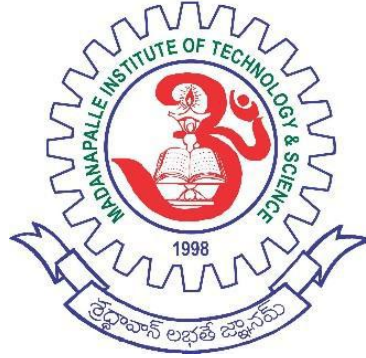


# MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE MADANAPALLE

(UGC-AUTONOMOUS)

[www.mits.ac.in](http://www.mits.ac.in)



## DEPARTMENT OF MECHANICAL ENGINEERING

### ACADEMIC REGULATIONS AND COURSE STRUCTURE & SYLLABI

For the students admitted to

**B.Tech. Regular Four Year Degree Programme from the Academic Year 2014-15**

and

**B.Tech. Lateral Entry Scheme from the Academic Year 2015-16**



## B.TECH. MECHANICAL ENGINEERING



## **VISION AND MISSION OF THE INSTITUTION**

### **Vision:**

Become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation.

### **Mission:**

To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

### **Quality Policy :**

Madanapalle Institute of Technology & Science is committed to bring out and nurture the talents and skills of youth in the fields of Engineering and Management to cater to the challenging needs of society and industry.

- We shall achieve this by contributing to the academic standing and overall knowledge development of the students
- Providing excellent infrastructure and conducive learning environment.
- Enhancing the competence of faculty and promoting R&D Programs
- Collaborating with institutions and industries.
- Ensuring continual improvement of Quality Management System.

## **VISION AND MISSION OF THE DEPARTMENT**

### **VISION**

To perpetually generate quality human resource in mechanical engineering who can contribute constructively to the technological and socio-economic development of the Nation.

### **MISSION**

- M1:** Offering quality graduate and post graduate programs in mechanical engineering education and to prepare humanist and rational graduates with scientific temperament for excelling in their professional career or higher studies.
- M2:** Promoting excellence in teaching and research through collaborative activities.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

The Programme Educational Objectives of the B.Tech. Mechanical Engineering are:

The graduates will

**PEO1:** Build a thriving career in mechanical engineering, and allied disciplines.

**PEO2:** Design and produce products by the optimum methods for the benefit of the society while working in a team with ethical values.

**PEO3:** Engage in continuous learning to adapt to the socio-economic-technological developments and pursue higher studies.

## **PROGRAMME OUTCOMES**

At the end of the programme the graduates will be able to

**PO1:** Utilize the knowledge of basic sciences and engineering principles for solving complex problems in mechanical engineering and allied disciplines.

**PO2:** Analyze complex engineering problems using the systematic approach of problem identification, formulation, literature survey, analysis, and presenting conclusions.

**PO3:** Design mechanical engineering components, systems or processes meeting specifications.

**PO4:** Provide innovative solutions for complex engineering problems using appropriate research methodologies like experimentation, interpretation of data, and synthesis of new information.

**PO5:** Employ the modern engineering tools and techniques for expeditious and effective execution of tasks.

**PO6:** Apply the knowledge of societal, health, safety and legal issues in professional engineering practice.

**PO7:** Recognize the environmental impact of engineering activities and strive towards sustainable development of the humanity.

**PO8:** Adhere to the ethical principles, responsibilities and standard norms of engineering practice.

**PO9:** Work in multi-disciplinary and collaborative environment.

**PO10:** Communicate effectively with the engineering community and the society.

**PO11:** Use the principles related to management and finance while working on a project as a member or a leader of a team.

**PO12:** Involve in lifelong learning in order to continuously improve knowledge and keep abreast with new developments in the profession.

## PRELIMINARY DEFINITIONS AND NOMENCLATURES

**Academic Council:** The Academic Council is an apex academic body of the Institution and is responsible for the maintenance of standards of instruction, education and examination within the Institution. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic related matters.

**Academic Autonomy:** Means freedom to an Institute in all aspects of conducting its academic programmes, granted by the UGC/University for Promoting Excellence.

**Academic Year:** It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

**AICTE:** Means All India Council for Technical Education, New Delhi.

**Audit Course:** It is a non-credit course, which has no external evaluation.

**Autonomous Institute:** An institute / college designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with Jawaharlal Nehru Technological University, Ananthapuramu (JNTUA) and State Government.

**Backlog Course:** A course is considered a backlog course if the student has obtained a Letter grade (F).

**Basic Sciences:** The courses of foundational nature in the areas of Mathematics, Physics, Chemistry etc., are offered in this category.

**Board of Studies (BoS):** BoS is an authority as defined in UGC regulations. Each department is responsible for curriculum design and updating the syllabi from time to time in respect of all programmes, offered by the departments.

**Branch of Study:** It is a branch of knowledge, an area of study or a specific program (like Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering and Computer Science & Engineering)

**Programme:** Means specialization. Ex: B.Tech in Civil Engineering, M.Tech in Computer Science and Engineering etc.

**Certificate Course:** Institution offers certain certificate courses (beyond the curriculum) to make a student gain hands-on expertise and skills required for holistic development.

**Choice Based Credit System (CBCS):** The credit based system that provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

**Compulsory Course:** Course required to be undertaken for the award of the degree as per the program.

**Commission:** Means University Grants Commission (UGC), New Delhi.

**Continuous Internal Assessment:** The internal assessment is made through Mid-term tests, assignments, slip tests, surprise tests, quizzes etc.

**Course:** A course is a subject offered by the Institution for learning in a particular semester.

**Course Outcomes:** The essential skills that need to be acquired by every student through a course.

**Credit:** A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value.

**Credit point:** It is the product of grade point and number of credits for a course.

**Cumulative Grade Point Average (CGPA):** It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

**Curriculum:** Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Programme Educational Objectives.

**Degree:** A student who fulfills all the Programme requirements is eligible to receive a degree.

**Degree with Specialization:** A student who fulfills all the programme requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like ECE, CSE, EEE etc.

**Department:** An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources.

**Elective Course:** A course that can be chosen from a set of courses. An elective can be Discipline (Professional) and/or Open Elective.

**Evaluation:** Evaluation is the process of judging the academic work done by the student in her/his courses. It is done through a combination of continuous internal assessment and end semester examinations.

**Foundation Course:** Foundation courses are the courses based upon the content that leads to Enhancement of skill and knowledge and is value-based and is aimed at man-making education.

**Grade:** It is an index of the performance of the students in a said course. Grades are denoted by Alphabets.

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

**Institute:** Means Madanapalle Institute of Technology & Science, Madanapalle unless indicated otherwise by the context.

**Massive Open Online Course (MOOC):** MOOC courses inculcate the habit of self learning, through online education.

**Pre-requisite:** A course, the knowledge of which is required for registration into higher level course.

**Professional Core:** The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

**Professional or Discipline Elective:** A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

**Programme:** Means, Bachelor of Technology (B.Tech) degree programme or UG Degree Programme.

**Program Educational Objectives:** The broad career, professional, personal goals that every student will achieve through a strategic and sequential action plan.

**Project work:** Course that a student has to undergo during his/her final year which involves the student to undertake a research or design, which is carefully planned to achieve a particular aim. It is a credit based course.

**Registration:** Process of enrolling into a set of courses in a semester of the Programme.

**Regulations:** The regulations are common to all B.Tech programmes conducted at the Institute of Madanapalle Institute of Technology & Science, Madanapalle and shall be called “MITS Regulations R-14” and are binding on all the stakeholders.

**Semester:** It is a period of study consisting of 17 weeks of academic work equivalent to normally 90 working days (525 contact hours) excluding examination and preparation holidays. The odd Semester starts usually in the month of July and even semester during December.

**End Semester Examinations:** It is an examination conducted at the end of a course of study.

**S/he:** Means “she” and “he” both.

**Student Outcomes:** The essential skill sets that need to be acquired by every student during her/his programme of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

**University:** Means the Jawaharlal Nehru Technological University Anantapur, Ananthapuramu.

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# **ACADEMIC REGULATIONS**

**For the students admitted to**

**B.Tech. Regular Four Year Degree Programme from the Academic Year 2014-15**

**and**

**B.Tech. Lateral Entry Scheme from the Academic Year 2015-16**

## **Applicable for students admitted to B.Tech. (Regular) from 2014-15 batch onwards**

### **1. Admission Procedure**

As per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made to the first year of Four year B.Tech. Degree programme as given below:-

- a) As per the norms of Government of Andhra Pradesh, A-Category (based on the rank obtained in EAMCET) seats will be filled by the Convener, EAMCET.
- b) As per the norms of Government of Andhra Pradesh, B-Category seats will be filled by the management.

### **2. Programmes of Study**

With the approval from AICTE & JNTUA, the following B. Tech. Degree programmes are offered at present.

<b>Sl. No</b>	<b>Specialization</b>	<b>Code</b>
1.	Civil Engineering	01
2.	Electrical & Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science & Engineering	05

### **3. Programme Pattern**

- 3.1 The medium of instruction, examinations and project reports shall be English.
- 3.2 The entire programme of study is for four academic years. All four academic years shall be on semester pattern.
- 3.3 A student admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.
- 3.4 The minimum instruction days for each Semester shall be 90.
- 3.5 A student eligible to appear for the end examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered.
- 3.6 When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.
- 3.7 The curriculum of B.Tech. programme is designed to have a total of 180 credits for the award of B.Tech. degree.
- 3.8 Each course is assigned certain number of credits which will depend upon the number of lecture per week. In general, credits are assigned to the courses based on the following contact hours per week per semester.
  - a. For Theory Courses: One credit for each Lecture hour.
  - b. For Practical Courses: One credit for two hours of Practical OR  
Two credits for three (or max. of four) hours of Practical.

### **4. Award of B.Tech. Degree**

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

- 4.1 Pursue a programme of study for not less than four academic years and in not more than eight academic years.
- 4.2 Register for 180 credits and secure all 180 credits.
- 4.3 Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. programme and their admission stands cancelled.

## **5. Attendance Requirements**

- 5.1 A student shall be eligible to appear for Semester End examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.
- 5.2 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- 5.3 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- 5.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- 5.5 A student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.
- 5.6 A stipulated fee shall be payable towards condonation of shortage of attendance to the Institution.

## **6. Relative Weightage for Internal Evaluation and End Semester Examination**

- a. The performance of a student in each semester shall be evaluated course-wise.
- b. Performance evaluation in each course (theory/ practical) shall be based on a total of 100 marks, of which the relative weightage for internal evaluation and end semester examination shall be 40% and 60% respectively.
- c. However, Audit courses shall be evaluated entirely on the basis of internal evaluation.

### **6.1 Internal Evaluation**

- 6.1.1 The total internal weightage for theory courses is 40 marks with the following distribution.
  - a. 30 marks for Mid-term tests.
  - b. 10 marks for Assignments.
- 6.1.2 For all theory courses including audit courses (except NSS Programme) there shall be two mid-term tests in each semester. The duration of mid-term test shall be 1 hour and 30 minutes. Student shall answer six short answer questions of one mark each and three (out of five) long answer questions of 8 marks each. First mid-term test shall be conducted for I, II units of syllabus and second mid-term shall be conducted for III, IV & V units. The average marks secured from I & II mid-term tests shall be the final mid-term test marks.
- 6.1.3 In case any student is not able to appear for any one of the mid-term tests in any theory course for genuine reasons (for example; medical), the Principal at his discretion, on the recommendation of Head of the department and the faculty concerned, shall permit to conduct one additional mid-term test. This shall be conducted after the second mid-term test of that course(s), only on submission of supporting evidence.
- 6.1.4 The 10 marks allotted to assignments in each theory course shall be based on evaluation of two assignments (5marks each), on topics relevant to that particular course. The first assignment is to be submitted before I mid-term test and the second assignment is to be submitted before II mid-term test.

## **6.2 End Semester Examination**

6.2.1 End semester examination of theory courses shall have the following pattern:

6.2.1.1 There shall be 6 questions and all questions shall be compulsory.

6.2.1.2 Question “1” shall contain 10 compulsory short answer questions, one mark each. There shall be two short answer questions from each unit.

6.2.1.3 In each of the questions from 2 to 6, there shall be either-or type questions of 10 marks each. Student shall answer any one of them.

6.2.1.4 Each of these questions from 2 to 6 shall cover one unit of the syllabus.

6.2.1.5 The duration of Theory/practical end semester examination is 3 hours.

6.2.1.6 End examination of theory courses consisting of two parts of different courses, for ex: Electrical & Mechanical Technology shall have the following pattern:

a. Question paper shall be in two parts viz., Part A and Part B with equal weightage.

b. In each part there shall be 3 either-or type questions for 10 marks each.

## **6.3 Practical Courses**

6.3.1 The internal evaluation for practical courses shall be 40 marks for day to day work based on conduction of experiment/prerequisite work/ record/ Viva.

6.3.2 The end semester examination shall be conducted by the laboratory teacher concerned and one senior teacher of the same department nominated by the Principal.

6.3.3 In a practical course consisting of two parts (ex: Electrical & Mechanical Lab), the end semester examination shall be conducted for 60 marks in each part and final marks shall be arrived by considering the average of marks obtained in the two parts. Internal examination shall be evaluated as above for 40 marks in each part and final internal marks shall be arrived by considering the average of marks obtained in the two parts.

## **6.4 Audit Courses**

An audit course is an educational term for the completion of a course of study for which a nominal assessment of the performance of the student is made without awarding grades. In this case, 'audit' indicates that the individual merely has received teaching and achieved a given standard of knowledge of the subject, rather than being evaluated. A student who audits a course does so for the purpose of self-enrichment and academic exploration.

### **Regulations for Audit Courses:**

6.4.1 Institution intends to encourage the students to do any two audit courses – one in each of II and III years of their programme. The students shall have the choice to opt for one audit course from list-1 and another from list-2 given by the college.

6.4.2 Audit Courses shall bear no credits.

6.4.3 The details of audit courses shall be reflected in Grade card of the successful students

6.4.4 Attendance for audit courses is compulsory and shall be considered while calculating the aggregate attendance.

6.4.5 There shall be only internal assessment/evaluation for audit courses. The student shall be declared passed in audit courses when he/she secures 40% marks or above in the internal evaluation. If any student does not attain the required pass percentage, the student needs to reappear for the mid-term tests, as and when the college conducts them in subsequent semesters.

6.4.6 For practical oriented audit courses like NSS, evaluation shall be based on practical work, as judged by the coordinator of NSS, without any compulsory internal examination.

## 6.5 Massive Open Online Courses (MOOCs)

The college in line with the developments in Learning Management Systems (LMS) intends to encourage the students to do online courses in MOOCs, offered internationally. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion of the course from the MOOCs providers.

