types of links; pairs; chains and mechanisms
- 2 To study planar four bar mechanism and its inversions (four bar mechanism; single and double slider crank mechanism
- 3 Graphical synthesis of i) 4 bar mechanism ii) radial cam with roller follower
- 4 Kinematic study of mechanisms i) shaper machine mechanism ii) power hacksaw mechanism
- 5 To study various types of cam and follower arrangement and plot follower displacement v/s cam rotation for various cam follower systems
- 6 To study various types of gears and generate spur gear involute tooth profile using simulated gear shaping process and study standard and non standard involute gear tooth profile
- 7 To study various types of gear laws; simple; compound; reverted; epicyclic and differential

- 8 To perform experiment for static balancing / dynamic balancing on balancing apparatus
- 9 Determine M O I of connecting rod by compound pendulum method and trifilar suspension pendulum
- 10 Determine gyroscopic couple on motorized gyroscope

|               |                                |              |           |
|---------------|--------------------------------|--------------|-----------|
| <b>ME-352</b> | <b>ENERGY CONVERSION-I LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

1. To study low pressure boilers with their accessories and mountings
2. To study high pressure boilers with their accessories and mountings
3. To prepare heat balance sheet for a given boiler
4. To study impulse and reaction steam turbines
5. To find out dryness fraction of steam by throttling calorimeter
6. To calculate power output and efficiency of a steam turbine
7. To study and determine the condenser efficiency
8. To study and determine the volumetric efficiency of a reciprocating air compressor
9. To study cooling tower and determine its efficiency
10. To determine calorific value of a sample of fuel using bomb calorimeter
11. To determine composition of flue gases by orsat apparatus

|               |                                  |              |           |
|---------------|----------------------------------|--------------|-----------|
| <b>ME-354</b> | <b>MANUFACTURING SCIENCE LAB</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                  | <b>0 0 2</b> | <b>1</b>  |

**LIST OF EXPERIMENTS**

1. To cut external threads on lathe machine
2. To prepare a job on surface / cylindrical grinder and measure the various parameters of the finish piece
3. Manufacturing and assembly of a unit consisting of two to three components to have the concept of tolerances and fits (Shaft and bush assembly or shaft; key and bush assembly or any suitable assembly)
4. Leveling of machine tools and testing their accuracy
5. Disassembly and assembly of small assemblies such as tail stock; bench vice; screw jack etc
6. Multi slot cutting on milling machine by indexing
7. Drilling and boring of a bush
8. To study nomenclature; cutting angles of a single point cutting tools
9. To design and manufacture a simple drilling jig for a given job
10. To study the working of CNC machine

|               |  |              |           |
|---------------|--|--------------|-----------|
| <b>ME-355</b> | <b>MACHINE DESIGN - I LAB (CASE STUDIES)</b> | <b>L T P</b> | <b>Cr</b> |
|               |  | <b>0 0 2</b> | <b>1</b>  |

**LIST OF CASE STUDIES**

1. Design a screw clamp
2. Design for shearing load of a plate with more than one bolt.

- Design a welded bracket to withstand static loading
- Design an automotive-type clutch taking wear factor into consideration.
- Design a flywheel under fluctuating loads.
- Design of an internal and external shoe-brake.
- Design a shaft to transmit power.
- Design a V-belt for torsional and radial loads.
- Design an inspection capsule to be lowered into an oil well for hydrostatic pressure and abrasive rock.
- Design a rope drive.

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|--------|--------------------|-------|----|
| ME-357 | FLUID MACHINES LAB | L T P | Cr |
|        |                    | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- To study the constructional details and draw characteristic and constant efficiency curves of a pelton turbine
- To study the constructional details and draw characteristic and constant efficiency curves of a Francis turbine
- To study the constructional details and draw characteristic and constant efficiency curves of a Kaplan turbine
- To study the constructional details and draw characteristic curve of centrifugal pump
- To study the constructional details and draw characteristic curve of a reciprocating pump
- To study the constructional details and draw performance curve of gear oil pump
- To study the constructional details and determine the efficiency of a hydraulic Ram
- To study the constructional details of a centrifugal compressor
- To study the model of hydro power plant and draw its layout
- To determine the volumetric efficiency of a reciprocating compressor

|        |                   |       |    |
|--------|-------------------|-------|----|
| ME-359 | HEAT TRANSFER LAB | L T P | Cr |
|        |                   | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- To determine the thermal conductivity of a metallic Rod
- To determine the thermal conductivity of an insulating power
- To find out the heat transfer and effectiveness of a pin fin under natural convection condition
- To calculate the heat transfer and effectiveness of a pin fin under forced convection condition
- To determine the emissivity of a given specimen body
- To verify the Stefan Boltzman constant for thermal radiation
- To determine the overall heat transfer coefficient and effectiveness of a given heat exchanger under parallel flow condition
- To determine the overall heat transfer coefficient and effectiveness of a given heat exchanger under counter flow condition
- To determine the convective heat transfer coefficient for a horizontal rod
- To determine the overall thermal resistance of a composite wall

|        |                             |       |    |
|--------|-----------------------------|-------|----|
| ME-360 | ENERGY CONVERSION-II<br>LAB | L T P | Cr |
|        |                             | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- To study constructional details and working principle of four stroke SI engine
- To study constructional details and working principle of four stroke CI engine
- To prepare heat balance sheet for multi cylinder diesel engine
- To prepare heat balance sheet for multi- cylinder petrol engine
- To find indicated power of multi cylinder petrol engine by Morse test
- To find frictional power of a single cylinder diesel engine; by William's Line Method
- To study various lubrication systems of an IC engine
- To find frictional power of a single cylinder petrol engine by William's Line Method
- To perform constant speed test on Multi-cylinder diesel engine and draw curves for
  - BP vs Fuel rate; air Rate
  - BP vs BSFC (break specific fuel consumption)
- To perform variable speed test on multi cylinder petrol engine and draw curves for
  - Speed vs BP
  - speed vs Volumetric Efficiency

|        |                            |       |    |
|--------|----------------------------|-------|----|
| ME-361 | MACHINE DESIGN - II<br>LAB | L T P | Cr |
|        |                            | 0 0 2 | 1  |

**LIST OF CASE STUDIES**

Design a two speed gear box to transmit 3KW of power output at a speed of 500rpm/1000rpm

- Gear shift lever
- Gear shift lever
- Shafts
- Shafts
- Shafts
- Gears
- Gears
- Gears
- Bearings selection
- Bearings selection

|        |                                     |       |    |
|--------|-------------------------------------|-------|----|
| ME-401 | REFRIGERATION & AIR<br>CONDITIONING | L T P | Cr |
|        |                                     | 5 0 0 | 3  |

**OBJECTIVE**

It helps the students to understand the concepts and uses of various types of refrigeration systems and equipments. The student will be able to estimate the heating/cooling load and design air conditioning system and equipments.

**PRE REQUISITES**

Knowledge of Thermodynamics

- INTRODUCTION:** Definition of refrigeration and air conditioning; Necessity; Methods of Refrigeration; Unit of refrigeration; Coefficient of performance (COP); Fundamentals of air conditioning system; Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with

- vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v; t-s and p-h diagrams; Effects of operating conditions on COP; Refrigerants-Definition; Classification; Nomenclature; Desirable Properties; Comparative study; secondary refrigerants; Introduction to eco-friendly Refrigerants
- 2 **MULTISTAGE REFRIGERATION SYSTEMS:** Introduction; Optimum inter stage pressure for two compressor system; method of improving cop; flash chamber; sub cooling of liquid refrigerant by using vapour refrigerant; sub cooling by external cooling source; sub cooling with liquid refrigerant ;sub cooler heat exchanger; Cascade Refrigerating Systems-Necessity Selection of Pairs of refrigerants for the System; Concept of cascade temperature; Analysis; Applications; Numericals
  - 3 **OTHER REFRIGERATION SYSTEMS:** (A) Vapour Absorption Refrigeration Systems – Basic Systems; Actual COP of the System; Performance; Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems; (B) Steam Jet Refrigerating System- Introduction; Analysis; Relative merits and demerits; Performance Applications; Problems; (C) Air Refrigeration System: Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems; Comparison of different systems; Numericals
  - 4 **REFRIGERATION EQUIPMENTS:** Type of compressors and their performance curves; Types of Condensers and Evaporators; Expansion devices; Float Valves; AXV; TXV; Capillary Tube;System Balancing; Numericals;
  - 5 **PSYCHROMETRY OF AIR & AIR CONDITIONING PROCESSES:** Properties of moist Air-Gibbs Dalton law; Specific humidity; Dew point temperature; Degree of saturation; Relative humidity; Enthalpy; Humid specific heat; Wet bulb temp;; Thermodynamics wet bulb temp;; Psychrometric chart; Psychrometry of air-conditioning processes; Mixing Process; Basic processes in conditioning of air; Psychrometric processes in air washer; Problems
  - 6 **AIRCONDITIONING LOAD CALCULATION:** Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure; Solar radiation; Infiltration and ventilation; Heat generation inside conditioned space; Apparatus selection; Comfort chart; Numericals
  - 7 **AIR CONDITIONING SYSTEMS WITH CONTROLS & ACCESSORIES:** Classifications; Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Numericals

**TEXT BOOK**

Arora, C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill

**REFERENCE BOOKS**

- 1 Arora and Domkundwa., “A Course in Refrigeration and Air Conditioning”, Dhanpat Rai and Sons

- 2 Manohar, Prasad., “Refrigeration and Air Conditioning”, Wiley Eastern
- 3 Stocker, WF, and Jones, JW., “Refrigeration and Air Conditioning”, Tata McGraw Hill

**WEB REFERENCES**

- 1 www.elitesoft.cm
- 2 www.trane.com
- 3 www.carrier.com
- 4 www.carmelsoft.com

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|--------|-----------------------|-------|----|
| ME-402 | COMPUTER AIDED DESIGN | L T P | Cr |
|        |                       | 5 0 0 | 3  |

**OBJECTIVE**

- To understand hardware and software requirement for CAD/CAM
- To develop basic knowledge and experience of engineering modeling concepts
- To teach the fundamentals of Modeling of Curves; Surfaces and Solids
- To study and use various CAD/CAM software
- To study the fundamentals of Finite Element Analysis

1. **INTRODUCTION & PRIMITIVES:** Fundamentals of CAD; Design process; Applications of computer for design; Benefits of CAD ; Points and Lines; Line drawing algorithms; DDA algorithm; Bresenham’s line algorithm; Circle generation algorithm; Mid point circle algorithm
2. **GEOMETRIC MODELING:** Wire frame modeling; wireframe entities and their definitions; Concept of Parametric and nonparametric representation of curve; hermite cubic splines; Bezier curves; B-splines nurbs
3. **SURFACE MODELING:** Surface modeling and entities; Algebraic and geometric form; Parametric space of Surface; Blending functions; Reparametrisation of surface patch; Sub dividing cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Hermite bicubic surface; Bezier surface; B-spline surface
4. **SOLID MODELING:** Solid models; Solid entities; Solid representation; Sweep representation; Constructive solid geometry and Boundary representation; Solid modeling based applications
5. **GEOMETRIC TRANSFORMATIONS:** Transformation Principles; Translation; Scaling; Rotation; Matrix Representations and Homogeneous Coordinates; Composite transformations and other transformations
6. **FINITE ELEMENT ANALYSIS:** Basic steps of Finite Element Analysis; discrete systems; solid and structural mechanics plane trusses Euler Bernoulli Beam Element; Plane Frame elements
7. **SINGLE VARIABLE PROBLEMS IN TWO DIMENSIONS :** Boundary Value Problems; Applications in solid mechanics

**TEXT BOOK**

Ibrahim, Zeid., "CAD", Tata McGraw Hill

**REFERENCE BOOKS**

1. Hearn and Baker., " Computer Graphics", Tata McGraw Hill
2. Mikel, P. Groover, and Emory, W, Zimmers., "CAD/CAM", Prentice Hall of India
3. Rao, P. N., "CAD/CAM", Tata McGraw Hill
4. Reddy. J. N., "Finite Element Method", Tata McGraw Hill, 3<sup>rd</sup> edition.

**WEB REFERENCES**

www.nptel.iitm.ac.in  
www.scribd.com

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|--------|-----------------------|-------|----|
| ME-404 | MECHANICAL VIBRATIONS | L T P | Cr |
|        |                       | 5 1 0 | 4  |

**OBJECTIVE**

The objective of the course is to teach the fundamentals of vibrations in lumped and distributed systems with emphasis on the underlying theory, assumptions, modeling and their response.

1. **INTRODUCTION:** Types of vibrations; S; H; M; principle of superposition applied to Simple Harmonic Motions; Beats; Fourier theorem and simple problems.
2. **UNDAMPED FREE VIBRATIONS:** Single degree of freedom systems; Mass Undamped free vibration-natural frequency of free vibration; stiffness of spring elements; effect of mass of spring; Compound Pendulum.
3. **DAMPED FREE VIBRATIONS:** Single degree freedom systems; different types of damping; concept of critical damping and its importance; study of response of viscous damped systems for cases of under damping; critical and over damping; Logarithmic decrement.
4. **FORCED VIBRATION:** Single degree freedom systems; steady state solution with viscous damping due to harmonic force; Solution by Complex algebra; Reciprocating and rotating unbalance; vibration isolation transmissibility ratio due to harmonic excitation and support motion; Vibrometer and accelerometer; Whirling of shafts with and without air damping; Discussion of speeds above and below critical speeds.
5. **SYSTEMS WITH TWO DEGREES OF FREEDOM:** Introduction; principle modes and Normal modes of vibration; co-ordinate coupling; generalized and principal co-ordinates; Free vibration in terms of initial conditions; Geared systems; Forced Oscillations-Harmonic excitation; Applications: a) Vehicle suspension; b) Dynamic vibration absorber; c) Dynamics of reciprocating Engines
6. **CONTINUOUS SYSTEMS:** Introduction; vibration of string; longitudinal vibration of rods; Torsional vibration of rods; Euler's equation for beams.
7. **NUMERICAL METHODS FOR MULTI DEGREE FREEDOM SYSTEMS:** Introduction; Influence coefficients; Maxwell reciprocal theorem; Dunkerley's equation; Orthogonality of principal modes; Method of matrix iteration-Method of

determination of all the natural frequencies using sweeping matrix and Orthogonality principle; Holzer's method; Stodola method.