### Regulations for MOOCs:

- 6.5.1 Institution intends to encourage the students to do one MOOC in each semester, from II year II Semester to IV year I Semester of the B.Tech. Programme.
- 6.5.2 The MOOC(s) shall be offered for the existing course titles (discipline core or discipline electives) in the respective B.Tech. Structure.
- 6.5.3 The respective departments shall give a list of **standard** MOOCs providers among edx, Udacity, Coursera, NPTEL or any other standard providers, whose credentials are endorsed by the HoD.
- 6.5.4 In general, MOOCs providers provide the result in percentage. In such case, the departments shall follow the grade table given below, while providing CGPA for the MOOCs. If MOOCs provider declares a student as passed, the institution shall consider the same.

Letter Grade	Grade points	Percentage obtained in MOOCs
O (Outstanding)	10	90 - 100
A+ (Excellent)	9	80 - 89
A (Very Good)	8	70 - 79
B+ (Good)	7	60 - 69
B (Above Average)	6	50 - 59
C (Average)	5	45 - 49
P (Pass)	4	40 - 44
F (Fail)	0	< 40
Ab (Absent)	0	

- 6.5.5 In case of any deviation from the clause 6.5.4, the committee appointed by the Principal shall take a decision for converting MOOC results in to the relevant grade points.
- 6.5.6 The Credits for MOOC(s) shall be same as given for the respective discipline core or discipline electives.
- 6.5.7 Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- 6.5.8 A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HoD.

- 6.5.9 In case a student fails to complete the MOOCs he/she shall re-register for the same with any of the providers from the list provided by the department. Still if a student fails to clear the course/s, the Institution shall evaluate for the said course/s for 60 marks (scaled up to 100 marks), as per the MOOCs syllabi during the final year.
- 6.5.10 In case a provider fails to offer a MOOC in any semester, then in all such cases the college shall conduct the end semester examinations for the same as per the college end semester examination pattern. The syllabi for the supplementary examinations shall be same as that of MOOCs. There shall be no internal assessment however the marks obtained out of 60 shall be scaled upto 100 marks and the respective letter grade shall be allotted.
- 6.5.11 In case any provider discontinues to offer the course, Institution shall allow the student to opt for any other provider from the list provided by the department, for completion of the same course
- 6.5.12 The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it or them to the department concerned through the Coordinator/Mentor, before the end semester examination of the particular semester.
- 6.5.13 The Provisional Degree Certificate and/or consolidated grade sheet shall be issued only to those students, who have submitted proof of completion of MOOC(s), for the courses they have registered with.

## **6.6 Choice Based Credit System (CBCS)**

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning.

### **Regulations for CBCS:**

- 6.6.1 The CBCS, also called as Open Electives (OEs) will be implemented in the college.
- 6.6.2 It is mandatory for Under Graduate (UG) students to study 4 CBCS courses during III and IV Years of their programme by taking one course in each semester.
- 6.6.3 A student shall opt for any 4 courses from the list given by the institute from time to time, complying with the requirement of the prerequisite course(s), if any.
- 6.6.4 In any given semester, a CBCS course shall be offered by a department, only when there are a minimum number of students opting for that course, as defined by that department.
- 6.6.5 A student, pursuing or has already completed a course under core/discipline elective is not eligible to pursue the same under CBCS / Open Electives category.

## **6.7 Special clauses for certain courses**

### **6.7.1 Design and/or drawing, Building Drawing**

- 6.7.1.1 Related software tools like Autocad shall be used for drawing
- 6.7.1.2 For courses such as Engineering Drawing, Machine Drawing, Building Drawing and Estimation, the relative weightage for internal evaluation and end semester examination shall be 40% and 60% respectively.
- 6.7.1.3 For internal evaluation day to day work shall be evaluated for 20 marks by the course teacher concerned based on the reports/submissions prepared in the class. The remaining 20 marks shall be awarded on the basis of two mid-term tests of duration 2 hours each with equal weightage.
- 6.7.1.4 In the end semester examination pattern for Engineering Drawing/ Engineering Graphics & Building Drawing, there shall be 5 questions, either-or type, of 12 marks each. There shall be no short answer type questions.
- 6.7.1.5 The end semester examination pattern for Machine Drawing is as follows;
- a. The duration will be for 4 hrs.

- b. Q1 Questions set on section I of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each-8 marks.
- c. Q2 Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 8 marks each-16 marks.
- d. Q3 Drawing of assembled views of section III items of syllabus with a weightage of 36 marks

### **6.7.2 Soft Skills**

- 6.7.2.1** The relative weightage for internal evaluation and end semester examination shall be 40% and 60% respectively.
- 6.7.2.2** Out of 40 marks allotted for internal evaluation, the day to day oral presentations of the students during practice hours, shall be evaluated for 20 marks by the course instructor concerned. The remaining 20 marks shall be awarded on the basis of two mid-term tests. The duration of mid-term test shall be 1 hour and 30 minutes. Student shall answer four questions (out of six) each carrying five marks. First mid-term test shall be conducted for I & II units of syllabus and second mid-term test shall be conducted for III, IV & V units. The average marks secured from I & II mid-term tests shall be the final mid-term marks.
- 6.7.2.3** In the end semester examination there shall be 5 questions, either- or type, of 12 marks each. 5 Questions shall cover one unit each with internal choice. The duration of External exam shall be 3 hours.

### **6.8 Mini Project (2 credits)**

Students shall take a Mini Project or Field Work (for Civil Engineering) during their IV Year I Semester for 2 credits. Students shall submit a Report in 3 copies to the department concerned after the work. The work shall be evaluated for 100 marks, out of which 40 marks for work execution, 20 marks for report submission and 40 marks for internal viva-voce. The evaluation shall be made by the Internal Departmental Committee (IDC), comprising of HoD, internal guide and 2 to 3 senior faculty members.

### **6.9 Project work**

Every student shall be required to undertake a suitable project in Department / Industry / Research organization in consultation with Head of the department and faculty guide and submit the project report thereon at the end of the semester in which the student is registered on dates announced by the college/department.

The project work submitted to the department shall be evaluated for 200 marks, out of which 80 marks are for internal evaluation and 120 marks for external viva-voce. The internal evaluation shall be made by the internal departmental committee (IDC), on the basis of three reviews given by each student on the topic of his project. Student shall submit 5 hard copies of the project report. The viva-voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the Principal at the end of the Semester.

In case a student fails in viva voce he /she shall reappear as and when B.Tech. IV Year II Semester supplementary examinations are conducted.

### **6.10 Technical Seminar**

A technical seminar carrying 2 credits is common for both FSI and conventional study during IV Year II Semester. Each student shall collect information on a specialized topic. He/she shall submit 3 copies of the report and deliver a seminar on the same. The report and the presentation shall be evaluated for 100 marks by a departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member.

The seminar shall be conducted anytime during the semester as per the convenience of the department committee and the student. There shall be no external examination for seminar.

### **7. Supplementary Examinations**

- a. At the end of each Semester there will be regular examinations for the current Semester. Those students who could not clear their courses in their previous attempt can appear for the examinations under supplementary category along with the regular students after registering themselves at the examination section. Supplementary examinations for all other Semesters, other than the current one will be conducted during the same period.
- b. Provided that for those candidates who have been detained in either the first or second semester of academic year 2014-15, they have to study and pass either the course Advanced Calculus (14MAT11T01) or Linear Algebra & Complex Analysis (14MAT12T02), whichever course they have not passed earlier.

### **8. Minimum Academic Requirements**

Students need to acquire necessary credits to get promoted to the subsequent academic year in addition to the attendance requirements mentioned in section no.5.

- 8.1 The minimum letter grade required for pass in each theory/practical/Seminar/Project work is “P” (internal evaluation + End Semester Examination). However a minimum of 40% marks in each theory/practical in the end semester examination have to be secured.
- 8.2 If a student found to be guilty due to malpractice in the end semester examinations, he/she shall be awarded a letter grade “F”.
- 8.3 A student shall be promoted from II to III year only if he/she acquires 40% of the credits from the courses that have been studied up to II year I semester from the following examinations, irrespective of whether the candidate takes the end semester examination or not as per the normal course of study.
  - a. One regular and three supplementary examinations of I Year I Semester.
  - b. One regular and two supplementary examinations of I Year II Semester.
  - c. One regular and one supplementary examination of II year I semester
- 8.4 A student shall be promoted from III to IV year only if he/she acquires 40% of the credits from the courses that have been studied up to III year I semester from the following examinations, irrespective of whether the candidate takes the end semester examination or not as per the normal course of study.
  - a. One regular and five supplementary examinations of I year I semester.
  - b. One regular and four supplementary examinations of I year II semester.
  - c. One regular and three supplementary examinations of II year I semester.
  - d. One regular and two supplementary examinations of II year II semester.
  - e. One regular and one supplementary examination of III year I semester.
- 8.5 In case a student is detained due to lack of required credits for promotion to the next academic year, he/she needs to obtain the same by taking the supplementary examinations.
- 8.6 Students, who fail to earn 180 credits as indicated in the course structure within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.

### **9. Transitory Regulations**

Discontinued, detained or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who are detained due to shortage of attendance or for not fulfilling academic requirements or failed after having undergone the programme in earlier regulations or have discontinued and wish to continue the programme are eligible for admission into unfinished Semester



from the date of commencement of class work with the same or equivalent courses as and when such courses are offered, subject to section 4.3 and they will be in the academic regulations into which they get readmitted.

#### **10. Withholding of Results**

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

### **11. Grading System**

#### **11.1 Letter Grade**

**11.1.1** Based on the student's performance during a given Semester, the students are awarded a final letter grade at the end of the Semester in each course. The letter grades and the corresponding grade points are as follows:

<b>Letter Grade</b>	<b>Grade points</b>	<b>Absolute marks</b>
O (Outstanding)	10	90 - 100
A+ (Excellent)	9	80 - 89
A (Very Good)	8	70 - 79
B+ (Good)	7	60 - 69
B (Above Average)	6	50 - 59
C (Average)	5	45 - 49
P (Pass)	4	40 - 44
F (Fail)	0	< 40
Ab (Absent)	0	

**11.1.2** A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than F and Ab in that course. A letter grade F or Ab in any course implies that the candidate is yet to clear that course.

**11.1.3** A course successfully completed cannot be repeated.

**11.1.4** A Semester Grade Point Average (SGPA) will be computed for each semester. The SGPA shall be calculated as follows:

$$SGPA = \frac{\sum_{i=1}^n c_i g_i}{\sum_{i=1}^n c_i}$$

Where 'n' is the number of courses registered and cleared for the semester, 'ci' is the number of Credits allotted to a particular course, and 'gi' is the grade points carried by the letter corresponding to the grade awarded to the student for the course. SGPA will be rounded off to the second place of decimal and recorded as such. The SGPA would indicate the performance of the student in the semester to which it refers.

Starting from the second semester at the end of each semester S, a Cumulative Grade Point Average (CGPA) will be computed for every student as follows:

$$CGPA = \frac{\sum_{i=1}^m c_i g_i}{\sum_{i=1}^m c_i}$$

Where 'm' is the total number of courses the student has registered and cleared from the first semester onwards up to and including the semester S, 'ci' is the number of Credits allotted to a particular course 'si' and 'gi' is the grade-point carried by the letter corresponding to the grade awarded to the student for the course 'si'. CGPA will be rounded off to the second place of decimal and recorded as such.

The CGPA would indicate the cumulative performance of the student from the first semester up to the end of the semester to which it refers.

The CGPA, SGPA and the grades obtained in all the courses in a semester will be communicated to every student at the end of every semester.

When a student gets the grade 'F' in any course during a semester, the SGPA and the CGPA from that semester onwards will be tentatively calculated, taking only 'zero point' for each such 'F' grade. After the 'F' grade(s) has/have been substituted by better grades during a subsequent semester, the SGPA and the CGPA of all the semesters, starting from the earliest semester in which the 'F' grade has been updated, will be recomputed and recorded to take this change of grade into account.

**11.1.5** Cumulative grade point average [CGPA] averaged over all the courses is calculated for the award of class.

## 11.2 Award of Class

The following Class is awarded to the student on successful completion of the B.Tech. Degree Programme depending upon the CGPA obtained;

Class	CGPA	Based on the
-------	------	--------------

First Class with Distinction	$\geq 7.5$ & $10.0$	aggregate of grades secured from the total Credits.
First Class	$\geq 6.5$ & $< 7.5$	
Second Class	$\geq 5.5$ & $< 6.5$	
Pass Class	$\geq 4.0$ & $< 5.5$	

**11.3** In case of a specific query by students/employers regarding Semester Grade Point Average (SGPA)/ Cumulative Grade Point Average (CGPA) into percentage, the following formulae will be adopted for **notional conversion of SGPA/CGPA** into percentage.

$$\text{SGPA to Percentage} = (\text{SGPA} - 0.5) \times 10$$

$$\text{CGPA to Percentage} = (\text{CGPA} - 0.5) \times 10$$

## 12. Award of Ranks

- Ranks are awarded based on the CGPA secured by the candidates for all the courses from first to final year,

Provided the candidate has:

- Completed the entire programme in the college itself (excluding MOOCs).
- Passed all the courses in first attempt only.
- Not discontinued the programme for any period during the course of study.
- Not been awarded any punishment for being involved in malpractice or indiscipline during the course of study in the Institute.
- In case, more than one student secures same CGPA, then first rank shall be awarded based on:
- Student who secured more number of letter grade “O,” “A+” and so on in decrementing order of grades.
- After applying the above clause, if a tie still exists, then all such students shall be awarded the same rank.
- Certificate and medal/award shall be given to such students as an appreciation for their achievement.

## 13. Student transfers

Student transfer shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

## 14. General

- 14.1** The academic regulations should be read as a whole for purpose of any interpretation.
- 14.2** Malpractice rules nature and punishments are appended.
- 14.3** Where the words “he”, “him”, “his” occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- 14.4** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

- 14.5** The Institute, with the approval of the Academic Council, may change or amend the academic regulations / structure / credits / syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Institute.
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**Applicable for students admitted to B.Tech. (Lateral Entry Scheme) from 2015-16 batch onwards**

**1. Admission Procedure**

- 1.1 Candidates qualified in ECET and admitted by the Convener, ECET.  
1.2 20% of the sanctioned strength in each programme of study shall be filled by the Convener, ECET as lateral entry students.

**2. Programme Pattern**

- 2.1 The medium of instruction (including examinations and project reports) shall be English  
2.2 The entire programme of study is for three academic years. All three academic years shall be on semester pattern.  
2.3 The minimum instruction days including examinations for each Semester shall be 90.  
2.4 A student eligible to appear for the end examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered.  
2.5 When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.  
2.6 The curriculum of B.Tech. programme is designed to have a total of 134 credits for the award of B.Tech. degree.  
Each course is assigned certain number of credits which will depend upon the number of contact hours (lectures & tutorials) per week. In general, credits are assigned to the courses based on the following contact hours per week per semester.  
a. One credit for each Lecture / Tutorial hour.  
b. One credit for two hours of Practicals.  
c. Two credits for three (or more) hours of Practicals.

**3. Award of B.Tech. Degree**

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

- 3.1 Pursue a course of study for not less than three academic years and in not more than six academic years.  
3.2 Register for 134 credits and secure all 134 credits.  
3.3 Students, who fail to fulfill all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech. programme and their admission stands cancelled.

**4. Minimum Academic Requirements**

Students need to acquire necessary credits to get promoted to the subsequent academic year in addition to the attendance requirements mentioned in section no.5 of B.Tech regular stream.

- 4.1 The minimum letter grade required for pass in each theory/practical course is P grade (internal evaluation + End Semester Examination). However a minimum of 40% (theory/practical) in end semester examination have to be secured.
- 4.2 A student shall be promoted from III to IV year only if he/she acquires 40% of the credits from the courses that have been studied up to III year I semester from the following examinations, irrespective of whether the candidate takes the end semester examination or not as per the normal course of study.
- One regular and three supplementary examinations of II year I semester.
  - One regular and two supplementary examinations of II year II semester.
  - One regular and one supplementary examination of III year I semester.
- 4.3 In case a student is detained due to lack of required credits for promotion to the next academic year, he/she needs to obtain the same by taking the supplementary examinations.
- 4.4 Students, who fail to earn 134 credits as indicated in the course structure within six academic years from the year of their admission, shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.
- 5. All other regulations remain the same as that of B.Tech. regular stream.**

#### **Disciplinary Action for Malpractices / Improper Conduct in Examinations**

	<b>Nature of Malpractices/Improper conduct</b>	<b>Punishment</b>
	<i>If the candidate:</i>	
<b>1. (a)</b>	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, blue tooth or any other form of material concerned with or related to the course of the examination (theory or practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
<b>(b)</b>	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the examination hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him.
<b>2.</b>	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that

		Semester/year. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that Semester/year. The candidate is also debarred for four consecutive Semesters from class work and all Semester end examinations if his involvement is established. Otherwise the candidate is debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6.	Refuses to obey the orders of the any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation,	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that Semester. If candidate physically assaults the invigilator or/ officer in charge of the examination, then the candidate is also barred and forfeit their seats. In

	assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the examination hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred and forfeits the seat.  Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year.

<b>11.</b>	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that Semester examinations depending on the recommendation of the committee.
<b>12.</b>	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

**Note:** Whenever the performance of a student is cancelled in any course(s) due to Malpractice, he/she has to register for the End semester examination in that particular course(s) consequently and has to fulfill all the norms required for award of Degree.

### Curriculum – B.Tech.Mechanical Engineering

#### Breakup of Courses

Sl. No .	Category	No. of Theory Courses	No. of Practical Courses	Project Work	Seminar	Curriculum Credits	Weightage (%)
1	Foundation Courses	10	5	--	--	46	26
2	Programme Core Courses	24	10	1+1	1	110	61
3	Discipline Electives	4	--	--	--	12	6.7
4	Open Electives	4	--	--	--	12	6.7
5	Audit Courses	2	--	--	--	--	--
	<b>Total</b>	<b>42</b>	<b>15</b>	<b>2</b>	<b>1</b>	<b>180</b>	<b>100</b>



## Curriculum Structure

Year	First Semester			Second Semester		
	Course Code	Course Name	Credits	Course Code	Course Name	Credits
<b>I</b>	14ENG11T01	Functional English	4	14ENG12T02	Technical Report Writing	3
	14MAT11T01	Advanced Calculus	4	14MAT12T02	Linear Algebra & Complex Analysis	4
	14PHY12T01	Engineering Physics	4	14CHE11T01	Engineering Chemistry	4
	14CHE11T02	Environmental Science	2	14CSU12T01	Computer Programming	4
	14EEE12T01	Basic Electrical & Electronics Engineering	3	14ME11T01	Engineering Graphics	4
	14PHY12P01	Engineering Physics Practicals	2	14CHE11P01	Engineering Chemistry Practicals	2
	14CSU11P01	Computing Practical	2	14CSU12P02	Computer Programming Practical	2
	14ME12P01	Workshop Practice	2			
		<b>Total</b>	<b>23</b>		<b>Total</b>	<b>23</b>

Year	First Semester			Second Semester		
	Course Code	Course Name	Credits	Course Code	Course Name	Credits
<b>II</b>	14MAT103	Differential Equations & Laplace Transforms	3	14MAT104	Probability & Statistics	3
	14HUM101	Principles of Economics	3	14ME106	Fluid Mechanics	3
	14ME102	Mechanics of Solids	3	14ME107	Machine Design – I	3
	14ME103	Kinematics of Machinery	3	14ME108	Dynamics of Machinery	3
	14ME104	Thermodynamics	3	14ME109	Applied Thermodynamics	3
	14ME105	Material Science & Engineering	3	14ME110	Production Techniques – I	3
		<b>Audit Course - I</b>	<b>0</b>			
	14ME202	Mechanics of Solids & Material Science Practicals	2	14ME204	Production Techniques Practicals – I	2
	14ME203	Machine Drawing Lab	2	14ME205	Dynamics Lab & Electrical Machines Practicals	2
		<b>Total</b>	<b>22</b>		<b>Total</b>	<b>22</b>

Year	First Semester			Second Semester		
	Course Code	Course Name	Credits	Course Code	Course Name	Credits
III	14ENG103	Soft Skills	3	14ME114	Prime movers & Fluid Machines	3
	14HUM102	Principles of Management	3	14ME115	Instrumentation & Control Systems	3
	14ME111	Machine Design II	3	14ME116	Finite element Methods	3
	14ME112	Heat Transfer	3	14ME117	IC Engines	3
	14ME113	Production Techniques - II	3		<b>Discipline Elective – I</b>	3
		<b>Open Elective - I</b>	3		<b>Open Elective – II</b>	3
		<b>Audit Course - II</b>	0			
	14ME206	Heat Transfer Practicals	2	14ME208	IC Engines Practicals	2
	14ME207	Production Techniques Practicals - II	2	14ME209	Fluid Mechanics & Machines Practicals	2
		<b>Total</b>	<b>22</b>		<b>Total</b>	<b>22</b>

Year	First Semester			Second Semester		
	Course Code	Course Name	Credits	Course Code	Course Name	Credits
IV	14ME118	Engineering Optimization	3			
	14ME119	Metrology & Measurements	3		<b>Discipline Elective - IV</b>	3
	14ME120	CAD / CAM	3		<b>Open Elective - IV</b>	3
		<b>Discipline Elective - II</b>	3	14ME502	Project Work	14
		<b>Discipline Elective - III</b>	3	14ME601	Technical Seminar	2
		<b>Open Elective - III</b>	3			
	14ME210	CAD/CAE/CAM Practicals	2			
	14ME211	Instrumentation & Control Engineering Practicals	2			
	14ME501	Mini Project	2			
		<b>Total</b>	<b>24</b>		<b>Total</b>	<b>22</b>

**List of Discipline Core Courses**  
**(All Courses Carry Equal Marks (100))**

Sl. No.	Course Code	Course Name	Credits
<b>Theory Course</b>			
1.	14ME102	Mechanics of Solids	3
2.	14ME103	Kinematics of Machinery	3
3.	14ME104	Thermodynamics	3
4.	14ME105	Material Science & Engineering	3
5.	14ME106	Fluid Mechanics	3
6.	14ME107	Machine Design - I	3
7.	14ME108	Dynamics of Machinery	3
8.	14ME109	Applied Thermodynamics	3
9.	14ME110	Production Techniques - I	3
10.	14ME111	Machine Design II	3
11.	14ME112	Heat Transfer	3
12.	14ME113	Production Techniques - II	3
13.	14ME114	Prime movers & Fluid Machines	3
14.	14ME115	Instrumentation & Control Systems	3
15.	14ME116	Finite element Methods	3
16.	14ME117	IC Engines	3
17.	14ME118	Engineering Optimization	3
18.	14ME119	Metrology & Measurements	3
19.	14ME120	CAD / CAM	3
<b>Practical Courses</b>			
1.	14ME202	Mechanics of Solids & Material Science Practicals	2
2.	14ME203	Machine Drawing Lab	2
3.	14ME204	Production Techniques Practicals – I	2
4.	14ME205	Dynamics Lab & Electrical Machines Practicals	2
5.	14ME206	Heat Transfer Practicals	2
6.	14ME207	Production Techniques Practicals - II	2
7.	14ME208	IC Engines Practicals	2
8.	14ME209	Fluid Mechanics & Machines Practicals	2
9.	14ME210	CAD/CAE/CAM Practicals	2
10.	14ME211	Instrumentation & Control Engineering Practicals	2
		Total	77

## List of Discipline Electives

### Discipline Electives -I

Sl. No.	Course Code	Course Name
1.	14ME401	Composite Materials & Design
2.	14ME402	Power Plant Engineering
3.	14ME403	Computational Fluid Dynamics & Applications

### Discipline Electives -II

Sl. No.	Course Code	Course Name
1.	14ME404	Introduction to MEMS
2.	14ME405	Mechanical Vibrations
3.	14ME406	Fluid Power Systems
4.	14ME407	Automation & Robotics

### Discipline Electives –III

Sl. No.	Course Code	Course Name
1.	14ME408	Solar Thermal Process Engineering
2.	14ME409	Refrigeration and Air Conditioning
3.	14ME410	Production Planning & Control
4.	14ME411	Non Destructive Testing

### Discipline Electives -IV

Sl. No.	Course Code	Course Name
1.	14ME412	Entrepreneurship
2.	14ME413	Automotive Technology
3.	14ME414	Total Quality Management
4.	14ME415	Product Lifecycle Management

**List of Open Electives (CBCS)**  
**(All Courses Carry Equal Marks (100) & Credits (3))**  
**Refer UG Regulations Clause: 6.6**

<b>Open Elective - I</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Area</b>	<b>Prerequisite Course Code / None</b>
1.	14HUM401	Professional Ethics	Humanities	None
2.	14MAT401	Numerical Analysis	Mathematics	14MAT102
3.	14CHE401	Introduction to Nano Science and Technology	Chemistry	None
4.	14PHY401	Physics of Laser and Applications	Physics	None
5.	14ECE401	Optical Communication	ECE	14ECE110
6.	14ECE402	Digital Image processing	ECE	14ECE105
7.	14ECE403	Electronic measurements & Instrumentation	ECE	14ECE103
8.	14EEE401	Modern Control Systems	EEE	14EEE108,14EEE113
9.	14EEE402	Communication Systems	EEE	14EEE104,14EEE109
10.	14EEE403	Computer Architecture	EEE	14EEE104,14EEE107
11.	14EEE416	Non-Conventional Energy Resources	EEE	None
12.	14CSU401	Service Oriented Architecture	CSE	None
13.	14CSU402	Artificial Intelligence	CSE	14CSU2T01
14.	14CSU403	Multimedia Computing	CSE	14CSU2T01
15.	14CE401	Pavement Design, Maintenance and Management	CE	14CE109
16.	14CE402	Rural water supply and sanitation	CE	14CE102, 14CE107
17.	14CE403	Green Buildings and Energy Conversion	CE	None

<b>Open Elective - II</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Area</b>	<b>Prerequisite Course Code / None</b>
1.	14HUM402	Human Resource Development	Humanities	None
2.	14MAT402	Engineering Optimization	Mathematics	None
3.	14CHE402	Green Chemistry and Catalysis for Sustainable Environment	Chemistry	None
4.	14PHY402	Optical Physics and Applications	Physics	None
5.	14ECE404	Introduction to MEMS	ECE	14ECE104
6.	14ECE405	Robotics	ECE	None
7.	14ECE406	Virtual Instrumentation	ECE	None
8.	14ECE407	Pattern Recognition and its Applications	ECE	None
9.	14EEE404	Switchgear and Protection	EEE	14EEE110, 14EEE115
10.	14EEE405	Digital Image Processing	EEE	14EEE117
11.	14EEE406	Operating Systems	EEE	14CSU101, 14EEE114
12.	14CSU404	Computer Graphics	CSE	14CSU101
13.	14CSU405	Human Computer Interaction	CSE	None
14.	14CSU406	Mobile Computing	CSE	None
15.	14CE404	Design of Pre-stressed Concrete Structure	CE	14CE105,14CE112,14CE113
16.	14CE405	Design Advanced Concrete Structures	CE	14CE113
17.	14CE406	Introduction to Bridge Engineering	CE	14CE105,14CE112,14CE113

**Open Elective - III**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Area</b>	<b>Prerequisite Course Code / None</b>
1.	14ECE408	Digital communication Techniques	ECE	14ECE110
2.	14ECE409	Biomedical Imaging	ECE	None
3.	14ECE410	Operating systems	ECE	None
4.	14ECE411	Machine Vision	ECE	None
5.	14EEE407	Power Quality	EEE	14EEE112, 14EEE115
6.	14EEE408	Introduction to MEMS	EEE	14EEE104, 14EEE109
7.	14EEE409	Mobile Telecommunication Networks	EEE	14EEE104, 14EEE109
8.	14EEE410	HVDC and FACTS	EEE	14EEE112, 14EEE116
9.	14EEE415	Design Of Photovoltaic Systems	EEE	14EEE105, 14EEE113
10.	14CSU407	Cryptography and Network Security	CSE	14CSU101, 14CSU113
11.	14CSU408	Research Methodologies	CSE	None
12.	14CSU409	Mobile Application Development	CSE	None
13.	14CSU413	Big Data Technologies	CSE	None
14.	14CE407	Construction Equipment, planning & Management	CE	None
15.	14CE408	Principles of Geographical Information Systems	CE	None
16.	14CE409	Geotechnical Earthquake Engineering and Machine Foundations	CE	14CE115,14CE119