**TEXT BOOK**

Singh, V. P., "Mechanical Vibrations", Dhanpat Rai and Company Pvt. Ltd, 3rd edition, 2006

**REFERENCE BOOKS**

1. Rao, S.S., "Mechanical Vibrations", Pearson Education Inc, 4<sup>th</sup> Edition, 2003
2. Graham, Kelly, S., "Mechanical Vibrations Schaum's Outline Series", Tata McGraw Hill, Special Indian edition, 2007
3. Thomson, W.T and Marie Dillon, Dahleh., "Theory of Vibration with Applications", Pearson Education Inc, 5th edition 2007
4. Rao, J. S, and Gupta, K., "Theory and Practice of Mechanical vibrations", New Age International Publications, New Delhi 2001

|        |                         |       |    |
|--------|-------------------------|-------|----|
| ME-421 | POWER PLANT ENGINEERING | L T P | Cr |
|        |                         | 5 0 0 | 3  |

**OBJECTIVE**

After going through the course the students will have the knowledge of different types, working and economy of power plant together with direct energy conversion systems. This course imparts the necessary knowledge regarding conventional and non conventional power plants. Further, the student should be able to work out the economics of a power plant.

**PRE REQUISITES**

Knowledge of Thermodynamics, Energy Conversion

1. **INTRODUCTION:** Energy resources and their availability; types of power plants; selection of the Plants; review of basic thermodynamic cycles used in power plants.
2. **HYDRO ELECTRIC POWER PLANTS:** Rainfall and run-off measurements and plotting of various curves For estimating stream flow and size of reservoir; power plants design; construction and operation of different components of hydro-electric power plants; site selection; comparison with other Types of power plants
3. **STEAM POWER PLANTS:** Flow sheet and working of modern-thermal power plants; super critical Pressure steam stations; site selection; coal storage; preparation; coal handling systems; feeding and burning of pulverized fuel; ash handling systems; dust collection-mechanical dust collector and electrostatic precipitator.
4. **COMBINED CYCLES:** Constant pressure gas turbine power plants; Arrangements of combined plants (Steam and gas turbine power plants); re-powering systems with gas production from coal; using PFBC systems; with organic fluids; parameters affecting thermodynamic efficiency of combined Cycles; Problems
5. **NUCLEAR POWER PLANTS:** Principles of nuclear energy; basic nuclear reactions; nuclear reactors-PWR; BWR; CANDU; Sodium graphite; fast breeder; homogeneous; gas cooled; Advantages and Limitations; nuclear power station; waste disposal

- POWER PLANT ECONOMICS:** load curve; different terms and definitions; cost of electrical energy; Tariffs methods of electrical energy; performance and operating characteristics of power plants incremental Rate theory; input-out put curves; efficiency; heat rate; economic load sharing; Problems
- NON-CONVENTIONAL POWER GENERATION:** Solar radiation estimation; solar energy collectors; low; medium and high temperature power plants; OTEC; wind power plants; tidal power plants; Geothermal power plants; Direct Energy Conversion Systems: Fuel cell; MHD power generation-principle; open and closed Cycles systems; thermoelectric power generation; thermionic power generation.

**TEXT BOOK**

Nag, P.K., "Power Plant Engineering", Tata McGraw Hill, Second Edition, 2001

**REFERENCE BOOKS**

- El-Waki, M.M., "Power Plant Engg", McGraw Hill 1985
- Sharma, P. C., "Power Plant Engg", S K Kataria and Sons
- Arora and Domkundwar,, "A Course in Power Plant Engineering", Dhapat Rai and Sons.
- Bernhardt, G.A, Skrotzki, and William, A. Vopat., "Power station Engineering and Economy", Tata McGraw Hill

**WEB REFERENCES**

- www.4shared.com
- www.scribd.com

|        |                                |       |    |
|--------|--------------------------------|-------|----|
| ME-422 | FLEXIBLE MANUFACTURING SYSTEMS | L T P | Cr |
|        |                                | 5 0 0 | 3  |

**OBJECTIVE**

This course aims at imparting theoretical and practical aspects of the basic techniques of flexible manufacturing systems and provides an overview of the basics of FMS techniques and allied/supporting techniques. This course is very useful for present upcoming manufacturing industries.

- AUTOMATION:** Types of automation; reasons for automating; automation strategies; Detroit-type automation: Automated flow lines; methods of work part transport; Transfer mechanisms; buffer storage; automation for machining operations.
- AUTOMATED ASSEMBLY SYSTEMS:** Design for automated assembly; types of automated assembly systems; part feeding devices; quantitative analysis of the delivery system operation; analysis of a single-station assembly machine; numericals.
- GROUP TECHNOLOGY:** Part families; parts classification and coding; types of classification and coding systems; Machine cell design: The composite part concept; types of cell designs; determining the best machine arrangement; benefits of group technology.

- FLEXIBLE MANUFACTURING SYSTEMS:** Components of an FMS; types of systems; where to apply FMS technology; FMS work stations; Material handling and storage system: Functions of the handling system; FMS layout configurations; Material handling equipment; Computer control system: Computer function; FMS data file; system reports; Planning the FMS; analysis methods for FMS; applications and benefits.
- ROBOTIC TECHNOLOGY:** Joints and links; common robot configurations; work volume; types of robot control; accuracy and repeatability; other specifications; end effectors; sensors in robotics.
- ROBOT PROGRAMMING:** Types of programming; lead through programming; motion Programming; interlocks; advantages and disadvantages; Robot languages: Motion programming; simulation and off-line programming; work cell control.
- ROBOT APPLICATIONS:** Characteristics of robot applications; robot cell design; types of robot applications: Material handling; processing operations; assembly and inspection.

**TEXT BOOK**

Groover, M. P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2<sup>ND</sup> Edition, 2001

**REFERENCE BOOKS**

- Nanua, Singh., "Approach to Computer Integrated Design and Manufacturing", John Wiley and Sons, 1998
- Browne, J. Harhen, J. Shivnan, J., "Production Management Systems" "A CIM Perspective", Addison Wesley, 2<sup>nd</sup> Edition, 1996
- Groover, M.P., "CAD/CAM", Zimmers EW / Prentice Hall of India

|        |                     |       |    |
|--------|---------------------|-------|----|
| ME-423 | MACHINE TOOL DESIGN | L T P | Cr |
|        |                     | 5 0 0 | 3  |

**OBJECTIVE**

This course introduces students to fundamental principles and their applications to problems of machine tool design like kinematics, spindle etc.

**PRE REQUISITES**

Knowledge of Machine Design

- INTRODUCTION:** Introduction to Machine Tools Drives and Mechanisms; Working and Auxiliary motions in machine tools; Kinematics of different types of machine tools; general requirements of machine tool design.
- DESIGN OF ROTARY DRIVES:** Design of Machine tool Drives; AC Motors with Stepped Drive; DC and AC Variable Speed ; Drive Motors Characteristics and Selection.
- DESIGN OF SPEED & FEED DRIVES:** Design of speed box and feed box; Classification of speed and feed boxes.
- CONTROL ELEMENTS:** Single and Multi Axis CNC Controllers; Hydraulic Control; Pneumatic Control; Limit Switches; Proximity Switches; Sequencing Control using hard wired and PLC systems.

5. **DESIGN OF MACHINE TOOL STRUCTURES:** Functions and design criteria for machine tools structures; Static and Dynamic Stiffness; Ergonomics and Aesthetics in Machine Tool Design; Design of Spindle and Spindle Supports: Function of Spindles; Design requirements; Standard Spindle noses; Design Calculations of Spindles; Bearing Selection and Mounting.
6. **DESIGN OF GUIDEWAYS & POWER SCREWS;** Functions and types of guideways; design of guideways' design of power screws; ball screws.
7. **DESIGN OF SPECIAL PURPOSE MACHINES:** Modular Design Concepts; Standard Modules; Example of Design of a Typical SPM .

**TEXT BOOK**

Mehta, N. K., "Machine Tool Design", Tata McGraw Hill, 2<sup>nd</sup> Ed, 1999

**REFERENCE BOOKS**

1. Basu, S. K, and Pal, J. K., "Design of Machine Tools", Oxford IBM 1995 4<sup>th</sup> Edition.
2. Sen, G.C, and Bhattacharya, A., "Principles of Machine Tools", 2<sup>nd</sup> Edition, New Central Book Agency 1979
3. Koenigs, Berger, F., "Design Principal of Cutting Machine Tools", Pergman Press Oxford

|        |                        |       |    |
|--------|------------------------|-------|----|
| ME-431 | AUTOMOBILE ENGINEERING | L-T-P | Cr |
|        |                        | 5-0-0 | 3  |

**OBJECTIVE**

It imparts knowledge of construction, working and performance of various systems of an automobile such as structure, transmission, driveline, suspension, steering and braking. Student is also made aware of the pollution problems associated with automobiles.

**PRE REQUISITES**

Knowledge of Engineering Mechanics; Thermodynamics.

1. **INTRODUCTION TO AUTOMOBILES:** Classification; Components; and Requirements of Automobile Body; Vehicle Frame; Separate Body and Frame; Unitized Body; Car Body Styles; Bus Body and Commercial Vehicle Body Types; Front Engine Rear Drive and Front Engine Front Drive Vehicles; Four Wheel Drive Vehicles; Safety considerations; Safety features of latest vehicle; Future trends in automobiles.
2. **POWER TRANSMISSION:** Requirements of transmission system; General Arrangement of Power Transmission system Requirement of Clutches; Description of different types of clutches; Object of the Gear Box; Different types of Gear Boxes; Freewheel Unit; Overdrive unit-Principle of Overdrive; Advantage of Overdrive; Transaxle; Transfer cases; Introduction to continuously variable transmission.
3. **DRIVE LINES, UNIVERSAL JOINT, DIFFERENTIAL AND DRIVE AXLES:** Effect of driving thrust and torque reactions; Hotchkiss Drive; Torque Tube Drive and radius Rods; Propeller Shaft; Universal Joints; Slip Joint; Constant Velocity Universal Joints; Front Wheel

Drive; Principle; Function; Construction and Operation of Differential; Rear Axles; Types of load coming on Rear Axles; Full Floating; Three quarter Floating and Semi Floating Rear Axles.

4. **SUSPENSION SYSTEMS:** Need of Suspension System; Types of Suspension; factors Influencing ride comfort; Suspension Spring; Constructional details and characteristics of Leaf springs.
5. **STEERING SYSTEM :** Front Wheel geometry and Wheel alignment viz; Caster; Camber; Kingpin Inclination; Toe-in/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack and Pinion Power Steering Gear; Electronics steering.
6. **AUTOMOTIVE BRAKES; TIRES & WHEELS:** Classification of Brakes; Principle and Constructional details of Drum Brakes; Disc Brakes; Brake actuating systems; Mechanical; Hydraulic; Pneumatic Brakes; Factors affecting Brake performance; Power and Power Assisted Brakes; Tires of Wheels; Types of Tire and their constructional details; Wheel Balancing; Tire Rotation; Types of Tire wear and their causes.
7. **EMISSION CONTROL SYSTEM & AUTOMOTIVE ELECTRICAL :** Sources of Atmospheric Pollution from the automobile; Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation ( PVC ) Systems; Evaporative Emission Control; Heated Air Intake System; Exhaust Gas Recirculation ( ECR ) Systems; Air Injection System and Catalytic Converters; Purpose construction and operation of lead acid Battery; Capacity Rating and Maintenance of Batteries; Purpose and Operation of Charging Systems; Purpose and Operations of the Starting System; Vehicle Lighting System;

**TEXT BOOK**

Kirpal, Singh., "Automobile Engineering", Vol 1 and 2, Standard Publishers Distributors

**REFERENCE BOOKS**

1. "Automotive Mechanics – Crouse / Anglin", Tata McGraw Hill
2. H. M, Sethi., "Automotive Technology", Tata McGraw Hill
3. Srinivasan, S., "Automotive Mechanics", Tata McGraw Hill
4. Joseph, Heitner., "Automotive Mechanics", EWP
5. Anthony, E. Schwaller., "Motor Automotive Technology", Delmer Publishers, Inc

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2. [www.howstuffworks.com](http://www.howstuffworks.com)
3. [www.automotive-links.com](http://www.automotive-links.com)

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|--------|-----------|-------|----|
| ME-432 | METROLOGY | L T P | Cr |
|        |           | 5 0 0 | 3  |

**OBJECTIVE**

The course provides knowledge about all types of measurements, design of gauges and study of measuring instruments. The students will be able to

use and select different types of measuring instruments in industry after completion of this course.

|        |              |       |    |
|--------|--------------|-------|----|
| ME-433 | MECHATRONICS | L T P | Cr |
|        |              | 5 0 0 | 3  |

**PRE REQUISITES**

Knowledge of Manufacturing Practice

- 1 PRINCIPLE OF ENGINEERING METROLOGY:** Introduction: Definition of Metrology; economics of measurement; Abbe's principle of alignment; Measuring errors: Application of Least Square principles; general care of measuring instruments; general rules for accurate measurement.
- 2 LINEAR MEASUREMENT:** Need for linear measurement; Line and end measurement Datum and Reference surfaces; Surface plate; V-Block; straightness; combination square; vernier caliper ; Micrometer; Dial test indicator; slip gauges or gauge blocks.
- 3 ANGULAR MEASUREMENT:** Accuracy of instruments for angular measurements; measurement of angular dimensions; circular division; and angular measurement by divided head.
- 4 LIMITS FITS TOLERANCES & DESIGN OF LIMIT GAUGES:** Need for Limit systems:- Limit systems; limits and fits; inter changeability; fundamental deviations; Indian standards: IS 19919 Types of fits; Taylor's principle of gauge design; gauge tolerance limitations of gauging; care if gauges; material of gauges.
- 5 MEASUREMENT AND GAUGING OF SCREW THREADS AND GEARS:** Screw threads terminology; measuring elements; optical check; of thread angles and forms; screw thread errors; Taylor's principle applied to thread gauges; limit gauges for internal and external threads; Scope of gear measurements; gear terminology and standard proportions: helical gears; spur gear measurements; errors in gears.
- 6 SPECIAL MEASURING MACHINES:** The measuring machines; measuring systems; optical probe in metrology; simple mechanical measuring machines converting jig borer to inspection machine; automatic and multi dimension machines.
- 7 ACCEPTANCE TESTS FOR MACHINE TOOLS:** Instruments required for alignment tests; lathe tests; milling machine tests; radical tests; practical tests published standards and alignments tests on machine tools.