**Open Elective - IV**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Area</b>	<b>Prerequisite Course Code / None</b>
1.	14ECE412	Satellite communication	ECE	14ECE110
2.	14ECE413	Reconfigurable computing	ECE	14ECE104
3.	14ECE414	Software for embedded systems	ECE	14ECE106
4.	14ECE415	IOT Networks	ECE	Computer Networks, Microprocessor
5.	14ECE416	RF Integrated Circuits	ECE	
6.	14EEE411	Power Apparatus & Networks	Electrical	14EEE112, 14EEE115
7.	14EEE412	Wind Electrical Systems	Electrical	14EEE103, 14EEE120
8.	14EEE413	Robotics	Electrical	14EEE103, 14EEE107, 14EEE108
9.	14EEE414	High Voltage Engineering	Electrical	14EEE101
10.	14CSU410	Distributed Databases	CSE	14CSU101, 14CSU106
11.	14CSU411	Cloud Computing	CSE	14CSU101
12.	14CSU412	Software Project Management	CSE	None
13.	14CE410	Environmental Impact Assessment	CE	14CHE102,14CE116
14.	14CE411	Introduction to Finite Element Methods	CE	14CE105,14CE112
15.	14CE412	Ground Improvement Techniques	CE	14CE115,14CE119



**List of Audit Courses**  
**(No Credits & End Exam – Only Internal Evaluation)**  
**Refer UG Regulations Clause: 6.4**

<b>Audit Course - I</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Department of</b>	<b>Prerequisite Course Code / None</b>
1.	14ENG301	Effective Public Speaking	English	None
2.	14ENG302	Creative Writing	English	None
3.	14HUM301	Entrepreneurship Development	Humanities	None
4.	14HUM302	Introduction to Intellectual Property Rights	Humanities	None
5.	14CSE301	Data Analysis Using R	CSE	None

<b>Audit Course - II</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Department of</b>	<b>Prerequisite Course Code / None</b>
1.	14ENG303	Phonetics and Spoken English	English	None
2.	14ENG304	Introductory Psychology	English	None
3.	14CSE302	Ethical Hacking	CSE	None
4.	14MBA301	Business Ethics and Corporate Governance	Management Studies	None
5.	14HUM303	National Service Scheme (NSS)*	Humanities	None

- **NSS is a field oriented course, has no internal & external evaluation**

**Semester-wise Marks**

<b>Sl. No.</b>	<b>Year/Semester</b>	<b>Total Marks</b>	<b>Credits</b>
1.	I/I	700	22/23
2.	I/II	800	24/23
3.	II/I	800	22
4.	II/II	800	22
5.	III/I	800	22
6.	III/II	800	22
7.	IV/I	900	24
8.	IV/II	500	22

# **FOUNDATION COURSES**

**Things do not happen.  
Things are made to happen.  
*John. F. Kennedy***

## B. Tech. I Year I Semester

### 14ENG11T01 FUNCTIONAL ENGLISH

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

**Course Prerequisite:** None

**Course Description:** The course content focuses on LSRW skills and vocabulary building to enrich their command over language. Relevant task based activities are also carried out to enhance their communication skills.

#### **Course Objectives:**

1. The syllabus has been designed to enhance communication skills of the students of Engineering & Technology.
2. The course enables students to communicate in English for academic and social purpose and helps them improve their grammatical accuracy and vocabulary.
3. It enhances LSRW skills and also inculcates the habit of reading for pleasure.

#### **UNIT I:**

Units from the Textbook

1. Present Past and Future
2. Communicating
3. Making things clear
  - Grammar – Tenses – Clauses – Phrases – Common Verbs
  - Vocabulary – Idioms – Word Building – Learn a Language
  - Listening & Reading Activities
  - Writing – Job Application – Describe a scene
  - Phonetics - Intonation

#### **UNIT II:**

Units from the Textbook

1. Sports & Games
2. Set in the Past
3. Do it yourself
  - Grammar – Articles – Past Events – Reporting Verbs – Relative Clauses – ing forms – Adjectives
  - Vocabulary- Issues in Sports – Idioms – Guessing unknown Words – Prefix
  - Listening & Reading Activities
  - Writing – Linking Events in a Story
  - Phonetics – Rising & Falling Tone, Stress

### **UNIT III:**

Units from the Textbook

1. Working it Out
2. In the Market – Place
3. Possibilities  
Grammar – Modals – Conditionals – Indirect Questions – Probability – Common Verbs  
Vocabulary- Jobs – Career – Advertisement – Idioms  
Listening & Reading Activities  
Writing – Giving Reasons – Weighting up Alternatives

### **UNIT IV:**

Units from the Textbook

1. Life, the Universe and everything
2. Evaluating
3. Yourself & Others  
Grammar- Adjectives & Nouns–Time Comparison-Structures-Pronouns -Common Verbs  
Vocabulary–Environment-Idioms-Adjectives-Relationships  
Listening & Reading  
Writing-Summary-Organizing Information-Draft Making

### **UNIT V:**

Units from the Textbook

1. Right and Wrong
2. Body and Mind
3. Using the Passive
4. World Affairs  
Grammar-Modals-Degrees of Comparison-Passive Forms-Reporting Verbs-Common Verbs  
Vocabulary-Forms of Medical Treatment-World Affairs-Idioms  
Listening & Reading Activities  
Writing-Causes & Results  
Pronunciation-Disagreeing politely

### **Course Outcomes:**

The students after completing the course will be able to:

1. Use LSRW skills through the prescribed text and develop ability to communicate effectively.
2. Articulate well among themselves and with Faculty.
3. Construct compound sentences using common conjunctions.
4. Manage to organize and deliver oral presentation.
5. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively.

**Text Book:**

Adrian Doff and Christopher Jones, 2000. *Language in use– Classroom Book (Upper – Intermediate)*, Cambridge University Press.

**References:**

1. Raymond Murphy's Intermediate English Grammar with CD, Raymond Murphy, Cambridge University Press, 2012.
2. Communication Skills, Sanjay Kumar & Pushpalatha, Oxford University Press, 2012.
3. Writing Tutor. Advanced English Learners' Dictionary, 9th Edition, Oxford University Press, 2015.
4. Powerful Vocabulary Builder, Anjana Agarwal, New Age International Publishers, 2011
5. Keep Talking, F. Klippel, Cambridge University Press, 2013.
6. Listening Extra, Miles Craven, Cambridge University Press, 2008.
7. Reading Extra, Liz Driscoll, Cambridge University Press, 2004.
8. Writing Extra, Graham Palmer, Cambridge University Press, 2004.
9. Speak Well, Jayashree Mohanraj et al, Orient Blackswan, 2013.

**Mode of Evaluation:** Written Examination, Day-to-day Assessment

## B. Tech. I Year I Semester

14MAT11T01

ADVANCED CALCULUS

L T P C  
4 1 0 4

**Course Prerequisite:** The basic knowledge of Trigonometry, Geometry & Calculus.

### Course Description:

Functions and Graphs; limit and continuity; applications of derivative and integral. Conics; polar coordinates; convergences of sequences and series. Maclaurin and Taylor series. Partial Derivatives. Vector Calculus in  $R^n$ , vector analysis; theorems of Green's, Stoke's and Gauss's.

### Course Objectives:

1. To avail the basic concepts of polar Graphing and Conic section.
2. To familiarize the knowledge of functions of several variables and their Derivatives, extreme values.
3. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.
4. To analyze the line integral, surface integral & volume integrals through the vector integral theorems.
5. To introduce Sequences & Series for convergence of various tests and power series expansions.

### UNIT I: POLAR COORDINATES AND CURVATURE

Polar coordinates, Graphing, polar equations of conic Sections, Integration, properties of limits, infinity as a limit, continuity and differentiability of vector functions, arc length, velocity and unit tangent vector, Curvature, Normal vector, Torsion and Binormal vector, Tangential and normal components of velocity and acceleration.

### UNIT II: FUNCTIONS OF SEVERABLE VARIABLES

Functions of severable variables, level curves, Limits, Continuity, Partial derivatives, chain Rule, Directional derivative, gradient vectors, Tangent planes & normal line, Maximum, Minimum & Saddle points of functions of two or three variables, Constrained Maxima & Minima, Method of Lagrange multipliers.

### UNIT III: MULTIPLE INTEGRALS

Double Integrals, Area, Change of integrals to Polar Coordinates, Change of order of integration, Triple Integral, Integral in Cylindrical and Spherical Coordinates.

### UNIT IV: VECTOR CALCULUS

Line integral, work, circulation, flux, path independence, potential function, conservative fields; Green's theorem in the plane, Surface area & Surface Integral; Stokes' theorem, Gauss divergence theorem.

## **UNIT V: SEQUENCES AND SERIES**

Sequence of real numbers frequently occurring limits, infinite series different tests of Convergence, series of non-negative terms, absolute & conditional convergence, alternating series, Power series, Maclaurin series, Taylor series of functions.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Understand graphing and conic sections to trace the geometric shapes of various curves like Cartesian, polar and parametric relevant to the field of Engineering.
2. Demonstrate knowledge to work in functions of several variables provides mathematical solutions to various engineering problems.
3. Apply the multiple integrals to found the region of integration in 2-Dimensions & 3-Dimensions.
4. Demonstrate knowledge of vector calculus and applications of integration to solve complex problems.
5. Apply tools for convergence of various tests and the series expansions necessary for engineering problems.

### **Text Book:**

Weir, MD, Hass J, Giordano FR: Thomas' Calculus Pearson education 12th ED, 2015.

### **References:**

1. Erwin Kreyszig - Advanced Engineering Mathematics, 8th Edition Wiley-India, 2007
2. James Stewart - Calculus, 5e, Cengage learning, 2003.
3. Monty J. Strauss, Gerald L. Bradley, & Karl J. Smith – Calculus 3rd Edition, Pearson 2007.

**Mode of Evaluation:** Assignments, Internal Mid Examinations, External End Examination.



## B. Tech. I Year I Semester

### 14PHY12T01 ENGINEERING PHYSICS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>1</b>	<b>0</b>	<b>4</b>

#### Course Description:

Mechanics, Waves and Oscillations are a basic physics course, which will cover Mechanics, Vibrations and Waves and Optics.

#### Course Objectives:

1. Expose students to the fundamental principles and laws of mechanics in physics and understanding the basic laws of nature through physics.
2. Educate students to think and participate deeply, creatively, and analytically in applying various kinds of forces in day today life.
3. Demonstrate the ability to identify and apply the appropriate analytic, numerical, computational and other mathematical reasoning, to situations of the physical world.
4. Analyze and understand the subjects Mechanics, Oscillations, Waves and Optics in preparing the students for advanced level courses.
5. Adaptability to new developments in science and technology by successfully completing or pursuing graduate education in engineering.
6. Expose students to theoretical and mathematical aspects of Interference and Diffraction techniques for mechanical testing of materials.

#### Course Syllabus:

##### UNIT I: VECTORS AND KINEMATICS AND NEWTONIAN MECHANICS

**Vectors and Kinematics:** Introduction, Vectors, Vector multiplication, Velocity and Acceleration, Motion in Plane, Polar Co-ordinates.

**Newtonian Mechanics:** Introduction, Newton's Laws, Applications of Newton's laws and everyday forces of Physics (Self reading), Constraint equations and applications.

##### UNIT II: MOMENTUM, WORK AND ENERGY

**Momentum:** Introduction, Dynamics of a system of particles, conservation of momentum, Impulse and restatement of the momentum relation, flow of mass, momentum transport.

**Work and Energy:** Introduction, Equations of motion in one-dimension and several dimensions, work energy theorem and applications, Potential energy, force, small oscillations in bound system, non-conservative forces, power, conservation laws and particle collisions.

##### UNIT III: ANGULAR MOMENTUM & INTRODUCTION TO SHM

**Angular Momentum:** Introduction, Angular momentum of particle, torque, fixed axis rotation. Dynamics of pure rotation about an axis.

**Simple Harmonic Motion:** Introduction, Displacement, velocity and acceleration in SHM. Damped Harmonic oscillator, Forced Harmonic oscillations.

#### **UNIT IV: SIMPLE HARMONIC MOTION & TRANSVERSE WAVE MOTION**

**Simple Harmonic Motion:** Energy of a simple harmonic oscillator. Superposition of vibrations along same direction and in perpendicular directions, Lissajous figures.

**Transverse wave motion:** Introduction, Waves, solution of wave equation, reflection and transmission, standing waves, energy of vibrating string, standing wave ratio, wave group and group velocity.

#### **UNIT V: PHYSICAL OPTICS**

**Physical optics:** Introduction - Interference, Newton's rings, interference from two and more sources. Diffraction, intensity distribution, Fraunhofer diffraction, Transmission diffraction grating.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Describe and explain the fundamental physical principles and laws of Mechanics in Physics.
2. Explain the role of the different realms of physics and their applications in both scientific and technological systems.
3. Apply the physical principles, together with logical and mathematical reasoning, to situations of the physical world.
4. Analyze a problem and develop the problem solving skills.
5. Define and evaluate the fundamentals of mechanical testing of materials using Interference and Diffraction techniques.

#### **Text Books:**

1. An Introduction to Mechanics, by D. Kleppner and R. Kolenkow, Tata McGraw-Hill Edition, 2007.
2. French Anthony P, Vibrations and Waves, CBS, 1987.

#### **Reference Books:**

1. The Physics of Vibrations & Waves, by H. J. Pain, 6th edition, John Wiley & Sons, Inc., 2005.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. Berkeley Physics Course Volume I, Tata-McGraw Hill.

**Mode of Evaluation:** Assignment, Written Examination.

## B. Tech I Year I Semester

14CHE11T02

ENVIRONMENTAL SCIENCE

L T P C  
2 1 0 2

### Course Prerequisite:

Basic knowledge about sciences up to intermediate or equivalent level.

### Course Description:

The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

### Course Objectives:

1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

### UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance– Need for Public Awareness. Renewable energy Resources, Solar energy-solar cells, solar batteries, wind energy, wind mills, ocean energy, tidal energy and non-renewable energy resources: LPG, water gas, producer gas. World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

### UNIT II: 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 – Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem d. Aquatic – Lake Ecosystems.

### UNIT III: BIODIVERSITY AND ITS CONSERVATION

Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India –Value of biodiversity: consumptive use, Productive use, social, ethical and aesthetic values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

#### **UNIT IV: ENVIRONMENTAL POLLUTION**

Definition, Cause, effects and control measures of : a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Nuclear hazards. Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Disaster management: floods, earthquake, cyclone and landslides.

#### **UNIT V: SOCIAL ISSUES AND THE ENVIRONMENT**

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management –Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Population growth, variation among nations. Population explosion.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. To understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. Demonstrate knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarize with biodiversity, its importance and the measures for the conservation of biodiversity.
4. Demonstrate knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Demonstrate awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

#### **Text Books:**

Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press, 2005.

#### **Reference Books:**

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2. Perspectives in Environmental Studies, Second edition, AnubhaKoushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

**Mode of evaluation:** Assignments, Internal Mid examinations and External semester end examination.

## B. Tech. I Year I Semester

14EEE12T01

## BASIC ELECTRICAL & ELECTRONICS ENGINEERING

L T P C

3 2 0 3

**Course Prerequisite:** None

### Course Description:

This course is designed to provide basic understanding on electrical and electronic engineering. The course material can be used as a starting point for further study in individual disciplines or topics. This need will come for non-electrical or electronic students at a later stage in their carrier growth.

Course covers basic passive and active circuit elements, network analysis, network theorems, introduction to single-phase and three-phase AC Systems, magnetic circuits, transformers, electrical machines, semi-conductor diodes and their applications, transistors and their applications.

### Course Objectives:

1. To learn the basics of the Electrical and Electronics Engineering
2. To learn basic Electric & Magnetic Circuits
3. To learn the construction and Operation of Transformers, D.C. and A.C. rotating Machines
4. To learn basics of Semiconductor Devices

### UNIT- I: DC CIRCUIT ANALYSIS

Voltage and current sources, resistors and ohm's law, KCL, KVL, Independent and Dependent sources, Instantaneous power, Nodal and Mesh Analysis, Linearity and Superposition application in circuit analysis, Source transformation, Inductors and capacitors and their integral relationships, First order circuits.

### UNIT- II: AC CIRCUIT ANALYSIS

A.C. Voltage & Current, Complex numbers, Frequency-domain analysis, Power and Power-factor, First order circuits, Poly-phase circuits.

### UNIT- III: MAGNETIC CIRCUITS AND TRANSFORMERS

Magnetic circuits and materials. Introduction, Ideal transformer, Equivalent circuit, Non-ideal transformer, Regulation and efficiency.

### UNIT - IV: DC AND AC ROTATING MACHINES

DC machine Construction, Armature reaction and commutation, Methods of excitation and speed control, Principle of operation of Induction motor and Synchronous motor.

### UNIT -V: INTRODUCTION TO SEMICONDUCTOR DEVICES

V-I characteristics of junction diode, Ideal diode, Non ideal diode, clipper Half wave rectifier, Full wave rectifier, bridge rectifier. PNP and NPN transistors and the operating zones, BJT as amplifier and biasing techniques.

**Course Outcomes:**

The students after completing the course will be able to:

1. Analyze the D.C., A.C. electrical circuits and magnetic circuits.
2. Apply the electrical circuit concepts to practical circuits.
3. Analyze the magnetic circuits.
4. Analyze the components of transformers, rotating electrical machines and their operation.
5. Identify electronic components and their use in practical circuits.

**Text Book:**

Leonard S. Bobrow: Fundamentals of Electrical Engineering, Oxford University Press, Second Edition, 2005.

**Reference:**

Hughes: Electrical and Electronic Technology, Pearson Education, Ninth Edition, 2008.

**Mode of Evaluation:** Assignment, Written Examination

## B. Tech. I Year I Semester

### 14PHY12P01 ENGINEERING PHYSICS PRACTICALS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

#### Course Description:

Experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

#### Course Objectives:

1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

#### List of Experiments: (Any 10 Out of 12)

1. Error Analysis and Graph Drawing
2. Spring constant - Coupled Pendulums
3. Frequency of the tuning fork - Melde's apparatus
4. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
5. Study of resonance effect in series and parallel LCR circuit
6. Determination of radius of curvature of a curved surface - Newton's Rings
7. Width of single slit - Diffraction due to Single Slit
8. Wavelength of the spectral lines - Diffraction Grating
9. Dispersive power of prism – Spectrometer.
10. Wavelength of a laser - Diffraction Grating
11. Thickness of a given wire - Wedge Method.
12. Energy gap of a material of p-n junction.

#### Course Outcomes:

The students after completing the course will be able to:

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Know about the characteristics and the behavior of various materials in a practical manner and gain knowledge about various optical technique methods.
3. Understand the characteristics and the behavior of various materials in a practical manner and gain knowledge about various experimental techniques and their usage.
4. Verify the theoretical ideas and concepts covered in lecture by completing a host of experiments.
5. Acquire and interpret experimental data to examine the physical laws.

**Lab Manual:** Laboratory Manual for Engineering Physics.

**Reference Books:**

1. Advanced Practical Physics for students, B.L.Worsnop and H.T. Flint, Metheun London, 1942.
2. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th edition, McGraw-Hill Inc., 1981.
3. Optics, A. Ghatak, 4th Edition, Tata McGraw-Hill, New Delhi 2011.

**Mode of Evaluation:** Continuous Internal Evaluation, Practical Examination.



## B. Tech. I Year I Semester

14CSU11P01

COMPUTING PRACTICALS

L	T	P	C
0	0	3	2

**Course Prerequisite:** None

### Course Description:

This course introduces how to solve problems using flowcharts and programming concepts. The focus is on developing students to understand and apply the concepts of programming using python. A practical introduction to computing that will build students confidence and familiarity with computer programming.

### Course Objectives:

1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of python.
3. Get acquaintances with classes and objects, stacks and queues using python.

### List of Experiments:

#### Week 1

- a) Develop animated models using scratch tool.

#### Week 2

- a) Develop the flowchart for finding a number is even or odd.
- b) Develop a flowchart for displaying reversal of a number.
- c) Develop a flowchart for finding biggest number among three numbers.

#### Week 3

- a) Develop a flowchart for swapping two values using functions.
- b) Develop a flowchart to sort the list of numbers.
- c) Develop a flowchart to find largest element in an array.

#### Week 4

- a) Implement Python script to read person's age from keyboard and display whether he is eligible for voting or not.
- b) Implement Python script to find biggest number between two numbers.

#### Week 5

- a) Implement Python Script to generate prime numbers series up to n.
- b) Implement Python Script to check given number is palindrome or not.
- c) Implement Python script to print factorial of a number.

**Week 6**

- a) Implement Python Script to perform various operations on string using string libraries.
- b) Implement Python Script to check given string is palindrome or not.

**Week 7**

- a) Define a function max\_of\_three() that takes three numbers as arguments and returns the largest of them.
- b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000.

**Week 8**

- a. Define a function which generates Fibonacci series up to n numbers.
- b. Define a function that checks whether the given number is Armstrong.

**Week 9**

- a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number.  
Suppose the following input is supplied to the program: 34, 67, 55,33,12,98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34', '67', '55', '33', '12', '98').
- b) With a given tuple (1, 2,3,4,5,6,7,8,9,10), write a program to print the first half values in one line and the last half values in one line.

**Week 10**

- a) Write a python script to perform basic dictionary operations like insert, delete and display.
- b) Write a python script to find frequency of words in a file using dictionaries.

**Week 11**

- a) Write Python script to display file contents.
- b) Write Python script to copy file contents from one file to another.

**Week 12**

- a) Define a class named Rectangle which can be constructed by a length and width. The Rectangle class has a method which can compute the area.
- b) Define a class named Circle which can be constructed by radius. The derived classes Area, Circumference uses methods called calArea(), calCirc() respectively to calculate area, circumference of circle.

**Week 13**

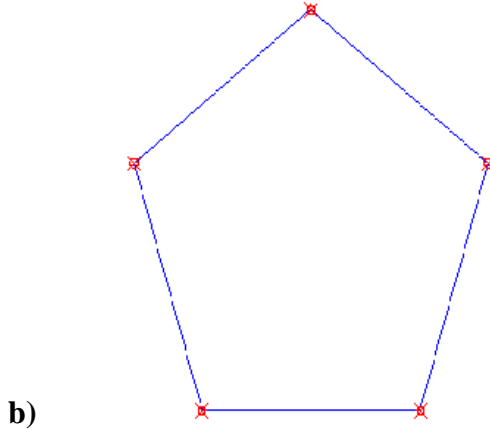
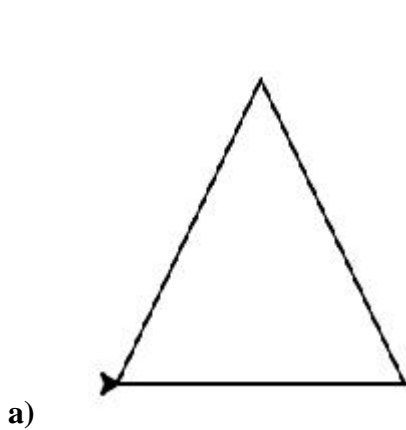
- a) Implement Python script to develop stack ADT and its operations.
- b) Implement Python script to evaluate postfix expression.

**Week 14**

- a) Implement Python script to develop queue ADT and its operations.
- b) Implement Python script to perform tree traversals.

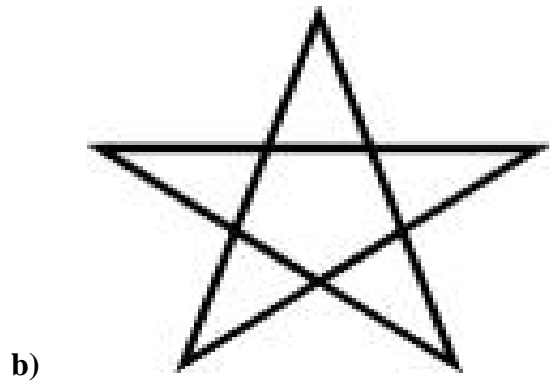
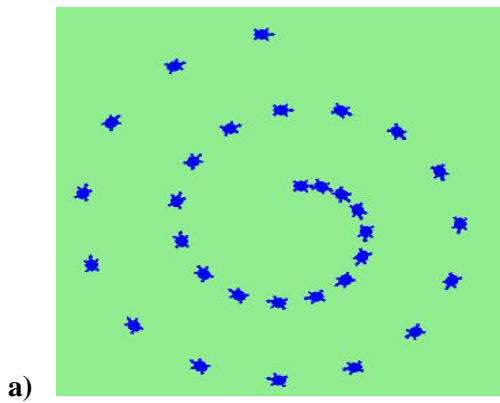
**Week 15**

Write a python script to display following shapes using turtle.



**Week 16**

Write a python script to display following shapes using turtle.



**NOTE:** Concepts related to Lab programs will be covered in Lecture hours.

**Course Outcomes:**

The students after completing the course will be able to:

1. Apply problem solving techniques to find solutions to problems.
2. Able to use python effectively and implement solutions using it.
3. Identity the stack and queues for a given problem or application.
4. Demonstrate improved logical and programming skills.

**Mode of Evaluation:** Assignment, Mid Exam, Written Examination, Practicals

## B. Tech. I Year I Semester

### 14ME12P01 WORKSHOP PRACTICE

L	T	P	C
0	0	3	2

**Course Prerequisite:** None

**Course Description:** Introduction to Casting, metal forming, forging, welding and brazing, metal cutting machines e.g., lathe, shaper, drilling, grinding; laboratory exercise involving machining, fitting and joining.

#### Course Objectives:

1. The objective of this course is to learn how the physical things we use are manufactured and gain technical knowledge and skills.
2. The concept based knowledge will be useful in all the disciplines the students are going to specialize.
3. The students are exposed to all the manufacturing processes i.e. Machining, Casting, Joining processes, metal forming, and Sheet metal work.
4. The students are exposed to resources in manufacturing and usage of computers in manufacturing.
5. Also brief review of the properties and heat treatment of common engineering materials and of measuring and gauging tools are also included.

#### Trades:

1. Carpentry
2. Welding
3. Fitting
4. Foundry
5. Black smithy
6. Sheet metal
7. Machine shop
8. Metrology
9. CNC programming
10. Manufacturing simulation

#### Course Outcomes:

The students after completing the course will be able to:

1. Measure linear, angular and radial dimensions using instruments like Vernier caliper, sine bar micro-gauge and height gauge.
2. Fabricate simple products using the operations of machine cutting, manual fitting, tin smithy, gas welding and arc welding.
3. Perform basic operations in carpentry, black smithy and foundry.
4. Write, upload and execute simple CNC programs on CNC machines for operations like plane turning and face turning.
5. Design and analyze simple workflow layouts in production and service industries using FlexSim software.

**Text Book:**

B S NagendraParashar and R K Mittal, Elements of Manufacturing Process, Prentice Hall of India, 2008, 6th print.

**Reference:**

Campbell J.S., Principles of Manufacturing Materials and Processes, Tata Mc-Graw-Hill, New Delhi, 1999 print.

**Mode of Evaluation: End exam, Practicals**

**B. Tech. I Year II Semester**

**14ENG12 T02**

**TECHNICAL REPORT WRITING**

**L T P C**  
**2 0 3 3**

**Course Prerequisite:** 14ENG101

**Course Description:** Today's Professional world demands effective transfer of technical Report Writing in the form of correspondence, talks, discussions, and documents more than ever before. Such forms of Communication not only reflect the knowledge and achievements of engineers, scientists, and other professionals but also act as the public face for organizations, reflecting their policies and achievements. Technical Communication is essentially formal, and hence requires a standard format for disseminating technical messages.

**Course Objectives:**

The objective of the course is to understand the process of effective communication by enhancing the learner's reading with understanding for note making and note taking as well as decision making and thereby leading to writing skills, which would then be used to write documents like technical reports and basic business communication.

**UNIT I:**

Communication Process - Communication networks- formal and informal - Barriers to communication.

**UNIT II:**

Reading - Surveying text - reading for important points - making inferences - identifying text structure - reading graphics - comparing sources - critical reading - comparing viewpoints.

**UNIT III:**

Writing - Effective Writing - Elements- Choice of Words and Phrases - Sentence Construction and Length - Technical Style of Writing - Business Style of Writing.

**UNIT IV:**

Report Writing - Basic Business communication - Types of Reports.

**UNIT V:**

Data Collection - Preparatory Steps - Sources of Data Methods of Data Collection - Mail Questionnaire - Report Structure - Data Analysis & Illustrations - Editing and proofreading - using technical tools for effective technical writing.

**Course Outcomes:**

The students after completing the course will be able to:

1. Do documentation, presentation, discussions and develop communicative competence.
2. Do critical reading and comparing texts and their viewpoints.
3. Do effective writing using Sentence structures.
4. Draft Technical and Business style of writing.
5. Prepare Questionnaire for preparing the report which will assist them for doing research work.

**Text Book:**

Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing. Fourth Edition. New Delhi: Tata McGraw Hill and Post-lecture reading material.

**References:**

1. Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principles and Practice, 2/e. New Delhi: Oxford University Press.
2. Gerson, Sharon J and Steren M. Gerson. 2011. Technical Writing : Process and Product. Third Edition. India : Pearson Education Asia.
3. Mishra, Sunita and C. Muralikrishna. 2004. Communication Skills for Engineers. Delhi: Pearson Education Pte. Ltd.
4. Krishna Mohan and Meenakshi Raman. 2010. Advanced Communicative English. New Delhi : Tata McGraw Hill
5. Eric H. Glendinning, Beverly Holmström Study Reading: A Course in Reading Skills for Academic Purposes, Cambridge University Press, 2004
6. Liz Hamp-Lyons, Ben Heasley Study Writing: A course in writing skills for academic purposes Cambridge University Press 2006
7. Thomas N Huckin and Olsen Technical Writing & Professional Communication McGraw-Hill, 1991
8. William Strunk Elements of Style B N Publishing 2007 (E book available)
9. Dorothy E Zemach and Lisa A Rumisek College Writing: From Paragraph to Essay Macmillan 2003 (e-book available).