**TEXT BOOK**

Gupta, I. C., "Engineering Metrology", Dhanpat Rai Publications

**REFERENCE BOOKS**

- Jain, R.K., "Engineering Metrology", Khanna Publication
- Alan, S. Morris., "The Essence of Measurement", Prentice Hall of India
- Jayal, A. K., "Instrumentation and Mechanical measurement", Galgotia Publication

**OBJECTIVE**

The students will become familiar with the field of Mechatronics, the different foundations for its interdisciplinary nature. From sensors, actuators, controls, communication, programming, design, integration, testing, etc, to the tools available to aid in design, prototyping and implementation. The students will have hands-on experience with hybrid (analog/digital) circuits, interfacing to sensors, actuators, networks, etc as well as with Mechatronics design.

**PRE REQUISITES**

Knowledge of Measurement and Instrumentation; Automatic Controls

- 1 INTRODUCTION:** Definition Trends; Control Methods: Standalone; PC Based (Real Time Operating Systems; Graphical User Interface; Simulation) - Applications: SPM; Robot; CNC; FMS; CIM.
- 2 SIGNAL CONDITIONING:** Introduction – Hardware; Digital I/O; Analog input ; ADC; resolution speed channels; Filtering Noise using passive components; Resistors; capacitors; Amplifying signals using OP amps; Software ; Digital Signal Processing; Low pass ; high pass; notch filtering.
- 3 PRECISION MECHANICAL SYSTEMS :** Pneumatic Actuation Systems; Electro-pneumatic Actuation Systems ; Hydraulic Actuation Systems ; Electro-hydraulic Actuation Systems ; Timing Belts ; Ball Screw and Nut; Linear Motion Guides ; Linear Bearings ; Harmonic Transmission ; Bearings; Motor / Drive Selection.
- 4 ELECTRONIC INTERFACE SUBSYSTEMS TTL;** CMOS interfacing ; Sensor interfacing Actuator interfacing; solenoids ; motors Isolation schemes ; opto coupling; buffer IC's Protection schemes ; circuit breakers ;over current sensing ; resetable fuses ; thermal dissipation ; Power Supply; Bipolar transistors / mosfets.
- 5 ELECTROMECHANICAL DRIVES :** Relays and Solenoids ; Stepper Motors ;DC brushed motors ; DC brushless motors ; DC servo motors ; 4-quadrant servo drives ; PWM's - Pulse Width Modulation ; Variable Frequency Drives; Vector Drives ; Drive System load calculation.
- 6 MICROCONTROLLERS OVERVIEW :** 8051 Microcontroller; micro processor structure ; Digital Interfacing; Analog Interfacing ; Digital to Analog Converters; Analog to Digital Convertors; Applications; Programming; Assembly; C (LED Blinking; Voltage measurement using ADC).
- 7 PROGRAMMABLE LOGIC CONTROLLERS:** Basic Structure; Programming: Ladder diagram Timers; Internal Relays and Counters; Shift Registers; Master and Jump Controls; Data Handling; Analog input / output; PLC Selection; Application.

**TEXT BOOK**

Singh, M. D, /Joshi, J. G., "Mechatronics", Prentice Hall of India

**REFERENCE BOOKS**

- 1 Newton, C. Braga., "Mechatronics Source Book", Thomson Publications
- 2 W. Bolton., "Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering", Pearson Education Press, 3rd edition,2005.

|        |                                 |       |    |
|--------|---------------------------------|-------|----|
| ME-441 | GAS DYNAMICS AND JET PROPULSION | L T P | Cr |
|        |                                 | 5 0 0 | 3  |

**OBJECTIVE**

To understand the basic difference between incompressible and compressible flow. To study the phenomenon of shock waves and its effect on flow. To gain basic knowledge about jet propulsion and Rocket Propulsion.

**PRE REQUISITES**

Knowledge of Thermodynamics, Fluid Mechanics

1. **COMPRESSIBLE FLOW – FUNDAMENTALS** : Energy and momentum equations for compressible fluid flows; various regions of flows; reference velocities; stagnation state; velocity of sound; critical states; Mach number; critical Mach number; types of waves; Mach cone; Mach angle; effect of Mach number on compressibility
2. **FLOW THROUGH VARIABLE AREA DUCTS** : Isentropic flow through variable area ducts; T-s and h-s diagrams for nozzle and diffuser flows; area ratio as a function of Mach number; mass flow rate through nozzles and diffusers; effect of friction in flow through nozzles
3. **FLOW THROUGH CONSTANT AREA DUCTS** : Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation; variation of flow properties; variation of Mach number with duct length
4. **ISOTHERMAL FLOW WITH FRICTION IN CONSTANT AREA DUCTS**: Flow in constant area ducts with heat transfer (Rayleigh flow); Rayleigh line and Rayleigh flow equation; variation of flow properties; maximum heat transfer
5. **NORMAL SHOCK** : Governing equations; variation of flow parameters like static pressure; static temperature; density; stagnation pressure and entropy across the normal shock; Prandtl - Meyer equation; impossibility of shock in subsonic flows; flow in convergent and divergent nozzle with shock; normal shock in Fanno and Rayleigh flows; flow with oblique shock (elementary treatment only)
6. **PROPULSION** : Aircraft propulsion – types of jet engines – energy flow through jet engines; study of turbojet engine components – diffuser; compressor; combustion chamber; turbine and exhaust systems; performance of turbo jet engines – thrust; thrust power; propulsive and overall efficiencies; thrust augmentation in turbo jet engine; ram jet; pulse jet engines and turbo prop engines.
7. **ROCKET ENGINES**: Thrust equation – effective jet velocity specific impulse – rocket engine performance; solid and liquid propellants; nuclear rocket engines; Arc Plasma Rocket engine Magneto Plasma Rocket engine; Comparison of different propulsion systems.

**TEXT BOOK**

Yahya, S. M., "Fundamental of compressible flow", New Age International 1996.

**REFERENCE BOOKS**

- 1 Cohen, H. Rogers, Sravanamutoo R.E.C "Gas Turbine Theory", Addison Wesley Ltd; 1987
- 2 Ganesan "Gas Turbines", V Tata McGraw-Hill, 1999
- 3 Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, New Delhi, 2001

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

**OBJECTIVE**

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

- 1 **INTRODUCTION**: Definition of ergonomics and ergonomist; social and economic values of ergonomics; general and individual ergonomics.
- 2 **POSTURE AND MOVEMENT**: Biomechanical; physiological and anthropometric background; postures; sitting and standing; Movement – lifting; carrying; pulling and pushing; Workplace design and assessment.
- 3 **INFORMATION AND OPERATION**: User; information – visual; hearing and other senses; Control for operation – fixed and others diagues user friendliness; different forms and help; Website design; mobile interaction; virtual reality.
- 4 **ENVIRONMENTAL FACTORS**: Noise reduction; hearing conservation; Vibration prevention; illumination – light intensity; brightness differences; colour of light; Climate – heat and cold; Chemical substances – measures; ventilation.
- 5 **WORK ORGANISATION JOBS & TASKS**: Tasks; jobs; work organization – flexible; autonomous groups; coaching measurement styles.
- 6 **ERGONOMIC APPROACH**: Project management – initiative phase; problem identification phase; selection of solution phase; implementation phase; evaluation phase.
- 7 **CASE STUDIES**: A set of case studies will be used to demonstrate how ergonomics had lead to changes in work activity; safety and product design; Case studies will include advanced computer application; work place assessment; accidents; analysis and industrial inspection.

**TEXT BOOK**

Jan, Dul, Bernard, Weerdancester., "Ergonomics for Beginners", CRC Press Taylor and Francis Group Boca Raton London New York

**REFERENCE BOOKS**

- 1 Knoz, Stephana, Johnson, Steven, Halconts., "Work Design - Industrial Ergonomics", Hathway, Scottsdagta, AZ

- 2 Sanders, M.S. and McCormic, E. J., "Human Factors in Engineering and Design", McGraw Hill New York
- 3 A. P. Verma., "Industrial Engineering", S K Kataria and Sons

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

**OBJECTIVE**

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

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

Reddy, J. N., "An Introduction to Finite Element Method", McGraw Hill Intl Student Edition

**REFERENCE BOOKS**

- 1 Zienkiewitch., "The finite element method; Basic formulation and linear problems", Vol1, 4<sup>th</sup> Edition McGraw Hill
- 2 C. S. Desai, and J. F. Abel., "Introduction to the Finite Element Method", Affiliated East west Press, 1972
- 3 Rao, S.S., "The Finite Element Method in Engineering", Pergaman Press 1989

|        |                                      |       |    |
|--------|--------------------------------------|-------|----|
| ME-451 | REFRIGERATION & AIR CONDITIONING LAB | L T P | Cr |
|        |                                      | 0 0 2 | 1  |

**LIST OF EXPERIMENTS:**

1. To study the vapour compression Refrigeration System and determine its COP and draw p-h and T-s diagram.
2. To study the mechanical heat pump and find it's COP.
3. To study the cascade system and find it's COP.
4. To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressors.
5. To study the various controls used in Refrigerating and Air Conditioning systems.
6. To study the Ice- plant; it's working cycle and determines its COP and capacity.
7. To study the humidification; heating; cooling and dehumidification processes and plot these on Psychrometric chart.
8. To determine the By-pass factor of Heating and Cooling coils and plot these on Psychrometric chart on different inlet conditions.
9. To study a vapour absorption system and determine its COP.
10. To study a domestic refrigerator and determine its COP.

|        |                           |       |    |
|--------|---------------------------|-------|----|
| ME-452 | COMPUTER AIDED DESIGN LAB | L T P | Cr |
|        |                           | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

**Implementation of simple programmes for graphical representation:**

1. Implement programmes for the graphic representation of transformation and projections.
2. Implement programmes for the graphic representation of Conic sections.
3. Implement programmes for the graphic representation of cubic splines and B-splines.
4. Implement programmes for the graphic representation of surfaces – Bilinear and Bicubic.

- Implement programmes for the graphic representation of surface patch and Bezier surface.

**Modeling:**

- Construction of simple machine parts and components.
- Modeling of machine components.
- Modeling of Surfaces of diffuser section; propeller
- Modeling of Gear blank and other mechanical parts
- Modeling of Mechanical assembly of parts

|        |                |       |    |
|--------|----------------|-------|----|
| ME-453 | DEPARTMENT LAB | L T P | Cr |
|        |                | 0 0 2 | 1  |

**OBJECTIVE**

To provide an opportunity to the students to take up experiments/programs/exercises that would help strengthen their knowledge in the discipline in a broader sense.

**LIST OF EXPERIMENTS**

- To analyze the structural details of the vehicle including Repair, Alignment (Dismantle and Assemble)
- To analyze the various mechanisms of engine including Piston-Cylinder, Crankshaft, Injection System, Starter System etc. (Dismantle and Assemble)
- To analyze the Differential mechanism. (Dismantle and Assemble)
- To analyze the Suspension System and Brake Systems of a Vehicle. (Dismantle and Assemble)
- To analyze various control systems, Electrical, Mechanical etc. (Dismantle and Assemble)
- To make linear and angular measurement of a job by using appropriate measuring instruments and compare the accuracy of the dimensions.
- To measure the various elements of the external threads by using Thread gauge, Thread micrometer and profile projector.
- To measure the Run out, Pitch, Profile, Lead, Backlash, Tooth thickness and Concentricity of a Spur gear by using various gauges and instruments.
- To measure the taper of a job by taper gauge and sine bar.
- To test the accuracy of the center lathe spindle and concentricity of spindle with tail stock.
- Study of working of industrial robot for understanding manipulator mechanism design, programming, controls, etc
- Demonstration and applications of various sensors using PLCs.
- Demonstrations of hydraulic actuators and their interfacing for different applications
- Demonstration of pneumatic actuators and their interfacing for different applications
- Lab view data acquisition and its applications for controls.

|        |                           |       |    |
|--------|---------------------------|-------|----|
| ME-454 | MECHANICAL VIBRATIONS LAB | L T P | Cr |
|        |                           | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

- To verify the relation of a simple pendulum.
- To verify the relation of a compound pendulum.
- To determine the radius of gyration of a given compound pendulum.

- To determine the radius of gyration of a given bar by using bi-filer suspension.
- To study the torsional vibrations of single rotor system.
- To study the free vibration of two rotor system and to determine the natural frequency of vibration thematically and experimentally.
- To study the damped torsional oscillation and to determine the dampening coefficient.
- To verify Dunkerley's rule.
- To study the longitudinal vibrations of helical spring and to determine the frequency and time period of oscillation thematically and actually by experiment.
- To study the undamped free vibration of equivalent spring mass system.
- To study the forced damped vibration of equivalent spring mass system.
- To study the forced vibration of the beam for different damping
- To study analytically and experimentally the vibrations of a base stationed as flexible springs
- To study the absorber system and its turning for a fixed-fixed beam
- To study whirling phenomenon in a shaft

|        |                             |       |    |
|--------|-----------------------------|-------|----|
| ME-461 | RENEWABLE SOURCES OF ENERGY | L T P | Cr |
|        |                             | 5 0 0 | 3  |

**OBJECTIVE**

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

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

7 **OTHER NON-CONVENTIONAL ENERGY SOURCES:** Fluidized bed combustions; heat from waste and other sources.

**TEXT BOOK**

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

**REFERENCE BOOKS**

- 1 Rai, G. D., "Solar Energy Utilization",
- 2 Duffie, and Bakeman., "Solar Heating and Cooling",
- 3 Wakil, M. M. EL., "Power Plant Technology", McGraw Hill
- 4 Sharma, P. C., "Power Plant Engineering", S K Kataria and Sons

|               |                                |              |           |
|---------------|--------------------------------|--------------|-----------|
| <b>ME-462</b> | <b>MAINTENANCE ENGINEERING</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                | <b>5 0 0</b> | <b>3</b>  |

**OBJECTIVE**

The course provides knowledge on the maintenance policies and techniques as corrective maintenance, preventive maintenance, breakdown maintenance, predictive maintenance, condition based maintenance and reliability maintenance so that the student is able to manage independently a Maintenance Deptt. in the industry.