**Online Sources:**

1. <http://owl.english.purdue.edu/>
2. <http://www.uefap.com/>
3. <http://www.nicenet.com>

**Mode of Evaluation:** Written Examination, Day-to-day Assessment

## B. Tech. I Year II Semester

14MAT12T02

## LINEAR ALGEBRA & COMPLEX ANALYSIS

L	T	P	C
4	1	0	4

**Course Prerequisite:** 14MAT101

### Course Description:

The course is meant as an introduction to Linear Algebra and Theory of Complex variable functions and their applications. Vector spaces, Basis and Dimension of vector spaces. Linear transformations, Range and Kernel. Elementary row operations, System of linear equations. Eigenvalues and Eigenvectors. Complex functions and their analyticity. Elementary complex functions, Complex integration. Taylor and Laurent series expansions. Calculus of Residues and their applications.

### Course Objective:

1. To introduce System of linear equations, Vector spaces, basis and dimension etc.
2. To emphasize the role of Linear transformations, Elementary row operations, Eigenvalues and Eigenvectors.
3. To analyze the Functions of Complex variables and their analyticity.
4. To familiarize the knowledge of Elementary complex functions, complex integration.
5. To avail the basic concepts of Laurent series expansions. Calculus of residues and their applications.

### UNIT-I: MATRICES & VECTOR SPACES

Solutions of linear systems of equations, The inverse of a matrix, Vector spaces, subspaces, linear independence, basis and dimension. Rank and inverse of a matrix and applications. Co-ordinates and change of basis.

### UNIT-II: LINEAR TRANSFORMATIONS

Definition and examples, kernel and range of linear transformation. The matrix of a linear transformation, Composite and invertible linear transformations, Eigenvalues and Eigenvectors.

### UNIT-III: FUNCTIONS OF COMPLEX VARIABLES

Complex numbers, Functions of a complex variables, Limit and continuity, Derivative, CR-equations, analytic functions.

### UNIT-IV: ELEMENTARY FUNCTIONS & COMPLEX INTEGRATION

Exponential, trigonometric and hyperbolic functions, Logarithmic functions, Complex exponents, inverse functions, Contour integrals, anti-derivatives. Cauchy-Goursat theorem, Cauchy Integral formula, Morera's theorem (No proof).



## **UNIT-V: LAURENT SERIES & THEORY OF RESIDUES**

Fundamental theorem of algebra, Liouville's theorem, Laurent series (No proof), Residues, Cauchy Residue theorem, Improper real integrals.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Solve system of equations and matrix applications, acquire knowledge on vector spaces.
2. Find the linear transformations and eigenvalues, eigenvectors of a matrix
3. Understand the concept of complex functions using CR-equations.
4. Gain knowledge of various types of functions in complex variables and evaluation of complex integrals.
5. Demonstrate adequate knowledge of Laurent series expansion and find residues at singular points.

### **Text Books:**

1. Elementary linear Algebra by Stephen Andrilli and David Hecker, 4th Edition, Elsevier, 2010
2. Complex variables and applications by R. V Churchill and J. W. Brown, 8th edition, 2008, McGraw-Hill.

### **References:**

1. Linear Algebra and its Applications by D.C. Lay, 3rd edition, Pearson Education, Inc.
2. Complex Variables with Applications by A. D. Wunsch, 3rd edition, Pearson Education, Inc.

**Mode of Evaluation:** Assignments, Internal Mid Examinations, External End Examination.

## B. Tech I Year II Semester

### 14CHE11T01 ENGINEERING CHEMISTRY

L T P C  
4 1 0 4

#### Course Prerequisite:None

Basic Chemistry at Intermediate or equivalent level.

#### Course Description:

It deals with basic principles of various branches of chemistry like physical, organic, analytical and material chemistry.

#### Course Objectives:

1. To analyse water impurities and determine its hardness, alkalinity and dissolved oxygen content.
2. To understand the basic concepts of thermodynamics and chemical kinetics.
3. To introduce the basic concepts of IR spectroscopy and its applications in study of progress of various organic reactions.
4. To familiarize the basic concepts of electrochemistry and its influence in corrosion.
5. To impart the importance of various engineering materials and to get familiarity with their applications in day to day life.

#### UNIT 1: WATER, WASTE WATER CHEMISTRY AND ANALYSIS

Impurities in water, Hardness of water, determination of hardness by EDTA Method and Numerical Problems, alkalinity, Chemical analysis of water: Dissolved Oxygen, Chlorides, Softening of water by Ion Exchange and Reverse Osmosis method. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization- chlorination and ozonization. Concept of break point chlorination.

#### UNIT II: THERMODYNAMICS AND CHEMICAL KINETICS

Thermodynamics: Thermodynamic Systems, State Functions, Thermal Equilibrium and Temperature, Work, Internal Energy and Heat Transfer, Heat Capacity. Natural and Reversible Processes, Entropy and Second Law, Entropy Changes in (a) accompanying change of phase, isothermal and (c) isobaric processes. Standard free energy change in chemical reactions. Chemical Kinetics: Rate Laws, Order, Rate Constants, Arrhenius Equation, Rate-determining step, Reaction mechanisms.

#### UNIT III: INSTRUMENTAL METHODS OF ANALYSIS AND POLYMERS

Instrumental methods: Infrared spectroscopy-principle and applications. Chromatography – classification (paper, thin layer and gel permeation) and uses. Nucleophilic substitution reactions (both SN1 and SN2) of alkyl halides. Elimination reaction of alkyl halides; Addition reactions to  $>C=C<$  bond. Classification of Polymers, Types of polymerization, Molecular weight of polymers- number average and weight average molecular weights, plastics, some important commercial thermoplastics: polyvinyl chloride, Teflon / Poly Tetra Fluoro Ethylene (PTFE), Nylon, Poly Ethylene Terephthalate (PET), Poly Ethylene (PE) or Polythene, Poly Styrene (PS) and thermosetting resins: Bakelite, Elastomers: Polyisoprene, Polyurethane, Synthetic rubbers: Buna-S Rubber, Buna-N Rubber, Polyurethane (or) Isocyanate rubber, Thiokol rubber, Silicon rubber.

#### **UNIT IV: ELECTROCHEMISTRY AND CORROSION**

Types of electrolytes, Electrochemical cells, Electrode potential, Galvanic cells, Nernst equation, Measurement of EMF, types of electrodes, concentration cells, Batteries- Lead-acid, Ni-Cd, Lithium and Lithium ion batteries. Hydrogen- oxygen fuel cell-principle and applications. Corrosion: Types of corrosion, Factors influencing rate of corrosion, Corrosion control methods, Protective coatings.

#### **UNIT V: ENGINEERING MATERIALS & NANO SCIENCE**

Cementing materials - Lime, Cement, Gypsum, Refractories, Abrasives, Insulators, Liquid crystals – classification and applications. Lubricants – definition, classification, Extreme pressure lubrication mechanism, important properties – viscosity, viscosity index, saponification number, flash point and pour point. Introduction to nanoscience and nanomaterials, synthesis – sol-gel and hydrothermal methods, characterization by powder XRD (Scherrers equation) and photo-catalytic application – dye degradation.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Understand the impurities in water and can determine its hardness, alkalinity and dissolved oxygen content.
2. Familiarize with thermodynamic systems, work done, internal energy, entropy and Standard free energy change in chemical reactions.
3. Understand the principles and applications of IR, Paper Chromatography, TLC, GPC/SEC.
4. Demonstrate knowledge of electrochemical cells, lead acid batteries, Ni-Cad batteries, lithium ion Batteries, lithium batteries, and methanol oxygen fuel cells.
5. Demonstrate exposure to the basic engineering materials such as cementing, lubricants, Refractories, Abrasives, Insulators, Liquid crystals and nanomaterials.

#### **Text Books:**

1. P.W. Atkins & Julio de Paula, 'The Elements of Physical Chemistry', Fifth edition (Oxford University Press, Oxford 2009).
2. T. W. Graham Solomons and Craig B. Fryhle, 'Organic Chemistry', 10th Edition, John Wiley & Sons, Inc. New York, 2011.
3. Dr S. S. Dara and Dr S. S. Umare, A Text book of Engineering Chemistry, S. Chand & Company Ltd, 2000 1st Ed.

#### **Reference Books:**

1. D. W. Ball, 'Physical Chemistry', First Edition, India Edition (Thomson, 2007).
2. L. G. Wade, Jr. and M. S. Singh, 'Organic Chemistry', 6th Edition, Pearson Education Inc., 2006.
3. Perry and Green, Perry's Chemical Engineers' Handbook, 9th Edition, Section 2, McGraw Hill
4. Dr Suba Ramesh and others, Engineering Chemistry, Wiley India, , 2011, 1st Ed
5. K. N Jayaveera, G. V. Subba Reddy and C. Rama Chandraiah, Engineering chemistry, 1st Ed. 2013, McGraw Hill education.

**Mode of Evaluation:** Assignments, Internal Mid Examinations and external semester end examination.

## B. Tech. I Year II Semester

14CSU12T01

COMPUTER PROGRAMMING

L T P C  
3 1 0 3

**Course Prerequisite:** None

### Course Description:

This course is an introduction to the theory and practice of computer programming, the emphasis of this course is on techniques of program development within the structure and object-oriented paradigm. Topics include C program basics, control structures, arrays, files, pointers, objects, classes, inheritance, and data structures.

### Course Objectives:

1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Get acquaintances with data structures, searching and sorting techniques using C++ generic programming.

### UNIT I: C PROGRAMMING

Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions. **Control Structures:** Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

### UNITII: FUNCTIONS

Functions Introduction, User defined function, accessing a function, Function prototypes, storage classes  
**Arrays:** Defining an array, processing an array, one dimensional arrays, two dimensional arrays  
**Searching:** Linear and Binary. **Sorting:** Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, and Quick Sort.**Pointers:** Fundamentals, Pointer Declarations, Pointers and one dimensional array, Dynamic memory allocation.

### UNITIII: STRINGS

Declaring and Defining a string, Initialization of strings, , Strings Library functions **Structures:** Defining a structure, Processing a structure Files: File Definition, Opening and closing a data file, Reading and Writing a data file, Files I/O Functions.

### UNITIV: C++ PROGRAMMING

Objects, Class Definition, Class Members, Access Control, Constructors and destructors, parameter passing methods, , dynamic memory allocation and deal location (new and delete), Generic Programming- Function and class templates, Inheritance basics, base and derived classes, inheritance types, base class access control

## **UNITV: DATA STRUCTURES**

Classification of Data Structures. **Stacks and Queues:** Stacks, Stacks Operations, Stack Implementation by using arrays, Queues, Queues Implementation by using arrays, Types of Queues. **Linked Lists:** Single Linked lists, Operations

### **Course Outcomes:**

The students after completing the course will be able to:

1. Effectively apply problem solving techniques in designing the solutions for a wide-range of problems.
2. Choose appropriate data structure and control structure depending on the problem to be solved.
3. Effectively use existing data structures and design new data structures appropriate to the problem to be solved.
4. Modularize the problem and also solution.
5. Use appropriate searching and sorting technique to suit the application.

### **Text Books:**

1. The C Programming Language, Kernighan and Ritchie, 2 ndEdition, Prentice Hall, India, 1988.(UNITS-I, II, III)
2. C++: The Complete Reference. Third Edition. Herbert Schildt. Osborne McGraw-Hill. Berkeley New York St. Louis San Francisco. Auckland Bogotá Hamburg .(UNIT-IV)
3. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition,Universities Press Orient Longman Pvt. Ltd.(UNIT-V)

### **References:**

1. Programming in ANSI C, E. Balagurusamy, Sixth Edition, Tata Mc-Graw Hill Publishing Co.Ltd.- New Delhi
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5 th edition, 2007.
3. Fundamentals of Data Structures in C++ by Ellis Horowitz, SartajSahni, Dinesh
4. Mehta, Universities Press, Second Edition.
5. Lipmen C++ Book.

**Mode of Evaluation:** Assignment, Written Examination.

## B. Tech. I Year II Semester

### 14ME11T01 ENGINEERING GRAPHICS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>4</b>	<b>4</b>

**Course Prerequisite:** None

#### **Course Description:**

Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

#### **Course Objectives:**

1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

#### **UNIT I: INTRODUCTION TO AUTO CAD**

Introduction to AutoCAD commands, simple drawings, Orthographic Projections-Theory, techniques, first angle projections, multi view drawing from pictorial views.

#### **UNIT II: PROJECTIONS OF POINTS & LINES**

Projections of points: Positions, notation system and projections.

Projections of lines: positions, terms used, different cases, traces of lines and finding true lengths, auxiliary projections.

#### **UNIT III: PROJECTIONS OF PLANES & SOLIDS**

Projections of planes: positions, terms used, different cases and projections procedure

Projections of Solids: Projections of Regular Solids inclined to one planes.

#### **UNIT IV: SECTIONS AND DEVELOPMENTS OF SOLIDS**

Section Planes and Sectional View of Right Regular Solids-Prism, cylinder. True shapes of the sections.

Development of Surfaces of Right Regular Solids-Prism, Cylinder and their Sectional Parts.

#### **UNIT V: INTERSECTIONS & ISOMETRIC PROJECTIONS**

**Intersections of surfaces of solids:** Intersection between: Line-plane, Plane-plane, line-solid, solid-solid.

**Isometric Projections:** Theory of isometric drawing, construction of isometric projection from orthographic.

**Course Outcomes:**

The students after completing the course will be able to:

1. Identify various commands in AutoCAD and their usage for engineering graphics
2. Draw the projections of points and straight lines with AutoCAD
3. Draw the projections of the planes and sections of solids.
4. Sketch the intersections of surfaces and developments of solids
5. Draw the conversion of the orthographic views to isometric views and vice versa.

**Text Book:**

D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.

**References:**

1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008.
2. Warren J. Luzadder & Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.ss

**Mode of Evaluation:** Assignment and Written Examination

## B. Tech I Year II Semester

14CHE11P01

ENGINEERING CHEMISTRY PRACTICALS

L	T	P	C
0	0	3	2

**Course Prerequisite:** None

**Course Prerequisites:** Basic Chemistry at Intermediate or equivalent level.

**Course Description:**

It deals with basic principles of various volumetric and instrumental analytical methods.