1. **INTRODUCTION:** Evolution of maintenance; objective of maintenance; maintenance policies and philosophies; maintenance concept; maintenance management and terotechnology; relationship with other functional areas; importance of maintenance; elements of good maintenance; economics of maintenance; training and safety aspects in maintenance.
2. **MAINTENANCE STRATEGIES:** Classification of maintenance programs; corrective preventive and predictive maintenance; comparison of maintenance programs; preventive maintenance – concept functions; benefits; limitations
3. **CONDITION BASED MAINTENANCE:** Objectives; what to monitor; when to monitor; principles of CBM; condition based maintenance techniques; manual inspections; performance monitoring; vibration monitoring; current monitoring; oildebris / spectroscopy; thermography and corrosion monitoring; steps in implementation of CBM; benefits of CBM.
4. **RELIABILITY CENTRED MAINTENANCE (RCM):** RCM logic; maintenance and RCM; benefits of RCM; Total Productive Maintenance (TPM); introduction; key supporting elements of TPM; methodology; evaluation and benefits.
5. **MAINTENANCE PLANNING AND CONTROL:** Basic ingredients; basic steps in maintenance management; maintenance planning and control system; documentation; maintenance productivity areas for improvement.
6. **RELIABILITY AND MAINTENANCE:** Reliability techniques for improvement of operational reliability; safety and availability of machines and production systems; maintainability criteria; checklist to assess the maintainability of a system; maintainability programs; objectives; key issues in

availability improvement program; fault diagnosis; pareto principle Ishikawa diagram.

7. **APPLICATION OF COMPUTERS TO MAINTENANCE MANAGEMENT:** Data processing systems for integrated maintenance; maintenance information and reporting systems.

**TEXT BOOK**

Higgin, L. R., "Maintenance Engineering Hand Book", McGraw Hill

**REFERENCE BOOKS**

1. Kelley, Anthony., "Maintenance Planning and Control", East-West Press
2. Blanchard, B. S. Lowey, EE., "Maintainability Principle and Practices", McGraw Hill
3. Niebel, Benjamin W, Marcel Dekher., "Engineering maintenance management",
4. M, Mahajan., "Ind Engg Production Mgt"
5. Jain, K. C. and Aggarwal, L. N., "PPC and Ind Mgmt"
6. Sushil, Kr, Srivastava., "Industrial Maintenance Management",
7. Charles, Eheling., "Reliability and Maintainability Engg"

|               |                              |              |           |
|---------------|------------------------------|--------------|-----------|
| <b>ME-463</b> | <b>TOTAL QUALITY CONTROL</b> | <b>L T P</b> | <b>Cr</b> |
|               |                              | <b>5 0 0</b> | <b>3</b>  |

**OBJECTIVE**

The course provides basic techniques of total quality control as control chart, product tools and standard sampling plans. After going through the course, the student will be able to use statistical techniques for controlling the quality of a product in industry.

1. **INTRODUCTION:** objectives; quality of design; quality of production; quality of conformance to design; quality of inspection; process monitoring; quality and productivity; quality cost; Advantages of Statistical Quality Control in Industry and Quality Circles.
2. **FUNDAMENTALS OF STATISTICS AND PROBABILITY IN QUALITY CONTROL:** Events and probability; laws of probability; Statistical Distributions: Normal; Binomial and Poisson distribution; their importance in SQC; Poisson Probability as approximation to Normal Probability; use of Normal and Poisson distribution tables.
3. **CONTROL CHARTS FOR VARIABLES:** Fundamentals of process control; tools of process control; quality characteristic; Design and use of Control Charts for Variables: Trial control limits; control limits for future use; revision of control limits; Cause and effect diagram; inference on the state of the process from control charts; Type I and Type II errors and methods to reduce them; Use of X (X bar) charts and R-Charts; X (X bar) and  $\sigma$ -charts; Efficiency of a control chart; OC curve of a control chart; Computing average run length for X-bar chart.
4. **TREND CONTROL CHARTS, CONTROL CHARTS WITH REJECT LIMITS AND MODIFIED CONTROL CHARTS:** Relationship between Specification Limits and Control Chart Limits;

- Process Capability analysis and its importance in quality of conformance.
- CONTROL CHARTS FOR ATTRIBUTES:** Defects and Defectives; control charts for fraction defectives and per cent fraction defectives and number of defectives; Control charts for number of defects; Comparison of control charts for variables with the charts for attributes; Computing Average run length for a p-chart.
  - PRODUCT CONTROL AND ITS TOOLS:** Fundamentals of lot-by-lot acceptance sampling by attributes; Notations; OC curve and its importance in acceptance sampling; AQL and LTPD for a sampling plan; Producer and consumer risks; Single and Double sampling plans and constructing OC curves; interpretation of the operating characteristics curve; Effect of change of sample size and acceptance number on OC Curve; ATI; ASN; AOQ and AOQL concepts; economics of inspection; Item by item sequential sampling plans; OC curve and ASN curve for sequential sampling plan.
  - STANDARD SAMPLING PLANS:** Types of Standard sampling plans; Difference between Acceptance-Rectification and Acceptance-Rejection Plans; single and double sampling plans based on AOQL and LTPD; Sampling plans based on Mil-Standards 105E

**TEXT BOOK**

Hansen, B.L. Ghare., "Quality Control Application", Prentice Hall of India

**REFERENCE BOOKS**

- Grant, EL, and Levenworth, R.S., "Statistical Quality Control", Tata McGraw Hill
- Paranthaman, D., "Quality Control", Tata McGraw Hill, India
- Juan JM and Gryna FM, "Quality Planning and Analysis" Tata McGraw Hill
- Feigenbaum AV "Total Quality Control" McGraw Hill International
- Montgomery. D C John "Statistical Quality Control" Wiley and Sons (Asia)

|        |                          |        |    |
|--------|--------------------------|--------|----|
| ME-481 | MAJOR PROJECT<br>PHASE-I | L-T-P  | Cr |
|        |                          | 0-0-10 | 5  |

**OBJECTIVE**

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

**OPERATION**

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

|        |                           |       |    |
|--------|---------------------------|-------|----|
| ME-482 | MAJOR PROJECT<br>PHASE-II | L T P | Cr |
|        |                           | 0 0 6 | 3  |

Refer to ME-481 for details.

|        |                |       |    |
|--------|----------------|-------|----|
| ME-483 | INTERNSHIP - I | L T P | Cr |
|        |                | 0 0 2 | 1  |

**OBJECTIVE**

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

**OPERATION**

The Internship course has two components, namely Internship-I of 6-8 weeks duration (Summer-term following 9<sup>th</sup> Term) and Internship-II of 13-14 weeks duration (11<sup>th</sup> Term). After the Internship-II, in 12<sup>th</sup> 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.

|        |                 |        |    |
|--------|-----------------|--------|----|
| ME-484 | INTERNSHIP - II | L T P  | Cr |
|        |                 | 0 0 24 | 12 |

Refer to ME-483 for details

|        |                             |       |    |
|--------|-----------------------------|-------|----|
| ME-485 | INTERNSHIP<br>DOCUMENTATION | L T P | Cr |
|        |                             | 0 0 6 | 3  |

**OBJECTIVE**

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

|        |                                       |       |    |
|--------|---------------------------------------|-------|----|
| ME-491 | COMMUNITY SERVICE<br>ORIENTED PROJECT | L T P | Cr |
|        |                                       | 0 0 2 | 1  |

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.

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

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

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

#### OBJECTIVE

To carryout 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.

|        |            |       |    |
|--------|------------|-------|----|
| ME-494 | SEMINAR –I | L T P | Cr |
|        |            | 0 0 2 | 1  |

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

|        |            |       |    |
|--------|------------|-------|----|
| ME-495 | SEMINAR-II | L T P | Cr |
|        |            | 0 0 2 | 1  |

Refer to ME-494 for details

|        |         |       |    |
|--------|---------|-------|----|
| PH-101 | PHYSICS | L T P | Cr |
|        |         | 5 1 0 | 4  |

#### OBJECTIVE

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

- INTERFERENCE:** Interference by division of wave front; Fresnel's 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.
- DIFFRACTION:** Difference between Interference and diffraction; difference between Fraunhofer and Fresnel diffraction; Fraunhofer diffraction through single slit; variation of intensity (analytical); plane transmission diffraction grating; absent spectra; maximum order spectra; dispersive and resolving power of grating.
- POLARIZATION:** Polarised and unpolarized light; double refraction; Nicol prism; quarter and half wave plates; optical activity; Dextro and Leavo rotatory; specific rotation; biquartz and Laurent's half-shade polarimeters.
- LASER AND FIBRE OPTICS:** Spontaneous and stimulated emissions; laser action (pumping and population inversion); characteristics of laser beam-concepts of coherence; solid state (Ruby) laser; gas (He-Ne) laser; applications; basic principles; fiber construction; propagation of light in fibers; numerical aperture; single mode and multi mode fibers; applications of optical fibers.
- SPECIAL THEORY OF RELATIVITY:** Inertial frames of reference; Galilean transformations; non-inertial frames of reference; Michelson-Morley experiment; postulates of special theory of relativity; Lorentz's transformations; length contraction; time dilation; variation of mass with velocity; mass energy equivalence.
- ELECTRO MAGNETIC THEORY and ELECTROSTATICS :** Review of basic concepts of electrodynamics; Maxwell's modification of Ampere's law, equation of continuity; Maxwell's equations and its simple plane wave solution in free space; Poynting's theorem; dielectric polarization; electric displacement; susceptibility and permittivity and various relations between these; Gauss law in dielectrics; electrostatic energy stored in dielectrics; behaviour of dielectrics in A.C. field: simple concepts; dielectric losses.
- ULTRASONICS:** Production of ultrasonics by magnetostriction and piezoelectric oscillator methods; detection of ultrasonics by Kundt's tube and acoustic grating method.

#### TEXT BOOK

Avadhunulu and Kshirsagar, "A Text Book of Engineering Physics", S. Chand & Co.

#### REFERENCE BOOKS

- Sears, F.W., "Electricity and Magnetism", Narosa
- Arthur Beiser, "Perspectives of Modern Physics", Tata McGraw Hill

- Vasudeva, A.S., "Modern Engineering Physics", S. Chand & Co.
- Resnick and Halliday, "Physics Vol. I-II", Wiley Eastern
- Brij Lal and Subramanyam, "A Text Book of Optics" S. Chand & Co.
- Brij Lal and Subramanyam, "A Text Book of Sound" S. Chand & Co.
- Wehr, Richards and Adair, "Physics of the Atom", Narosa

|        |                 |       |    |
|--------|-----------------|-------|----|
| PH-102 | APPLIED PHYSICS | L T P | Cr |
|        |                 | 5 1 0 | 4  |

**OBJECTIVE**

To educate the students with the present day physical sciences through concepts like nanotechnology, quantum physics, thermal physics, super conductivity, etc.

- 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.
- QUANTUM PHYSICS:** Failure of classical concepts; black body radiation; Planck's radiation law; wave packets; group velocity and phase velocity; Schrödinger wave equations: time dependant and time independent equations; significance of wave function; wave function for a particle in a box.
- 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  $\left( = \frac{3}{5} E_F \right)$  of free electrons (3D); Fermi-Dirac distribution function; thermionic emission; Richardson's equation.
- 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.
- THERMAL PHYSICS:** Gas law; iso-thermal and isentropic process; Rankin cycle; Carnet cycle; principal of equipartition of energy; specific heat of monoatomic gases; Maxwell's velocity distribution; mean velocity; RMS velocity; most probable speed; Joule Thomson's expansion; liquification of He I and He II Stefan Boltzmann's law; Newton's law of cooling.
- MAGNETIC PROPERTIES OF SOLIDS:** Atomic magnetic moments; orbital diamagnetism; classical Langevin's theory of dia-magnetism and para-magnetism; ferro-magnetic domains; antiferromagnetism; ferrimagnetism (simple ideas).

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

**TEXT BOOK**

Avadhunulu and Kshirsagar, "A Text Book of Engineering Physics", S. Chand & Co.

**REFERENCE BOOKS**

- Kittel, Charles "Introduction to Solid State Physics", John Wiley Powell and Crasemann, "Quantum Mechanics", Oxford and IBH
- Aggarwal, R.S., "Thermal Physics and Statistical Physics", MTG Books.
- Saxena, B.S., and Gupta, R.C., "Fundamentals of Solid State Physics", Pragati Prakashan.
- Pillai, "Solid State Physics", New Age
- Ghatak and Loknathan, "Quantum Mechanics", McMillan
- Beiser, Arthur, "Modern Physics", Tata McGraw Hill.

|        |             |       |    |
|--------|-------------|-------|----|
| PH-151 | PHYSICS LAB | L T P | Cr |
|        |             | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

The experiments in 1<sup>st</sup> term will be based mainly upon optics, electrostatics, wave and oscillations which are the parts of the theory syllabus of 1st term.

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

**REFERENCE BOOKS**

- Worshnop, B. L. and Flint, H. T. "Advanced Practical Physics", KPH
- Gupta, S. L. & Kumar, V. "Practical Physics", Pragati Prakashan

3. Chauhan & Singh, "Advanced Practical Physics Vol. I & II", Pragati Prakashan.

|        |                     |       |    |
|--------|---------------------|-------|----|
| PH-152 | APPLIED PHYSICS LAB | L T P | Cr |
|        |                     | 0 0 2 | 1  |

**LIST OF EXPERIMENTS**

1. To find the low resistance by Carey – Foster's bridge.
2. To find the resistance of a galvanometer by Thomson's constant deflection method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionization potential of Argon/Mercury using a thyratron tube .

8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photo electric cell.
11. To find the value of co-efficient of self-inductance by using a Raleigh bridge.
12. To find the value of Hall co-efficient of semi-conductor.
13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.

**REFERENCE BOOKS**

1. Worshnop, B.L. and Flint, H.T. "Advanced Practical Physics", KPH
2. Gupta, S.L. and Kumar, V. "Practical Physics", Pragati Prakashan.
3. Chauhan and Singh, "Advanced Practical Physics Vol. I & II", Pragati Prakashan.

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## 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.

|               |  |              |           |
|---------------|--|--------------|-----------|
| <b>EN-291</b> | <b>ESSENTIALS OF COMMUNICATION OBJECTIVE (BRIDGE COURSE)</b> | <b>L T P</b> | <b>Cr</b> |
|               |  | <b>5 0 0</b> | <b>3</b>  |

### 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

1. Wood F. T., "Remedial English Grammar for Foreign Students", The Macmillan Press Ltd., 1975
2. Tikku M. C., "An Intermediate Grammar Book"
3. "English for Engineers and Technologists: A Skill Approach", Vol. 2, Orient Longman
4. Ramesh M. S. and Pattanshetti C. C., "Business Communication", R.Chand and Company, Delhi
5. "Group Discussion", Sudha Publications/Ramesh Publishing House, New Delhi.

|               |                                    |              |           |
|---------------|------------------------------------|--------------|-----------|
| <b>MA-191</b> | <b>MATHEMATICS (MAKEUP COURSE)</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                    | <b>5 0 0</b> | <b>3</b>  |

### OBJECTIVE

Mathematics is a very essential part of all engineering courses. The students entering in the first year who are some how weak in concepts of Mathematics need up gradation in their level of Mathematics. This course is designed keeping in view such students.

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

### TEXT BOOK

NCERT, "Mathematics for XI and XII", NCERT, New Delhi

### REFERENCE BOOKS

1. Sharma R. D., "Text Book of Mathematics for Class XI", 10th Edition, Dhanpat Rai & Sons
2. Sharma R. D., "Text Book of Mathematics for Class XII", 10th Edition, Dhanpat Rai & Sons
3. Grewal B. S., "Higher Engineering Mathematics", 38th Edition, Khanna Publisher, 2005

|               |                                    |              |           |
|---------------|------------------------------------|--------------|-----------|
| <b>MA-291</b> | <b>MATHEMATICS (BRIDGE COURSE)</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                    | <b>5 0 0</b> | <b>3</b>  |

### 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**

Grewal B. S., "Higher Engineering Mathematics", 38th Edition, Khanna Publisher, 2005

**REFERENCE BOOKS**

1. Kreyszig F., "Advanced Engineering Mathematics", 9th Edition, John Wiley, 2006
2. Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House
3. Greenberg Michael D., "Advanced Engineering Mathematics", 2nd Edition, Dorling Kindersley India Pvt. Ltd., New Delhi

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## PROFESSIONAL DEVELOPMENT COURSES

### 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 | L | T | P | Cr |
|        |                                 | 0 | 0 | 2 | 1  |

### OBJECTIVE

To understand fundamentals of computer applications, networking and building projects.

1. **MS-WORD:** Introduction to MS-Word: Menus, toolbars, ruler, scroll bars, creating, saving, importing, exporting and inserting files, formation, indents/out dents, lists, tabs, styles, working with frames, columns, pictures, chart/graphs, forms, tools, equations and macros.
2. **MS-EXCEL:** Worksheet overview: rows, columns, cell, menus, creating worksheets; opening and saving worksheet; formatting, printing, charts, window, establishing worksheet links, macros, database, tables, using files with other programs.
3. **MS-POWERPOINT:** Overview of MS-PowerPoint, creating slides and presentations, rehearsing presentation, insert, tools, format, slide-show, Window options.
4. **MS-PROJECT:** Starting a Project, Starting Microsoft Project 2000, planning a project, defining the project scope, outlining and task relationships, outlining the project, developing the schedule, changing task relationships and constraints, adding and assigning resources, developing the project calendar, assigning project resources, determining project costs, adjusting project resources and timelines, analyzing the project, using different views and reports, displaying project data, organizing project information, sorting and filtering project data, creating custom filters.
5. **NETWORKING:** Basics of networking, study of topology: LAN, WAN, MAN, Connecting devices: passive hub, repeater, active hub, bridges, two layer switches, routers, three layer switches, gateway, network attack and defense: most common attacks.
6. **TROUBLESHOOTING:** Ping command, TRACERT or TRACEOUT, IP configuration, NETSTAT, NET, recovery commands DISKPART etc., setting up local security policies, installation of servers.
7. **FUNDAMENTALS OF CYBER LAW:** Overview of computer and web technology, access control: operating system access controls, group and roles, access control lists, Unix operating system security, Windows NT, capabilities, added features in Windows 2000, granularity, sandboxing and

proof-carrying code, hardware protection, other technical attacks.

### REFERENCE BOOKS:

1. Habraken, "MS-Office 2000 8 in 1", Prentice Hall
2. Taxali R. K., "PC Software for Windows Made Simple", Tata McGraw
3. Sandler, "Teach Yourself MS Office", BPB Publications
4. Bangia R., "Learning MS Office 2000", Khanna Book Co
5. Wang W. and Parker R. C., "MS Office 2000 Windows for Dummies", IDG Books India (P ) Ltd
6. Peter Dyson, "Undertaking PC Tools", Sybex / Tech Asian Edition Tech Publications.
7. Bansal S. K., "Cyber Crime"
8. Ahmand Tabrez, "Cyber law , E-commerce & M-Commerce"
9. Carl Chatfield and Timothy Johnson, "Microsoft Office Project 2007 Step by Step"

|        |                          |   |   |   |    |
|--------|--------------------------|---|---|---|----|
| PD-191 | CO-CURRICULAR ACTIVITIES | L | T | P | Cr |
|        |                          |   |   |   | 1  |

### 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 | L | T | P | Cr |
|        |                    | 0 | 0 | 2 | 1  |

### 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**

1. Muriel, James and Jongeward, Dorothy, "Born to Win", Signet Publishers, 1978
2. Harris, Thomas Anthony, "I'm OK, You're OK", Galahad Books, 2004
3. Dr. Alex, K., "Soft Skills", 2009, S. Chand, 2009
4. Adams Scott, "Positive Attitude", Andrews Mcbeel Publishing, 2004
5. Newton Tim, "Managing Stress – Emotion and Power at Work", Sage Publications Ltd., 1995
6. Koch Richard, "The 80/20 Principle :The Secret to Success by Achieving with Less", Broadway Business, 1999
7. Covey Stephen R., "The 7 Habits of Highly Effective People", Simon & Schuster UK, 2004

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

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

**OBJECTIVE**

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

1. **GOAL SETTING:** Types of goals; setting smart goals; personal goal setting; business goal setting; goal setting techniques.
2. **ENTREPRENEURIAL SKILLS:** Meaning; entrepreneurial competencies; advantages; risks involved, avenues and opportunities; support from Govt.; basic and significant personality traits; venture project planning and entrepreneurship cycles; planning the project; entrepreneurship in daily life; case studies in entrepreneurship; exercises.
3. **CORPORATE DRESSING:** The corporate fit; corporate culture; dress codes; dressing for interviews; clothing do's and don'ts.
4. **CORPORATE GROOMING:** Making a good impression at work; grooming check list; accessories, do's and don'ts for men and women; hygiene and skin care; hands and feet; make up and hair accessories.

5. **ETIQUETTE & MANNERS:** Social etiquette; dining etiquette; party and wedding etiquette; sensitivity towards diverse cultures; respecting religions and traditions.
6. **BUSINESS ETIQUETTE:** Dealing with people at work place (peers, subordinates and superiors); international business; etiquette at meetings and conferences.
7. **COMMUNICATION MEDIA ETIQUETTE:** Telephone etiquette; email etiquette; media etiquette.

**REFERENCE BOOKS**

1. Miner, B. John, "The 4 Routes to Entrepreneurial Success", Berrett-Koehler, 1996
2. Ellis, Keith, "The Magic Lamp", Three Rivers Press, 1998
3. Blair, Gary Ryan, "The Ten Commandments of Goal Setting", Goalsguy Learning Skills Inc., 2005
4. Gupta, Seema, "Correct Manners and Etiquette", Pustak Mahal, 1992
5. Soundararaj, Francis, "Speaking and Writing for Effective Business Communication", MacMillan, 1995

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

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

**OBJECTIVE**

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

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

**TEXT BOOK**

Gilat Amos, "MATLAB: An Introduction with Applications", John Wiley & Sons, Inc (Wiley Student Edition), 2008

**REFERENCE BOOK**

Herniter, E. Marc, "Programming in MATLAB", Brooks/Cole, Thomson Learning

|        |                             |     |    |
|--------|-----------------------------|-----|----|
| PD-291 | CO-CURRICULAR<br>ACTIVITIES | LTP | Cr |
|        |                             |     | 1  |

Refer to PD-191 for details.

|        |                            |       |    |
|--------|----------------------------|-------|----|
| PD-292 | EFFECTIVE<br>COMMUNICATION | LTP   | Cr |
|        |                            | 0 0 2 | 1  |

**OBJECTIVE**

To acquaint the students with the basics of effective spoken and written English and enhance their reading, listening, and communication skills.

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

**REFERENCE BOOKS**

- Wren and Martin, "High School Grammar", Paperback, 2000
- Condrell Jo, & Bough, Bennie, "101 Ways to Improve Your Communication Skills Instantly", 4th Edition, Paperback, 2005
- Rai S. M., Rai Urmila, "Communication Skills", Students Edition, Himalaya, 2007.
- Connor J. D. O, "Better English Pronunciation" Cambridge. 2nd Edition, Paperback, Cambridge University Press, 2008
- Raina Arjun, "Speak Easy Voice And Accent Training Manual", Paperback (Special India Edition, Full Circle
- Guffey Mary Ellen, "Business Communication" 3rd Edition, South – Western College Publishing, 2000

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

|        |                                  |       |    |
|--------|----------------------------------|-------|----|
| PD-293 | INTRA & INTER-PERSONAL<br>SKILLS | LTP   | Cr |
|        |                                  | 0 0 2 | 1  |

**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.

- SELF AWARENESS:** Development of our self image; social comparison; significant others; self esteem; self confidence.
- ASSERTIVENESS & CONFIDENCE:** Assertiveness; being confident; strategies to make assertive NO easier; dealing with emotions; difference between being aggressive and being assertive.
- 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.
- LEADERSHIP SKILLS:** Leadership skills and styles; motivating people; understanding abilities; delegating tasks; managing people; overcoming hurdles; exercises.
- 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).
- 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.
- THE ART OF CONVERSATION:** Skills to strike a conversation; sustaining conversation; communicating across cultures; conflict management.

**REFERENCE BOOKS**

- Haddon, F. Peter, "Mastering Personal and Interpersonal Skills", Viva Books Pvt. Ltd., 2003
- Schuller, Robert H., "Tough Times Never Last But Tough People Do", Orient Paperbooks, 1988
- Bolton, Robert, "People Skills", Touchstone Books, 1986
- Jansaz, De Suzanne, "Interpersonal Skills in Organizations", 3<sup>rd</sup> Edition, McGraw Hill Education (Asia), 2009
- Fontana, David, "Social Skills at Work", Universities Press, 2000
- Burns, James Mac Gregor, "Leadership", Harper Perennial, 1982
- Harris, Godfrey, "Art of Conversation", Jaico Publishing House, 2002
- Ganguly, Anand, "Group Discussions and Interviews", Ramesh Publishing House, 2008

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

|        |   |       |    |
|--------|---|-------|----|
| PD-358 | MECHANICAL ENGINEERING<br>APTITUDE COURSE | L T P | CR |
|        |   | 0 0 2 | 1  |

**OBJECTIVE:**

To develop overall professional concepts and orientation to state-of-the art technologies available in the whole world. The idea here is to use the knowledge acquired for providing solution to industrial problems.

- 1 Total quality control in production using inspection tools, verification of theoretical concepts based on data sampling, statistical quality control etc.
- 2 Non destructive testing of structures, containers, welded and fabricated components using ultrasonic, microwave, laser devices through video demonstration
- 3 Maintenance practices, preventive maintenance measures, strategies, vibration and noise signature technique to identify machine maintenance, desirable scheduling and planning through video demonstration/modeling
- 4 Bio fuels; use and status in India; Experimental Demonstration of preparing Jatropha oil and its blends; use in engines.
- 5 Use of solar energy, wind energy etc. through models and video demonstration.
- 6 Exposure to gas turbine, jet propulsion, rocket firing, operations/functions and experimentation through video demonstration
- 7 Working, trouble shooting etc. of a thermal power plant / petroleum process plant through actual visits.

**REFERENCES BOOKS**

1. Hansen BL, Ghane, "Quality Control Application" Prentice Hall of India
2. Higgin LR, "Maintenance Engineering Hand Book" McGraw Hill Book Company
3. Tiwari GN, Goshal MK "Renewable Energy Resources" Narora Publishing House, New Delhi
4. Cohen H Rogers, Sravanamutoo REC "Gas Turbine Theory" Addison Wesley Ltd., 1987
5. Sharma PC, "Power Plant Technology" S K Kataria and Sons

|        |                             |       |    |
|--------|-----------------------------|-------|----|
| PD-391 | CO-CURRICULAR<br>ACTIVITIES | L T P | Cr |
|        |                             |       | 1  |

Refer to PD-191 for details.

|        |                        |       |    |
|--------|------------------------|-------|----|
| PD-392 | PROBLEM SOLVING SKILLS | L T P | Cr |
|        |                        | 0 0 2 | 1  |

**OBJECTIVE**

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

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

**REFERENCE BOOKS**

1. Aggarwal R. S., "Verbal & Non-Verbal Reasoning", 2008, S. Chand, 1994
2. Aggarwal R. S., "Quantitative Aptitude for Competitive Examinations", S. Chand, 2008
3. Gulati, SL, "Quantitative Ability", Bookhive India, 2006
4. "GRE Barron's", 13<sup>th</sup> Edition, Barron's Educational Series, 2009
5. Devi Shakuntla, "Book of Numbers", 1984
6. Summers George J., "The Great Book of Puzzles & Teasers", Jaico Publishing House, 1989

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|--------|--------------------------------------|-------|----|
| PD-393 | ADVANCED PROFESSIONAL<br>DEVELOPMENT | L T P | Cr |
|        |                                      | 0 0 2 | 1  |

**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.
- HUMAN VALUES:** Ethics at work place; human values; morals & ethics; professional ethics; case studies.