**Course Objectives:**

1. To impart students a better training in analysis of chemical and instrumental methods.
2. To develop skill in analysis and estimation of a given sample by chemical and instrumental methods.
3. To bridge theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in engineering.

**Volumetric Analysis**

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of Copper (II) in water by Iodometry.
3. Estimation of Dissolved Oxygen by Winkler's method.
4. Estimation of alkalinity of water sample.
5. Estimation of Acidity of water sample.
6. Estimation of Iron (II) in waste water by dichrometry.
7. Estimation of copper ion by using standard EDTA.

**Instrumental Method of Analysis**

1. Determination of unknown strength of an acid solution by conductometric titration (Neutralisation Titration)
2. Conductometric titration of  $\text{BaCl}_2$  Vs  $\text{Na}_2\text{SO}_4$  (Precipitation Titration)
3. Dissociation constant of weak electrolyte by Conductometry
4. Determination of manganese by colorimetry
5. Estimation of ferrous ion by potentiometric titration (Redox Titration).

**Course Outcomes:**

The students after completing the course will be able to:

1. Carry out chemical analysis volumetrically
2. Estimate hardness, alkalinity and dissolved oxygen in the given water sample.
3. Handle and operate instruments to estimate various ions present in the given samples.

**Lab Manual:**

Engineering Chemistry Lab Manual, Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.

**Mode of evaluation:** Continuous cumulative evaluation of the lab experiments, record, Viva-voce and external lab examination.



## B. Tech. I Year II Semester

14CSU12P02

## COMPUTER PROGRAMMING PRACTICALS

L	T	P	C
0	0	3	2

**Course Prerequisite:** None

### Course Description:

This course is to apply the concepts of computer programming in a practical approach; the emphasis of this course is on techniques of program development within the structure and object-oriented paradigm. Implementation of program include C program basics, control structures, arrays, files, pointers, objects, classes, inheritance, and data structures.

### Course Objectives:

1. To make the student learn C Programming language.
2. To make the student solve problems, implement those using C & C++ programming languages.
3. To strengthen the ability to identify and apply the suitable data structure for the given real world problem.

### List of Experiments:

1. a) Write a C program to swap the two numbers.  
b) Write a C program to find the roots of a quadratic equation.  
c) Write a C program to compute the factorial of a given number.
2. a) Write a C program to find the series of prime numbers in the given range.  
b) Write a C program to generate Fibonacci numbers in the given range.
3. a) Write a C program to check for number palindrome.  
b) Write a C program to generate Pascal Triangle.
4. Implement the following operations on matrices using C  
a) Sum of Two Matrices      b) Product of Two matrices      c) Transpose of Matrix
5. Write a C program to find Factorial, GCD, fibonacci, towers of hanoi, sum of digits, base conversions, reversal of numbers. (Using recursion).
6. Write a C program to implement all string operations(strlen(), strcpy(), , strcmp(), strcat(), strcmp(), strstr(), strchr()) without using standard string library functions.
7. Write a C program to find the student grade by using structures.
8. Write a C program to perform the operations addition, subtraction, multiplication of complex numbers using structures.
9. Write a C program to copy the file contents from one file to another file(pass file names as command line arguments).
10. Implement the following searching techniques using C++ templates (Generic Programming)  
a) Linear Search      b) Binary Search
11. Implement the following sorting techniques using C++ templates  
a) Bubble Sort      b) Selection Sort      c) Insertion Sort
12. Implement the following sorting techniques using C++ templates  
a) Merge sort      b) Quick sort.
13. Implement the following Data Structures using C++ templates  
a) Stack ADT      b) queue ADT      c) Circular queue ADT

14. Write a C++ Program to convert infix to postfix expression and its evaluation.
15. Implement Singly linked list ADT and operations(Insertion, Deletion, Traversing

**Course Outcomes:**

The students after completing the course will be able to:

1. Apply problem solving techniques to find solutions to problems.
2. Use C & C++ languages features effectively and implement solutions using C & C++ languages.
3. Identify the appropriate data structure for a given problem or application.
4. Demonstrate improved logical and programming skills.
5. Write Data Structures using C++ templates

**References:**

1. “Programming with C”, Byron Gottfried, Third Edition, Schaum’s Outlines, McGraw Hill
2. “Fundamentals of Data Structures in C”, Horowitz, Sahni, Anderson-freed, SecondEdition, Universities Press.
3. “The C Programming Language”, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
4. “Classic Data Structures”, Samantha, PHI
5. Fundamentals of Data Structures in C++ by Ellis Horowitz, SartajSahni, Dinesh Mehta, Universities Press, Second Edition.
6. “Pointers in C”, YeswantKanetkar, BPB publications.

**Mode of Evaluation:** Practical

Intentionally Left Blank

## **PROGRAMME CORE COURSES**

**If opportunity doesn't knock,  
Build a door.**  
*Milton Berle*

## B. Tech. II Year I Semester

### 14MAT103 DIFFERENTIAL EQUATIONS & LAPLACE TRANSFORMS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14MAT101& 14MAT102

#### **Course Description:**

This course reviews and continues the study of differential equations with the objective of introducing classical methods for solving boundary value problems. This course serves as a basis of the applications for differential equations, Fourier series and Laplace transform in various branches of engineering and sciences. This course emphasizes the role of orthogonal polynomials in dealing with Sturm-Liouville problems.

#### **Course Objectives:**

1. To prepare students for lifelong learning and successful careers using mathematical concepts of ordinary differential equations
2. To avail knowledge of system of first order equations and power series solutions
3. To train the students in the applications of Second order equations and to emphasize the role of special functions.
4. To familiarize the knowledge of Laplace transform
5. To introduce Fourier series and the classical methods for solving boundary value problems

#### **UNIT I: DIFFERENTIAL EQUATIONS**

Introduction- General Remarks on Solutions- Families of Curves- Orthogonal Trajectories - Growth, Decay, Chemical Reaction and Mixing-Falling Bodies and other Motion Problems- Homogeneous Equations- Exact Equations-Integrating Factors-Linear Equations-Bernoulli's Equation. Introduction of Second Order Linear Equations-General solution of the Homogeneous Equation - Wronskian-The Homogeneous Equation with constant Coefficients, Euler's Equi-dimensional equation-The Method of Variation of Parameters-Higher Order Linear Equations-Operator Methods for Finding Particular Solutions.

#### **UNIT II: SYSTEM OF FIRST ORDER EQUATIONS AND POWER SERIES SOLUTIONS**

General remarks on Systems -Linear Systems-Homogeneous Linear Systems with Constant Coefficients. A Review of Power Series-Series Solutions of First Order Equations- Second order Linear Equations- Ordinary Points-Regular Singular Points - Frobenius method.

#### **UNIT III: APPLICATIONS OF SECOND ORDER EQUATIONS &SPECIAL FUNCTIONS**

Applications of Second order equations - Legendre polynomials-Properties of Legendre polynomials-Gamma Functions - Bessel Functions-Properties of Bessel functions.

#### **UNIT IV: LAPLACE TRANSFORMS**

Introduction- Remarks on Theory-Applications to Differential Equations-Derivatives and Integrals of Laplace Transforms – Convolutions -Unit Step and Impulse function.

#### **UNIT V: FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS**

The Fourier coefficients-The problem of Convergence-Even and Odd functions-Cosine and Sine Series-Extension to Arbitrary intervals.

Eigen values, Eigen functions and one dimensional wave equation-Heat equation-Laplace's equation – Sturm-Liouville theorem for Boundary value problems.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate knowledge to work in differential equations, provide mathematical solutions to various engineering problems.
2. Understand system of first order equations and Power Series solutions relevant to the field of Engineering.
3. Familiarize with the application of second order equations & Special Functions
4. Understand applications of Laplace Transforms useful to solve complex problems.
5. Understand the Fourier series and efficiency to apply tools for Boundary value problems necessary for engineering problems.

#### **Text book:**

Simmons G.F., Differential Equations with Applications and Historical Notes, Tata McGraw Hill Edition 2003, Eighteenth reprint 2010

#### **Reference books:**

1. Kreyszig E., Advanced Engineering Mathematics, 9th edition, Wiley, 2013.
2. Kreider D.L. and Others: An Introduction to Linear Analysis, Addison Wesley, 1966.
3. Shepley L. Ross: Differential Equations, John Wiley & Sons, 1984.
4. William E. Boyce., Richard C. Diprima., Elementary Differential Equations and Boundary Value Problems, John Wiley & Sons, Inc.7th edition, 2001

**Mode of Evaluation:** Assignments, Internal Mid Examinations, External End Examination.

## B. Tech. II Year I Semester

### 14HUM101 PRINCIPLES OF ECONOMICS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

**Course Description:** The course aims to provide an insight into production, distribution and consumption of wealth, analysis of market structure, input pricing, public finance and economics of development and macroeconomic issues including international trade with emphasis upon use of analytical tools. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics.

**Course Objectives:** The course is intended to

1. Describe the nature of economics in dealing with the issue of scarcity;
2. Perform supply and demand analysis to analyze the impact of economic events on markets;
3. Discuss about demand elasticity, marginal utility and indifference theory;
4. Analyze the behaviour of consumers in terms of the demand for products;
5. Evaluate the factors affecting firm behaviour, such as production and costs;
6. Analyze the performance of firms under different market structures;
7. Explain about the concept of markets and its application in the price and output determination in operations of the firm;
8. Discuss the concept of equilibrium and efficiency of perfect competition;
9. Make the students understand the concept of income distribution and public finance; and
10. Analyze elements of macroeconomics and explain the role played by various sectors of the economy.

#### **UNIT I: INTRODUCTION**

Why study Economics- The Scope and method of Economics- Understanding the problem of scarcity and choice and the concepts of comparative advantage along with various economic systems- The Economic Problem: Scarcity & Choice.

#### **UNIT II: DEMAND & SUPPLY**

Elements of market Economy- Demand, Supply and Market Equilibrium- Applications of Demand & Supply- Elasticity- MU & Indifference Theory- Household Behavior and Consumer Choice- Analysis of Production-The Production Process: The behavior of profit maximizing firms.

#### **UNIT III: COST ANALYSIS & MARKETS**

Cost Analysis- Cost Structure of Firms and output decision- Input pricing: Land, Labor, Capital and Investment- Input demand: The labour and land market, the Capital Market and the Investment Decision-Market mechanism: Perfect Competition- General Equilibrium and the efficiency of perfect competition- Monopoly, and Monopolistic Competition- Imperfect Competition- Monopoly, and Monopolistic Competition- Imperfect Competition.



#### **UNIT IV: ECONOMICS OF PUBLIC GOODS**

Economics of Public Goods, Externalities, Public Goods, Imperfect Information and Social Choice- Externalities. Poverty & impact of income distribution- Income distribution and poverty -Basic concepts of public finance- Public Finance: The economics of Taxation.

#### **UNIT V: MACRO ECONOMICS**

Elements of Macroeconomics, Measurement of Macroeconomic Variables- Macroeconomic concepts and National Income accounting. Role of Money, Banking and Credit creation - Money Supply & The Central Bank- Economic Basis for trade- International Trade and comparative advantage.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Understand various principles of economics.
2. Analyze the concepts of demand, elasticity, markets, supply and its essence in floating of an organization.
3. Compare different market structures and cost Analysis to identify suitable market.
4. Assess the income distribution, public finance and taxation to evaluate the different projects in the practical situation.
5. Apply the measurement methods of macro-economic variables.

#### **Text Book:**

Case E. Karl & Ray C. Fair, “Principles of Economics”, Pearson Education, 8<sup>th</sup> Edition, 2007

#### **References:**

1. Lipsey, R. G. & K. A. Chrystal , “Economics”, Oxford University Press, 11th Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. “Economics”, Tata McGraw-Hill 18th Edition, 2007

**Mode of Evaluation:** Assignment, Seminar, Written Examination.

## B. Tech. II Year I Semester

### 14ME102 MECHANICS OF SOLIDS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

**Course Description:** Fundamental principles of mechanics; Introduction to the mechanics of deformable bodies; Forces and Moments transmitted by slender members; Stress- Strain; Stress-Strain Temperature relations; Torsion; stresses and deflections due to bending; Stability of equilibrium.

#### **Course Objectives:**

1. Student will understand the relationships between the external loads applied to deformable body and the intensity of internal forces or stresses acting within the body.
2. Student will understand deformations or strains caused by external loads.
3. Student will understand shear forces and bending moments in various beams with different loads.
4. To create clear awareness to the student to design structures and machine components.
5. The student can apply these principles to the solution of a variety of practical problems.

#### **UNIT I: Fundamental principles of mechanics**

Introduction, principles of mechanics, concept of force & moment, equilibrium conditions, concept of two & three force members, free body diagram, friction and Numerical problems

##### **Introduction to mechanics of deformable bodies**

Analysis of deformable bodies, uniaxial loading & deformation, statically determinate & indeterminate situations, Castigliano's theorem and Numerical problems

#### **UNIT II: Shear Force and Bending Moment**

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and

Combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam. Singular integral methods for various beams with various types of loads

#### **UNIT III: Fundamentals of Stress & Strain**

Introduction, stress, plane stress, equilibrium of an element in plane stress, Mohr circle representation of a plane stress, general state of stress Analysis of deformations, strain components, relation between strain & displacement, strain component associated with arbitrary set of axis, Mohr circle representation of plane strain, general state of strain.

##### **Stress-Strain-Temperature relations**

Introduction, tensile test, idealization of stress strain curve, elastic stress strain relation Thermal strain, complete equations of elasticity, strain energy in a elastic body, criteria of initial yielding.

#### **UNIT IV: Torsion**

Introduction, geometry of deformation of a twisted circular shaft, stress strain relations, equilibrium requirements, stresses & deformations in twisted elastic circular shaft, torsion of elastic hollow circular shaft, combined stresses, strain energy due to torsion, yielding in torsion & Numerical.