**REFERENCE BOOKS**

- Anthony M.J, "Law for the Layman", Hind Pocket Books, 2003
- Mathur Reeta, "Recent Trends in Indian Economy", 3 Vol set, Sublime Publication, 2003
- Eisen J. Peter, "Accounting - The Easy Way", Barron's Educational Series, 2003
- Kiyosaki Robert, and Lechter Sharon, "Rich Dad, Poor Dad", Warner Books, 2001
- Lakhotia R. N, "Income Tax Guide for the Taxpayer", Vision Books, 2009

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

|        |  |       |    |
|--------|--|-------|----|
| PD-458 | COMPUTER APPLICATION IN MECHANICAL ENGINEERING | L T P | CR |
|        |  | 0 0 2 | 1  |

**OBJECTIVE:**

To equip the final year students with latest computer tools in order to facilitate and compete in the open market.

- Geometric Modeling / Surface Modeling / Solid Modeling / Geometric Transformations Perform / Practical Exercises
- Graphics design, Two dimensional drawing generation attempting practical exercises
- Construction of simple machine parts, machine components, assembly of components exercises
- Innovative Design practices, exercises
- Project line model optimization problems / exercises
- Industrial optimization project solutions
- Development of expert system for manufacturing processes, solutions

**REFERENCES BOOKS:**

- Hearn & Baker., "Computer Graphics". Tata McGraw Hill Publisher (India)
- Mikel. P. Grover., and Emory, W. Wizzers., "CAD/CAM", Prentice Hall of India, Delhi
- Rao, P. N., "CAD/CAM", Tata McGraw Hill, Delhi
- Taha, H. A. "Optimisation Research", Prentice Hall of India, Sixth / Seventh Edition, New Delhi
- Rao, S. S., "Engineering Optimisation Theory & Practice", New Age International, 3<sup>rd</sup> Edition

|        |                          |       |    |
|--------|--------------------------|-------|----|
| PD-491 | CO-CURRICULAR ACTIVITIES | L T P | Cr |
|        |                          |       | 1  |

Refer to PD-191 for details.

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## OPEN ELECTIVE COURSES

### OBJECTIVE

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

### METHODOLOGY

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

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|        |                      |       |    |
|--------|----------------------|-------|----|
| AE-411 | TRANSPORT MANAGEMENT | L T P | Cr |
|        |                      | 5 0 0 | 3  |

### OBJECTIVE

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

- 1. INTRODUCTION:** Necessity for making acts and rules on motor vehicles; Procedure for enactment and implementation of these acts by central and state Govts; Formats of the acts; rules and titles; Definitions – articulated vehicle; axle weight; certificate of registration; driver; conductor; licence; contract carriage; stage carriage; dealer; educational institution bus; goods; goods carriage; gross vehicle weight; heavy goods vehicle; invalid carriage; learners licence; HMV; LMV; motor cabs etc.
- 2. DRIVING LICENCE:** Necessity; age limit to obtain D.L. learners D.L permanent D.L grant; restrictions; renewal; endorsement; disqualification; suspension; fees; documents; educational qualifications required for driving trucks; buses; oil tankers; missile carriers; driving on hills; Driving schools:requirements; Effectiveness of different DLs; Maintenance of state registers of D;L. conductors licence – necessity; grant; age limit; disqualifications; revocation; disqualification; uniforms.
- 3. VEHICLE REGISTRATION:** Necessity; area of registration; time given for registration; format and documents to be attached and fees; period of registration; renewal; suspension; Temporary and permanent registration; vehicle fitness; refusal; NOC; registration for embassy vehicles; production of vehicle at the time of registration; Migration of vehicle from one state to other; Hire purchase; lease or hypothecation; transfer of registration on sale; removal of hypothecation clause; Transfer of ownership; Change of residence or place of business; death of owner; sale or purchase; Alteration in motor vehicle; age limit of vehicles; attachment of trailers; Maintenance of state registers of motor vehicles;
- 4. PERMITS:** Necessity; route allotments; state Govts; powers; provisions for application of permits; Procedure of R;T;A to grant permits; limits of issuance of permits and rules; documents to be attached; preferences while issuing permits; Types of permits – Private service; all India goods carriage; temporary; national; composite etc; Renewal; duration; cancellation; suspension of

permits and transfer of permits; Rules for replacement of vehicles; colour schemes; general conditions attached; Validation of permits for use in outside region; Issue of permits to state transport undertakings : restrictions

- 5. CONSTRUCTION; EQUIPMENT; MAINTENANCE AND TRAFFIC REGULATION:** General provisions; Central Govt; rules and provisions regarding construction; maintenance of vehicle; emissions and safety provisions; Control of traffic: limits of speed; weight; length and height; power to restrict and erect traffic signs; design of traffic signs and its colour scheme; Signals; driving test; Driving regulations; signaling devices; Definitions– Pass; ticket; removal of vehicle obstructing traffic; Safety measures for drivers and pillion riders; Precautions at unguarded railway crossings; Schemes for investigation of accidents and wayside amenities; Traffic navigation; global positioning system.
- 6. LOGISTICS:** Definition of fleet; types of fleet-luxury cars; buses; trucks; cash vans; fire-fighting vehicles etc; Management; supervisory; training and staffing; Driver; conductor and Mechanics hiring; duties; Vehicle operations-productivity and control; Fleet maintenance programs; tyre maintenance; productivity and control; Budget activity; Fleet management and data processing; Procurement and disposal; labour relations; energy management; Loss prevention management; control and predicting costs; Fitness of vehicles; Stores; definition; management; storing methods; inventory control; Duties and responsibilities of store manager; purchase manager; Storing methods; Bin card; requisition card; Inventory control procedures; Vendor development; Stores-layout; spare parts flow chart; Store documentation; store organization.
- 7. MOTOR INSURANCE:** Types; scope; limitations; liability of insurance Cos; insurance documents-claim form; estimate and bills; Necessity for insurance against third party risk; Requirements and limits of liability of insurance 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

1. Patankar P. G., "Road Passenger Transport in India"; CIRT Pune, March 2007.

2. Srivastav S. K., "Economics of Transport", S Chand & Co., 1981.

4. Dale Yoder, "Personnel Management & Industrial Relations", Tata McGraw Hill

|        |                           |       |    |
|--------|---------------------------|-------|----|
| BA-271 | HUMAN RESOURCE MANAGEMENT | L T P | Cr |
|        |                           | 5 0 0 | 3  |

#### OBJECTIVE

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

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

#### TEXT BOOK

Rao V. S. P., "Human Resource Management", Excel Publications

#### REFERENCE BOOKS

1. C. B. Memoria "Personal Management", Himalaya Publications, New Delhi
2. Edwin B. Flippo, "Personal Management" Tata McGraw Hill
3. Aswathappa K., "Human Resource Management", Tata McGraw Hill

|        |                              |       |    |
|--------|------------------------------|-------|----|
| BA-272 | ENTREPRENEURSHIP DEVELOPMENT | L T P | Cr |
|        |                              | 5 0 0 | 3  |

#### OBJECTIVE

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

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

#### TEXT BOOK

Gupta C. B. and Srinivasan N. P., "Entrepreneurial Development", Sultan Chand & Sons

#### REFERENCE BOOKS

1. Vasant Desai, "Management of a Small Scale Industry", Himalaya Publishing House

|        |                              |       |    |
|--------|------------------------------|-------|----|
| CE-471 | ADVANCED TRAFFIC ENGINEERING | L T P | Cr |
|        |                              | 5 0 0 | 3  |

#### 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.
- 3. HIGHWAY CAPACITY:** Importance. Space and time headway. Fundamental diagram of traffic flow. Relationship between speed; volume and density. Level of service. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.
- 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.
- 7. TRAFFIC AND ENVIRONMENT COMPUTER APPLICATION; TRAFFIC SIMULATION:** Detrimental effects of traffic. Vehicular air pollution. Situation in India. Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption. Arboricultur. Computer application in traffic engg.; transport planning and public transport. Traffic simulation; advantages. Steps in simulation. Scanning techniques. Introduction to Intelligent vehicle highway system. Various types of IVHS.

**TEXT BOOK**

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

**REFERENCE BOOKS**

1. Kadiyali L. R., "Traffic Engg. and Transport Planning", Khanna Publishers
2. Matson T. M., Smith W. S. and Hurd F. W., "Traffic Engineering", McGraw Hill, New York.
3. Drew D. R., "Traffic Flow Theory", McGraw Hill, New York.

**WEB REFERENCES**

1. syllabus.icbse.com/jntu/19-TRANSPORTATION%20ENGINEERING.pdf2.
2. www.nitkkr.ac.in/WebCivil/Civil\_syllabus.doc
3. www.uniqueinstitutes.org/kuk/civilengg/38civilf.pdf
4. worldinfo.org/wp-content/uploads/.../Ecology.Enquirer.August.2009.pdf

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|--------|--|-------|----|
| CE-472 | ELEMENTS OF TOWN PLANNING AND ARCHITECTURE | L T P | Cr |
|        |  | 5 0 0 | 3  |

**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; materials; 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; contrast; 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; densities 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**

Hiraskar G. K., "Fundamentals of Town Planning", Dhanpat Rai & Co, 2001

**REFERENCE BOOKS**

1. Rangwala S. C. and Krishnarjun N., "Town Planning", Charotar Publishing House, Anand, 1985.
2. Prammar V. S., "Design Fundamentals in Architecture", Somaiya Publications, New Delhi.

**REFERENCE WEB SITE**

1. [www.jadavpur.edu/academics/.../Architecture/archsyl.htm](http://www.jadavpur.edu/academics/.../Architecture/archsyl.htm)
2. [www.oauiife.edu.ng/faculties/edm/arch/coursedescription.pdf](http://www.oauiife.edu.ng/faculties/edm/arch/coursedescription.pdf)
3. [www.unitytempleutr.org/Unity%20Temple%20Teaches.pdf-issuu.com/brentallpress/docs/adr3\\_vol3\\_1](http://www.unitytempleutr.org/Unity%20Temple%20Teaches.pdf-issuu.com/brentallpress/docs/adr3_vol3_1)

|        |                            |       |    |
|--------|----------------------------|-------|----|
| CH-471 | ADVANCED APPLIED CHEMISTRY | L T P | Cr |
|        |                            | 5 0 0 | 3  |

**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 & naptha reforming.
2. **CHEMICALS TOXICOLOGY:** Introduction; kind of toxic pollutants; toxic chemicals in air water & soil; toxic elements in waste water; carcinogenesis, impact of toxic chemicals on enzymes; biochemical effects of As ,Cd, Pg, Hg, CO, NO<sub>2</sub>, O<sub>3</sub> 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 & bio-medical waste management; cause; effects & control measures of urban & 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.
5. Selection procedure for physical; chemical & biochemical methods of industrial waste water treatment.

6. **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.
7. **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 .
8. **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 & Electrophoresis.

**TEXT BOOK**

Jain & Jain, "Engineering Chemistry", Dhanpat Rai Publishing Co.

**REFERENCE BOOKS**

1. Drago, "Physical Methods of Chemistry".
2. Hutzinger, "Hand Book of Environmental Chemistry", Springer Verlag
3. Fristschen L. J. and Gay L. W., "Environmental Instrumentation", Springer Verlag
4. Bhatia H. S., "Environmental Pollution and Control", Galgotia Publications, 2003
5. Khopkar S. M., "Basic Concept of Analytical Chemistry", 2nd edition, New Age Publications, 1998

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|--------|-------------------|-------|----|
| CS-303 | COMPUTER GRAPHICS | L T P | Cr |
|        |                   | 5 0 0 | 3  |

**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.

- TWO DIMENSIONAL VIEWING:** The 2-D viewing pipeline, windows, viewports, window to view port mapping; clipping: point, clipping line (algorithms): 4 bit code algorithm, Sutherland-Cohen algorithm, parametric line clipping algorithm (Cyrus Beck).
- POLYGON CLIPPING ALGORITHM:** Sutherland-Hodgeman polygon clipping algorithm, homogeneous coordinates system, two dimensional transformations: transformations, translation, scaling, rotation, reflection, shearing, transformation, composite transformation.
- THREE DIMENSIONAL GRAPHICS:** Three dimensional graphics concept, matrix representation of 3-D transformations, composition of 3-D transformation; viewing in 3D: projections, types of projections; the mathematics of planner geometric projections; coordinate systems.
- HIDDEN SURFACE REMOVAL:** Introduction to hidden surface removal; the Z- buffer algorithm, scan-line algorithm, area sub-division algorithm.
- REPRESENTING CURVES AND SURFACES:** Parametric representation of curves: Bezier curves, B-Spline curves; parametric representation of surfaces; interpolation method.
- ILLUMINATION, SHADING, IMAGE MANIPULATION:** Illumination models, shading models for polygons, shadows, transparency; what is an image, filtering, image processing, geometric transformation of images.

**TEXT BOOK**

Foley James D., van Dam Andeies, Feiner Stevan K. and Hughes Johb F., "Computer Graphics Principles and Practices", 2nd Edition, Addison Wesley, 2000

**REFERENCE BOOKS**

- Hearn Donald and Baker M. Pauline, "Computer Graphics", 2nd Edition, Prentice Hall of India, 1999
- Rogers David F., "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw Hill, 2001
- Watt Alan, "Fundamentals of 3-Dimensional Computer Graphics", Addison Wesley, 1999
- John Corrign, "Computer Graphics: Secrets and Solutions", BPB Publications, 1994
- Krishanmurthy N., "Introduction to Computer Graphics", Tata McGraw Hill, 2002

**WEB REFERENCES**

- [http://en.wikipedia.org/wiki/Computer\\_graphics](http://en.wikipedia.org/wiki/Computer_graphics)
- <http://www.cgw.com/ME2/Default.asp>
- <http://www.graphics.cornell.edu/online/tutorial/>
- <http://graphics.stanford.edu/>

|               |                                |              |           |
|---------------|--------------------------------|--------------|-----------|
| <b>CS-402</b> | <b>ARTIFICIAL INTELLIGENCE</b> | <b>L T P</b> | <b>Cr</b> |
|               |                                | <b>5 0 0</b> | <b>3</b>  |

**OBJECTIVE**

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

**PRE-REQUISITES**

Knowledge of neural networks, data structures

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

**TEXT BOOK**

Rich Elaine, Knight Kevin and Nair, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009

**REFERENCE BOOKS**

- Nilson Nils J., "Artificial Intelligence", New York McGraw-Hill, 1971.
- Russell Stuart and Norvig Peter, "Artificial Intelligence: A Modern Approach", Prentice Hall of India, 1998
- Negnevitsky, "Artificial Intelligence: A Guide to Intelligent System", Pearson Education, 2004.
- Patterson O. W., "Introduction to Artificial Intelligence & Expert Systems", Prentice Hall of India, 1996.
- Winston Patrick Henry, "Artificial Intelligence", 3rd Edition, Addition Wesley, 1992
- Clockson & Mellish, "Programming PROLOG", Narosa Publications, 3rd Edition, 2002.

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1. <http://www.formal.stanford.edu/jmc/whatsai/>
2. <http://library.thinkquest.org/2705/>
3. [www.imdb.com](http://www.imdb.com).

|        |                                      |       |    |
|--------|--------------------------------------|-------|----|
| CS-422 | CRYPTOGRAPHY AND<br>DATA COMPRESSION | L T P | Cr |
|        |                                      | 5 0 0 | 3  |

**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**

B. Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", 2nd edition, Wiley, 1996.

**REFERENCE BOOKS**

1. Suhas Desai, "Security in Computing", Pearson Education, 2010
2. "Integration of Data Compression and Cryptography: Another Way to Increase the Information Security", IEEE Computer Society Volume 2, 2007
3. W. Trappe and L. Washington, "Introduction to Cryptography", 2nd edition, Pearson Education, 2006

**WEB REFERENCES**

1. <http://www.data-compression.com/index.shtml>
2. [http://www.webopedia.com/TERM/D/data\\_compression.html](http://www.webopedia.com/TERM/D/data_compression.html)
3. [http://en.wikipedia.org/wiki/Data\\_compression](http://en.wikipedia.org/wiki/Data_compression)
4. <http://www.debugmode.com/imagecmp/>

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|--------|------------------------|-------|----|
| EC-305 | EMBEDDED SYSTEM DESIGN | L T P | Cr |
|        |                        | 5 0 0 | 3  |

**OBJECTIVE**

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

1. **INTRODUCTION:** Different types of microcontrollers: Embedded microcontrollers; External memory microcontrollers; Processor Architectures: Harvard V/S Princeton; CISC V/S RISC; microcontrollers memory types; Introduction to Real Time Operating System.
2. **8051 MICROCONTROLLER ARCHITECTURE:** Architecture; memory considerations; Addressing modes; clocking; i/o pins; interrupts; timers; peripherals; serial communication; Instruction set; simple operations.
3. **PIC MICROCONTROLLER ARCHITECTURE:** Introduction to PIC microcontrollers; Architecture and pipelining; program memory considerations; Addressing modes; CPU registers; Instruction set; simple operations.
4. **INTERRUPTS AND I/O PORTS:** Interrupt logic; Timer2 scalar initialization; IntService Interrupt service routine; loop time subroutine; External interrupts and timers; synchronous serial port module; serial peripheral device; O/p port Expansion; I/p port expansion; UART.
5. **SOFTWARE:** Development tools/ environments; Assembly language programming style; Interpreters; High level languages; Intel hex format object files; Debugging.
6. **PROGRAMMING WITH MICRO-CONTROLLERS:** 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**

John B. Peatman, "Design with PIC Microcontrollers", Pearson Education, 4th edition, 2005.

**REFERENCE BOOKS**

1. Mazidi, "8051 Microcontroller", 2nd Edition, Prentice Hall, 2005

2. Predko, "Programming and Customizing the 8051 Microcontroller", 2nd Edition, McGraw Hill, 2002.
3. Catsoulis John, "Designing Embedded Hardware", 2<sup>nd</sup> Edition, O'Media, 2005.
4. Barr Michael, "Programming Embedded Systems in C and C++", Shroff Pub. and Distr., 3rd Edition, 2003.
5. Ayala A. J., "The 8051 Microcontroller: Architecture, Programming, and Applications", Pap/Dsk edition, West Publishing Company, 1991
6. Udai Shankar; "8051 Microcontrollers", CSVTU Research Journal, Chhattisgarh Swami Vivekanand Technical University, 2010.

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|--------|----------------------|-------|----|
| EC-401 | MOBILE COMMUNICATION | L T P | Cr |
|        |                      | 5 0 0 | 3  |

### OBJECTIVE

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

1. **MOBILE RADIO SYSTEM:** reference model; frequencies for radio transmission; signals; antennas; signal propagation; multiplexing; modulation
2. **CHARACTERISTICS OF RADIO WAVES:** Multipath characteristics of radio waves; signal fading; time dispersion; Doppler spread ; coherence time; LCR; fading statistics; diversity techniques
3. **WIRELESS SYSTEMS:** GSM: architecture; services; frame structure; signal processing Wireless data services :RAM ;CDPD; GPRS
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

Rappaport T. S., "Wireless Communication: Principles and Practice", 2nd Edition, Prentice Hall of India, 2001

### REFERENCE BOOK

1. Schiller Jochen, "Mobile Communication", 2nd Edition, Pearson Education, 2005.
2. William C. Y. Lee, "Mobile Cellular Telecommunications", 2<sup>nd</sup> Edition, McGraw Hill, 1995.

|        |  |       |    |
|--------|--|-------|----|
| EE-401 | PROGRAMMABLE LOGIC CONTROLLERS & SCADA | L T P | Cr |
|        |  | 5 0 0 | 3  |

### OBJECTIVE

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

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

Cox Richard A., "Technician's Guide to Programmable Controllers", 4th Edition, Delmar Thomson Learning, 2001

### REFERENCE BOOKS

1. Hackworth, John. R. and Hackworth, Jr. Frederick D., "Programmable Logic Controllers: Programming Methods and Applications", Pearson Education, 2004.
2. Webb, John W., & Reis, Ronal A., "Programmable Logic Controllers: Principles & Applications", Pearson Education / Prentice Hall, 2008.
3. Dunning, Gary, "Introduction to Programmable Logic Controllers", Delmar Thomson Learning, 2004.

|        |                           |       |    |
|--------|---------------------------|-------|----|
| EE-431 | INDUSTRIAL<br>ELECTRONICS | L T P | Cr |
|        |                           | 5 0 0 | 3  |

**OBJECTIVE**

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

- 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.
- 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.
- 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.
- 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.
- POWER SUPPLIES:** Performance parameters, of power supplies, comparison of rectifier circuit; filters, regulated power supplies; switching regulators; switch mode converter.
- 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.
- MOTOR CONTROL:** Voltage control at constant frequency; PWM control; phase control of dc motor; PLC control of a DC motor.

**TEXT BOOK**

Dubey G. K., "Power Semiconductor Controlled Drives", Prentice Hall Inc. New York.

**REFERENCE BOOKS**

- Thomas Kissel E., "Industrial Electronics", 3rd Edition, Prentice Hall of India.
- Date Patrick R. & Stephen Fardo W., "Industrial Electronics: Devices and Systems" 2nd Ed., Marcel Dekker, Inc. New York.

**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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|--------|--|-------|----|
| EL-421 | RENEWABLE ENERGY<br>SOURCES & ENERGY<br>CONSERVATION | L T P | Cr |
|        |  | 5 0 0 | 3  |

**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.

- 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.
- SOLAR ENERGY:** Solar radiation and its measurement; solar energy collectors; storage and applications.
- 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.
- 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.
- 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.
- 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.
- ENVIRONMENTAL IMPACT OF POWER PLANT OPERATION:** Introduction; particulate emissions; gaseous pollutants; thermal pollution; solid-waste pollution.

**TEXT BOOK**

Mukund R., "Non-conventional Energy Sources", Khanna Publishers, 2002

**REFERENCE BOOKS**

1. Domkundwar and Arora, "Power Plant Engineering", Dhanpat Rai & Sons 2002.
2. Rai R. C., "Power Plant Engineering", Dhanpat Rai Publication, 2005
3. Cul A. W., "Energy converters", McGraw Hill, 2000.
4. Nag, P. K., "Power Plant Engineering", Tata McGraw Hill, 1995
5. Subir, R., "Electrical Power System", Prentice Hall India, 2007

|        |                   |       |    |
|--------|-------------------|-------|----|
| 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-REQUISITES**

Knowledge of electromagnetic field theory and power systems.

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

requirement in steady state; sources of reactive power; static var systems; reactive power control during transients; introduction of harmonic and filters; generation of harmonics; design of AC filters; DC filters; carrier frequency and RI noise

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

**TEXT BOOK**

Arrillaga, J., "High voltage D.C.Transmission", Peter Peregrinus Ltd, 1996

**REFERENCE BOOKS**

1. Padiyar K. R., "HVDC Power Transmissions Systems", New Age International Pvt. Ltd., 2001
2. Rao S., "EHV-AC, HVDC Transmission & Distribution Engineering", Khanna Publishers, 1999
3. Tagare, D. M., "Reactive Power Management", Tata McGraw Hill, 1996
4. Dubey, G. K., "Power Semi-conductor Controlled Drives", Prentice Hall, 1999.
5. Subrahmaniam V., "Electric Drives: Concepts and Applications", Tata McGraw Hill, 2005.

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|--------|--------------------------|-------|----|
| 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 lightning discharges and high voltage testing arrangements.

**PRE-REQUISITES**

Knowledge of Electromagnetic field theory and power systems.

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

5. **LIGHTENING:** Lightning 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**

Begamudre, R. D., "E.H.V. AC Transmission", Wiley Eastern Ltd. 1992

**REFERENCE BOOKS**

1. Wadhwa C. L., "High Voltage Engineering", New Age international Ltd. 1995
2. Arrillaga J., "High voltage D.C. Transmission", Peter Peregrinus Ltd. 1996
3. Kamaraju V. and Naidu, M. S., "High Voltage Engineering", Tata McGraw Hill, 1996
4. Naidu M. S., "High Voltage Engineering", Tata Mc Graw Hill, 4 Edition, 2001
5. Ray Subir, "An Introduction to High Voltage Engineering, Prentice Hall of India, 2008

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

**OBJECTIVE**

The objective of devising this course is to prepare the students of 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**

Roy A. and Sharma P. L., "English for Students of Engineering", Orient Longman, 2007

The following four lessons are prescribes for textual study:

1. The Year 2050
2. Human Environment
3. The Discovery
4. Grief.

**REFERENCE BOOKS**

1. Tickoo M. L. and Subramanian A. E., "Intermediate Grammar, Usage ad Composition", Orient Longman.
2. Thomson and Martinet, "A Practical English Grammar", Oxford University Press
3. Hornby, "A.S. Guide to patterns and Usage in English", Oxford University Press
4. Balasubramanian T., "A Textbook of English Phonetics for Indian Students", MacMillan
5. D. O' Connor J, "Better English Pronunciation", Cambridge University Press, London.
6. McCarthy, "English Vocabulary in Use Foundation Books", Cambridge University Press
7. Hashem Abul, "Common Errors in English", Ramesh Publishing House
8. Roach P, "English Phonetics & Phonology", Cambridge University Press
9. Ramesh M. S. and Pattanshetti C. C., "Business Communication", R. Chand and Company
10. Wood F. T., "Remedial English Grammar for Foreign Students", The Macmillan Press Ltd., 1975

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

**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**

- 1 Mary Ellen Guffey, "Business Communication: Process & Product", 4th Edition, South-Western College Publishing, Cincinnati.
- 2 Sharma R. C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill
- 3 Ramesh M. S. and Pattanshetti C. C., "Effective Business English and Correspondence", R. Chand & Co.
- 4 Shruter C., "Effective Letters in Business by Robert", Tata McGraw Hill
- 5 Wing F. W. and Anncrea D., "English Business Letters", Orient Longman.
- 6 Sarah Freeman, "Written Communication in English", Orient Longman.
- 7 Leo Jones and Riched Alexander, "International Business English", Cambridge University Press
- 8 Sweet Stephen, "General and Business English", Sir Issac Pitman & Sons Ltd., London.
- 9 Charles Fl. Sides, "How to Write and Present Technical Information", Cambridge University Press
- 10 Susan Stevenson/Stave Whitmore, "Strategies for Engineering Communication", John Wiley and Sons/Replika Press. Pvt. Ltd. Delhi.

currencies and payment systems; offline secure processing; private data networks; security protocols; electronic payment systems: digital payment systems

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

**PART B**

4. **ERP- AN ENTERPRISE PERSPECTIVE:** Production Finance, Personnel disciplines and their relationship, Transiting environment, MIS Integration for disciplines, Information/Workflow, Network Structure, Client Server Integrator System, Virtual Enterprise.
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**

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

**REFERENCE BOOKS**

1. V. K. Garg and N. K. Venkita Krishna, "Enterprise Resource Planning – Concepts and Practice", Prentice Hall of India, 1998,
2. Motiwala, "Enterprise Resource & Planning", 1st edition, Pearson Education
3. John Antonio, Fernandez, "The SAP/3 Handbook", Tata McGraw Hill
4. Denial Amor, "The E-Business Revolution", Addison Wesley
5. Sokol, "From EDI to E-Commerce: A Business Initiative", Tata McGraw Hill
6. Greenstein and Feinman, "E Commerce", Tata McGraw Hill
7. Rajan and Nag, "E Commerce: The Cutting Edge of Business", Tata McGraw Hill
8. Jaffrey F. Rayport , Bernard J. Jaworski, "E-Commerces", Tata McGraw Hill, 2002
9. Greenstein and Feinman, "Electronic Commerce – Security, Risk Management and Control", Tata McGraw Hill, 2002
10. Hendry Chan, Raymond Lee, Tharam Dillon and Ellizabeth Cang, "E-Commerce Fundamentals and Applications", John Wiley.

|        |                                  |       |    |
|--------|----------------------------------|-------|----|
| IT-423 | INTRODUCTION TO E-COMMERCE & ERP | L T P | Cr |
|        |                                  | 5 0 0 | 3  |

**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

- Efraim Turbon, Jee Lee, David King, H. Michael Chang, "E-Commerce" Wiley VCH, 2004

**WEB REFERENCES**

- [www.exforsys.com/tutorials/erp/erp-and-e-commerce.html](http://www.exforsys.com/tutorials/erp/erp-and-e-commerce.html)
- [www.bizautomation.com](http://www.bizautomation.com)
- [itmanagement.earthweb.com/erp](http://itmanagement.earthweb.com/erp)
- [www.e2-llc.com/e2\\_ecommerce\\_erp.aspx](http://www.e2-llc.com/e2_ecommerce_erp.aspx)
- [e-comm.webopedia.com/TERM/e/ERP.html](http://e-comm.webopedia.com/TERM/e/ERP.html)

|        |                                  |       |    |
|--------|----------------------------------|-------|----|
| IT-443 | INFORMATION STORAGE & MANAGEMENT | L T P | Cr |
|        |                                  | 5 0 0 | 3  |

**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

- 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
- DATA CENTER INFRASTRUCTURE:** Example; key requirements of storage systems management activities
- STORAGE SYSTEMS ARCHITECTURE:** Storage system environment; components of a host; connectivity; physical disks; RAID array; disk storage systems; data flow exercise
- 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)
- BUSINESS CONTINUITY:** Introduction, overview, backup and recovery, local replication, remote replication.
- 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.
- SECURING STORAGE AND STORAGE VIRTUALIZATION:** Securing the storage infrastructure; virtualization technologies.

**TEXT BOOK**

Osborne Marc Farley, "Building Storage Networks", Tata McGraw Hill

**REFERENCE BOOKS**

- Spalding Robert, "Storage Networks: The Complete Reference", Tata McGraw Hill
- Gupta Meeta, "Storage Area Network Fundamentals", Pearson Education Limited

- Kowalski Gerald J. and Maybury Mark T., "Information Storage & Retrieval Systems Theory & Implementation", BS Publications
- Thejendra B. S., "Disaster Recovery & Business Continuity", Shroff Publishers & Distributors, EMC – Students Kit

**WEB REFERENCES**

- <http://www.cs.cmu.edu/~fp/courses/03-312/handouts/18-storage.pdf>
- [http://www.freedomdownloadscenter.com/Information\\_Management/](http://www.freedomdownloadscenter.com/Information_Management/)

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| MA-471 | DISCRETE MATHEMATICS | L T P | Cr |
|        |                      | 5 0 0 | 3  |

**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.

- 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.
- 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.
- NUMBER THEORY:** Basic properties; Divisibility theory; Congruences; Chinese remainder theorem; Fermat's little theorem;  $\tau$  &  $\mu$  functions.
- COMBINATORICS:** Fundamental principal of counting; Pigeonhole principal; Multinomial coefficients; Recurrence relation; Generating functions.
- 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.
- 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.
- TREES:** Trees and their properties; Spanning trees; Kruskal's algorithm; Prim's algorithm; Binary tree.

**TEXT BOOK**

Sarkar S. K., "A Textbook of Discrete Mathematics" 5th Edition, S. Chand Publications

**REFERENCE BOOK**

- Liu C. L., "Element of Discrete Mathematics" McGraw Hill.
- Sengadir, "Discrete Mathematics and Combinatorics", Pearson Education.
- Deo, "Graph Theory", Prentice Hall of India.
- Bough R. Johnson, "Discrete Mathematics", Pearson Education.

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| MA-472 | ADVANCED HIGHER ENGINEERING MATHEMATICS | L T P | Cr |
|        |   | 5 0 0 | 3  |

**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.

- SERIES SOLUTION OF DIFFERENTIAL EQUATION:** Series solution and its validity; General method; Forms of series solution.
- CALCULUS OF VARIATIONS:** Introduction; Functionals; Euler's equation; solutions of Euler's equation; Geodesies; Isoperimetric problems; Several dependent variables; Functionals involving higher order derivative; Approximate solution of boundary value problems- Rayleigh-Ritz methods; Hamilton's principle; Lagrange's equations.
- TENSOR ANALYSIS:** Introduction; Summation convention; Transformation of co-ordinates; Tensor of order zero; Kronecker Delta; Contravariant and Co-variant tensors; Quotient law; Riemannian space; Conjugate tensor; Christoffel symbols; Transformation of Christoffel symbol; Covariant differentiation of a covariant tensors; Covariant differentiation of a contravariant tensors.
- INTEGRAL EQUATIONS:** Definition and classification of integral equations; Conversion of a linear differential equation to an integral equation and vice versa; Voltera Integral equations, solution of integral equation by resolvent Kernel, Method of successive approximation, Euler integrals, Volterra Integral equation of the first kind, Fredholm equation of second kind.

**TEXT BOOK**

Grewal B. S., "Higher Engineering Mathematics", 38th Edition, Khanna Publisher, 2005

**REFERENCE BOOKS**

- Wylie C. Ray and Barrett Louis.C., "Advanced Engg. Mathematics", McGraw Hill
- Sastry S. S., "Engineering Mathematics", 11th Edition, Prentice Hall of India, 1994
- Jerri Abdul J., "Introduction of Integral Equation with Application", Wiley-Interscience; 2nd Edition, 1999
- Debnath Lokenath, "Integral Transforms and their Applications", 2nd Edition, Chapman & Hall, 2007
- Weatherburn, "Tensor Calculus", Cambridge University Press, 2008
- Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley, 2006

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| MA-473 | ADVANCED NUMERICAL TECHNIQUES | L T P | Cr |
|        |                               | 5 0 0 | 3  |

**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.

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

**TEXT BOOK**

Curtis F, Gerald and Patrick, "Applied Numerical Analysis", 7th Edition, Wheatley Solution

**REFERENCE BOOKS**

- Balagurusamy E., "Numerical Methods", Tata McGraw Hill
- Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India
- Jain M. K., Iyenger S. R. K. and Jain R. K., "Numerical Methods for Scientific and Engg. Computations" by - Wiley Eastire Ltd.
- Rao S. S., "The Finite Element Method in Engg.", Pregamon Press/McGraw Hill, 1989

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| MA-474 | OPERATION RESEARCH | L T P | Cr |
|        |                    | 5 0 0 | 3  |

**OBJECTIVE**

The aim of the topic is to provide a common platform for the Engineers, Scientists along with people from management, industry & defence sector. This topic also provides how to get optimal solution in above said branch.

- 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.
- INTEGER PROGRAMMING, GOEL PROGRAMMING & MULTICRITERIA DECISION MAKING:** Formulation of various industrial problems

- as integer and mixed integer programming problems; branch and bound algorithm; cutting plane methods for pure and mixed integer programming problems; Knap-sack; travelling salesman and shortest route problems. multicriteria decision; multicriteria decision making models; determination of set of feasible alternatives; solution techniques; goal programming approach; goal programming models; ranking and weighting of multiple goals; simplex method in goal programming.
- 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.
  - 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.
  - QUEING THEORY & INVENTORY CONTROL:** Introduction to waiting line models? steady state behavior of M/M/1 and M/M/C queues-the problem of machine interference and use of finite queuing tables- introduction to M/G/1, and G/M/1 .inventory control problem; Concept of inventory and various costs; EQQ formula newspaper boy problems.
  - 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.
  - STOCHASTIC PROGRAMMING:** Stochastic programming with one objective function; stochastic linear programming; two stage programming technique; chance constrained programming technique.

**TEXT BOOK**

Taha H. A., "Operations Research: An Introduction", Macmillan, N.Y.

**REFERENCE BOOK**

- Hitter F. S. and Lieberman G. J., "Introduction to Operations Research", Addison Wesley.
- Hadley G., "Linear Programming", Addison Wesley.
- Dantzig G., "Linear Programming and Extensions", Princeton, N.J.
- Fletcher R., "Practical Methods of Constrained Optimization", John Wiley.
- Bazaraa M. S., Jervis J. J. and Serali H. D., "Linear Programming & Network Flows", John Wiley.

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

**OBJECTIVE**

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

- INTRODUCTION:** Definition of ergonomics and ergonomist; social and economic values of ergonomics; general and individual ergonomics.
- POSTURE AND MOVEMENT:** Biomechanical; physiological and anthropometric background; postures; sitting and standing; Movement – lifting; carrying; pulling and pushing; Workplace design and assessment.
- INFORMATION AND OPERATION:** User; information – visual; hearing and other senses; Control for operation – fixed and others diagues user friendliness; different forms and help; Website design; mobile interaction; virtual reality.
- ENVIRONMENTAL FACTORS:** Noise reduction; hearing conservation; Vibration prevention; illumination – light intensity; brightness differences; colour of light; Climate – heat and cold; Chemical substances – measures; ventilation.
- WORK ORGANISATION JOBS & TASKS:** Tasks; jobs; work organization – flexible; autonomous groups; coaching measurement styles.
- ERGONOMIC APPROACH:** Project management – initiative phase; problem identification phase; selection of solution phase; implementation phase; evaluation phase.
- CASE STUDIES:** A set of case studies will be used to demonstrate how ergonomics had lead to changes in work activity; safety and product design; Case studies will include advanced computer application; work place assessment; accidents; analysis and industrial inspection.

**TEXT BOOK**

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

**REFERENCE BOOKS**

- Knoz Stephana, Johnson Steven, Halconts "Work Design - Industrial Ergonomics", Hathway, Scottsdagta, AZ
- Sanders M. S. and McCormic E. J., "Human Factors in Engineering and Design", McGraw Hill New York
- Verma A. P., "Industrial Engineering", S. K. Kataria and Sons

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

**OBJECTIVE**

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

- 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**

Reddy J. N., "An Introduction to Finite Element Method", McGraw Hill, Intl Student Edition

**REFERENCE BOOKS**

- 1 Zienkiewitch, "The Finite Element Method; Basic Formulation and Linear Problems", Vol 1, 4th Edition, McGraw Hill
- 2 Desai C. S. and Abel J. F., "Introduction to the Finite Element Method", Affiliated East west Press, 1972
- 3 Rao S. S., "The Finite Element Method in Engineering", Pergaman Press, 1989

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| ME-461 | RENEWABLE SOURCES OF ENERGY | L T P | Cr |
|        |                             | 5 0 0 | 3  |

**OBJECTIVE**

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

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

**TEXT BOOK**

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

**REFERENCE BOOKS**

1. Rai G. D., "Solar Energy Utilization", Khanna Publishers, 1995
2. Duffie J. A. and Beckman, "Solar Heating and Cooling"
3. Wakil M. M, EL, "Power Plant Technology", McGraw Hill
4. Sharma P. C., "Power Plant Engineering", S. K. Kataria and Sons

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|--------|------------------------------------|-------|----|
| PH-471 | NON DESTRUCTIVE TESTING TECHNIQUES | L T P | Cr |
|        |                                    | 5 0 0 | 3  |

**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.

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

**TEXT BOOK**

Baldev Raj, Jayakumar T., and Thavasimuthu M., "Practical Non-Destructive Testing", Narosa Publishing, 1997

**REFERENCE BOOKS**

- Suryanarayana C., "Testing of Metallic Materials", Prentice Hall of India, 1979
- American Society for Metals, "Metals Hand Book (Mechanical Testing)", Volume VIII, American Society for Metals, 1988
- Rolfe T. and Barson J., "Fracture and Fatigue Control and Structure - Application of Fracture Mechanics", Prentice Hall, 1977
- Halmshaw R, "Non-Destructive Testing", Edward Arnold, 1989
- Hull, "Non-Destructive Testing", ELBS Edition, 1991.
- Das A. K., "Metallurgy of Failure Analysis", JMH, 1992.

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| PH-472 | NANO TECHNOLOGY | L T P | Cr |
|        |                 | 5 0 0 | 3  |

**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 die context, and to maintain respect for the scientific approach.

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

- NANOMETROLOGY:** Introduction to nanometrology; length measurement; force measurement; measurement of single molecules; applications of metrology.
- 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.
- NANO-BIOTECHNOLOGY AND NANOMEDICINE:** introduction to nano-biotechnology and nano-medicine, nano-science in nano-biotechnology and nano-medicine, current and future applications array technologies, drug delivery, drug discovery, medical imaging, nano-technologies and cancer treatment, implants and Prosthetics.
- NANOFABRICATION:** Lithographic techniques for nano-printing; nano-manipulation techniques, self assembly.
- SYNTHESIS AND CHARACTERIZATION:** Metallic, semiconducting, magnetic and carbon based nano structures, nanocomposites and biological nanomaterials.
- APPLICATIONS OF NANOMATERIALS:** Sunscreens and cosmetics, composites, clays. coatings and surfaces, tougher and harder cutting toots, paints; remediation, fuel ceils; 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**

- Rainer Waser, "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley VCH, 2003
- Wang Z. L., "Characterization of Nanophase Materials", Wiley-VCH, 2001
- Edelstein A. S. and Cammamm R. C., "Nanomaterials: Synthesis, Properties and Applications", IOP (UK), 1996
- Heinzel T., "Mesoscopic Electronics in Solid State Nanostructures", Wiley-VCH, 2003

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| PH-473 | LASER TECHNOLOGY | L T P | Cr |
|        |                  | 5 0 0 | 3  |

**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.

3. **NORMAL INVERSION:** Inversions and two level systems, steady state inversions,
4. **POPULATION INVERSION:** Three and four level systems, transient population inversions, factors effecting population inversion, laser Amplifiers.
5. **EXCITATION AND PUMPING:** Excitation or pumping threshold requirements, pumping pathway and specific excitation parameters associated with optical and particle pumping.

6. **TYPES OF LASERS:** Helium-Neon Laser, CO<sub>2</sub> Laser, Ruby Laser, Semiconductor diode laser.
7. **LASER SPECTROSCOPY:** Introduction and applications

**TEXT BOOK**

Silfvast William T., "Laser Fundamentals", Cambridge University Press

**REFERENCE BOOKS**

1. Beynon John, "Introductory University Optics", Prentice Hall of India.
2. Ghatak A. K., "Optics", Tata McGraw Hill.

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- **Sri Viveka Institute of Technology, Vijayawada**



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