**Stability of equilibrium buckling**-Introduction, elastic stability, examples of instability, elastic stability of flexible columns

#### **UNIT V: Bending Stresses**

Introduction, deformation in pure bending, stress-strain relations, equilibrium requirements, stresses & deformations in pure bending. Stresses due to shear force and bending moment, combined stresses, strain energy due to bending, yielding in bending

#### **Deflections of Beam**

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Sketch the free body diagrams for various static members and calculate the forces and moments.
2. Analyze the distribution of shear force and bending moment for various types of beams under different load conditions.
3. Estimate the principal stresses under different load acting by analytical and Mohr's circle.
4. Design of shafts and analyze the elastic stability of flexible column.
5. Evaluate flexural stresses and bending stresses in beams for different cross-sections such as rectangular, circular, triangular, I and T.
6. Calculate the deflection and slope of various beams with different types of load using double integration method and Macaulay's method

#### **Text Books:**

S. H. Crandall et al., An Introduction to the Mechanics of Solids (in SI units) TMH, 2nd ed., 1978.

#### **References:**

1. Mechanics of Materials; F. P. Beer, E. R. Johnston and J. T. DeWolf, Third Edition, 2002, McGraw-Hill International Edition.
2. Mechanics of Solids, AN INTRODUCTION, T. J. Lardner, R R Archer, International Edition, 1994, McGraw-Hill
3. Introduction to Solid Mechanics by I. H. Shames, 2nd Edition, 1980, Prentice Hall of India Private Ltd. New Delhi.
4. Mechanics of Materials by Gere and Timoshenko, C B S Publishers & Distributors, 2nd Edition, 2004.

**Web Resources:**

<http://nptel.iitm.ac.in/>

[www.learnerstv.com/Free-Engineering-video-lecture-courses.htm](http://www.learnerstv.com/Free-Engineering-video-lecture-courses.htm)

[http://en.wikibooks.org/wiki/Strength\\_of\\_Materials](http://en.wikibooks.org/wiki/Strength_of_Materials)

**Mode of Evaluation:** Assignment, Mid Examination, Written Examination.

## B. Tech. II Year I Semester

14ME103

## KINEMATICS OF MACHINERY

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

### **Course Objectives:**

1. The objective of this course is to cover the kinematics and dynamics of planar single degree of freedom mechanisms.
2. After this course the student should have general mathematical and computational skills to enable the kinematics and dynamics analysis of machine elements including linkages, cams and gears and also becomes familiar with gear terminology and drawing of the cam profiles.

### **UNIT I: Mechanisms And Machines**

Elements or Links – Classification – Rigid Link, flexible and fluidlink. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higherpairs – closed and open pairs – constrained motion – completely, partially or successfully constrainedand incompletely constrained. Mechanisms and machines – classification of mechanisms and machines –kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slidercrank chain.Mobility of mechanisms.Straight Line Motion Mechanisms- Exact and approximate, copiersand generated types – Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and RobertMechanisms.Pantograph.

### **UNIT II: MECHANISMS**

#### **Steering Mechanisms:**

Conditions for correct steering – Davis Steering gear, Ackermannsteering gear. Hooke’s Joint (Universal coupling) -Single and double Hooke’s joint -applications –Simple problems.

#### **Belt, Rope And Chain Drives:**

Introduction, Belt and rope drives, selection of belt drive- types of beltdrives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensionsfor flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angularspeed ratio, classification of chains.

### **UNIT III: KINEMATICS**

#### **Velocity and Acceleration Diagrams:**

Velocity and acceleration – Motion of link in machine –Determination of Velocity and acceleration – Graphical method – Application of relative velocitymethod – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms,Coriolis acceleration, determination of Coriolis component of acceleration. Kleins construction. Analysisof slider crank mechanism for displacement, velocity and acceleration of slider using analytical method.

#### **Instantaneous Centre Method:**

Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

#### **UNIT IV: GEARS**

Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and worm gearing.

#### **GEAR TRAINS:**

Introduction – Types of gears – Simple, compound, reverted and Epicyclic gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains. Differential gear of an automobile.

#### **UNIT V: CAMS**

Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

#### **Analysis of Motion of Followers:**

Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Identify different types of mechanisms and inversions of different kinematic chains.
2. Calculate the basic parameters for Hooke's joint, steering mechanisms and belt drives.
3. Analyze velocity and acceleration at different point in a simple plane mechanism using relative velocity method and instantaneous center method.
4. Calculate pitch, module, number of teeth, path of contact for meshing gears and train value for different gear trains by using tabular column method.
5. Analyse displacement, velocity and acceleration of cam follower at different positions of cam with specified contours by drawing displacement diagram and cam profile for different types of motions (SHM, UARM and uniform velocity) of cam and follower.

#### **Text Books:**

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition, 2013.
2. Kinematics and dynamics of machinery, R.L Norton, Tata McGraw Hill Publishers, 1st Edition, 2009.

**References:**

1. Theory of Machines and Mechanisms, 3rd Edition, J.E. Shigley et. al, Oxford International Student Edition.
2. Theory of Machines, Thomas Bevan, Pearson (P) 3rd Edition, 2012.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. II Year I Semester

### 14ME104 THERMODYNAMICS

L T P C  
3 2 0 3

**Course Prerequisite:** None

#### **Course Description:**

Thermodynamics is one of the fundamental courses in the study of mechanical engineering. The principles of thermodynamics are applicable to a wide range of problems encountered in all branches of engineering. Also thermodynamics is an essential pre-requisite for subsequent courses in mechanical engineering like fluid mechanics, applied thermodynamics, heat transfer, gas dynamics, refrigeration and air conditioning, etc.

This course is designed to equip the students with a thorough understanding of basic concepts of thermodynamics and with necessary skills and techniques to solve problems in thermodynamics through a systematic analysis using fundamental principles. The specific topics to be covered in the course include concepts of system and surroundings, energy, energy transfer by work and heat, properties of substances and property changes, first and second laws of thermodynamics.

#### **Course Objectives:**

1. To introduce the concepts of system, surroundings, energy interactions, thermodynamics properties of substances and to teach different techniques used for estimating the properties like gas laws and property tables
2. To introduce the first and second laws of thermodynamics, and discuss their real time applications.
3. To teach the systematic approach to be employed for effectively solving the problems in thermodynamics.
4. To cover the topics of thermodynamic cycles and their relevance.

#### **UNIT I: Thermodynamic Basics**

Thermodynamic system and control volume, macroscopic and microscopic approach, properties & state, process & cycle, zeroth law, temperature scales,

Phase equilibrium, independent properties, equations of state, compressibility factor, Tables of thermodynamic properties & their use,

Definition of work and its identification, work done at the moving boundary, Concept of heat and heat transfer modes, comparison of heat and work.

#### **UNIT I: Properties of Pure Substances**

Pure substance, phase boundaries, P-v-T surface, enthalpy and entropy of a pure substance, tables of thermodynamic properties, ideal gas, and compressibility factor, equations of state, internal energy, enthalpy, entropy and specific heats, of ideal gases, mixture of gases, Dalton's model. Tds equations, Maxwell's equations, Clapeyron equation.



### **UNIT III: First Law of Thermodynamics**

First law for a cycle as well as for a change of state; internal energy, enthalpy, specific heats. First law as rate equation, conservation of mass in control volume; first law for control volume; Steady State process; examples of Steady State processes and transient processes.

### **UNIT IV: Second Law of Thermodynamics**

Limitations of first law & need for the second law; reversible process; heat engine, heat pump, refrigerator; Carnot cycle; energy conversion efficiency and COP, Kelvin-Planck & Clausius statements, the ideal gas Carnot cycle, the thermodynamic temperature scale,

Clausius inequality, Entropy, entropy change of a reversible & irreversible processes, entropy equation, entropy generation, principle of increase of entropy, second law for control volume; Steady State & transient process; reversible Steady State process.

Exergy, Reversible work and irreversibility, second law efficiency, exergy balance equation, control mass & control volume processes.

### **UNIT V: Thermodynamic Cycles**

Air-Standard Power cycles, Brayton Cycle, Gas turbine power cycle with regenerator, air standard refrigeration cycle, Reciprocation engine power cycles, Otto cycle, Diesel cycle, Stirling cycle, Atkinson and Miller cycle.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Calculate work and heat transfer in simple systems using the concepts of thermodynamic system, state, properties, processes.
2. Estimate the thermodynamic properties of substances at a given state using the tables or equations of state.
3. Analyze systems using first law and second law of thermodynamics.
4. Solve problems of energy balance using a systematic approach.
5. Quantify the performance of power generation systems and heat pumps based on cycles.
6. Estimate the quality of energy transferred through thermodynamic systems.

### **Text Books:**

1. Claus Borgnakke & Richard Sonntag, "Fundamentals of Thermodynamics", John Wiley & Sons, 2009, 7th Edition
2. Fundamentals of Engineering Thermodynamics, Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, seventh edition.

### **References:**

Engineering Thermodynamics by P K Nag, TATA McGraw HILL companies

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## **B. Tech. II Year I Semester**

### **14ME105 MATERIAL SCIENCE & ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

#### **Course Description:**

The course gives an introduction to materials science and its structure at the atomic and microscopic level. The relation between structure and properties of materials is also highlighted. The course mainly discusses about the structure and properties of different types of materials such as metals, ceramics and polymers.

#### **Course Objectives:**

1. To provide the relation between structure and properties of metallic materials.
2. To know the concept of phase transformation, phase diagrams and its influence on the properties of metals.
3. To learn the methods of improving properties by thermo, mechanical treatment and importance of non-metallic materials like polymers, ceramics and composites, material standards and their applications.

#### **UNIT I: STRUCTURE OF Materials**

Introduction: Historical prospective, importance of materials, Classification of Materials and its Properties.

Bonding in solids: Bonding forces and energies, primary and secondary bonding.

Crystallography and Metallic structures: Unit cell, Crystallographic directions and planes, FCC, BCC, Linear and planar densities, close-packed crystal structures.

#### **UNIT II: Diffraction techniques and Imperfections**

X-ray diffraction: Determination of crystal structure, Bragg's Law, Diffraction technique.

Crystal Imperfections: Vacancies and interstitials, dislocations and grain boundaries.

Diffusion: Steady State Diffusion.

#### **UNIT III: PHASE DIAGRAMS and Phase Transformations**

Phase diagrams: Phases, Phase rule, and microstructure, phase equilibrium, Binary phase diagrams, Phase Transformations. Fe-Fe<sub>3</sub>C Phase diagram

Phase Transformations: Avrami rate equations, Isothermal transformation, TTT diagrams, Continuous cooling transformation.

#### **UNIT IV: Materials Testing**

Dislocations: Dislocations and strengthening mechanisms of metals

Mechanical Properties of Metals: Tensile testing and influence of structure, elastic, plastic deformation and instability. Failure of Metals: Fracture, DBTT.

#### **UNIT V: POLYMERS, CERAMICS AND COMPOSITES**

Polymers: Introduction to polymers, structure and applications.

Ceramics: Introduction to ceramics, structure and applications.

Composites: Introduction to Composites, Types, FRP, MMC, PMC and applications.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Describe the concepts of bonds in solids, atomic packing fraction, coordination number, crystallization, grain size determination methods, grain size and grain boundaries and their effect on the properties of solids.
2. Identify the phase and composition of a binary alloy using lever rule and phase rule for various equilibrium phase diagrams.
3. Explain the composition and properties of cast irons, steels, different alloying elements on Iron-Iron carbon system and Non-ferrous metal alloys of copper, Aluminium and Titanium.
4. Explain the concepts of hardenability and different heat treatment techniques like annealing, normalizing, hardening and cryogenic cooling with the help of TTT diagrams.
5. Explain the importance of composites, their properties, applications, various manufacturing methods of composites, different types of composites like fiber reinforced materials, polymer composites, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

#### **Text Books:**

Callister William D & R. Balasubramaniam, Materials Science and Engineering, Wiley Student Edition, 7th Edition, 2007.

#### **References:**

1. George E. Dieter, Mechanical Metallurgy, SI Metric Edition McGraw Hill Book Company, London.
2. R. A. Higgins, Applied Physical Metallurgy, Sixth edition, Viva Low priced students edition, New Delhi.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. II Year I Semester

### 14ME202 MECHANICS OF SOLIDS & MATERIAL SCIENCE PRACTICALS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**Course Prerequisite:** None

#### **Course Objectives:**

The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques useful in Mechanical engineering.

Following is the list of experimental set ups on which experiments shall be conducted. Complete modalities of operation of the laboratory such as the exact titles of experiments, reports submission and evaluation methodology etc. shall be announced at the beginning of laboratory session.

#### **LIST OF EXPERIMENTS**

##### **MOS Practicals:**

1. Rockwell Hardness Testing & Brinell Hardness Testing
2. Tensile Test
3. Impact Testing
4. Torsion Test
5. Bending test on 1. Simply supported beam and 2. Cantilever beam
6. Test on springs.
7. Compression test on UTM
8. Double shear test on UTM

##### **MSE Practicals**

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Preparation and study of micro structure of binary alloy.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Evaluate hardness value for various materials using Rockwell hardness tester
2. Plot the stress strain curve of a ductile material under tensile and compressive load using universal testing machine
3. calculate the slope and deflection of simply supported beam under point load
4. Fabricate the material with binary alloy of various composition and to observe the change in microstructure with change in composition.
5. Prepare and study the microstructure of various pure metals and alloys.

**Text Book:**

Michael T. Simpson, Kent Backman, James E. “Corley, Hands-On Ethical Hacking and Network Defense”, Second Edition, CENGAGE Learning, 2010.

**References:**

1. Steven DeFino, Barry Kaufman, Nick Valenteen, “Official Certified Ethical Hacker Review Guide”, CENGAGE Learning, 2009-11-01.
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Basics Series – Elsevier, August 4, 2011.
3. Whitaker & Newman, “Penetration Testing and Network Defense”, Cisco Press, Indianapolis, IN, 2006.

**Mode of Evaluation:** Practical

## **B. Tech. II Year I Semester**

### **14ME203 MACHINE DRAWING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**Course Prerequisite:** None

#### **Course Objectives:**

To make the students to understand the concepts of I.S. conventions, methods of imensioning, the title boxes, to draw the machine elements and simple parts.To make the students to understand and draw assemblies of machine parts and to draw their sectional views.

#### **List of Experiments**

1. Study of welding joints
2. Study of Riveted joints
3. Study of screw threads, keys and Fasteners.
4. Basic 2D-drawings convert to 3D Drawings
5. Assembly of Sleeve And Cotter Joint
6. Assembly of Socket And Spigot Joint
7. Assembly of Shaft Coupling
8. Assembly of Gib& Cotter Joint
9. Assembly of Knuckle Joint
10. Assembly of Universal Joint
11. Assembly of Screw Jack
12. Assembly of Plummer Block
13. Assembly of Simple Eccentric
14. Assembly of Machine Vice

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Identify of different types of bolts, nuts, welding joints screw threads, keys and fasteners.
2. Visualize and prepare detail drawing of a given object.
3. Draw details and assembly of mechanical systems.
4. Read and interpret given drawing.
5. Create 2-D and 3-D models using any standard CAD software with manufacturing considerations.

#### **Text Books:**

Lab manual provided by the department

**Mode of Evaluation:** Practical

## B. Tech. II Year II Semester

### 14MAT104 PROBABILITY & STATISTICS

L T P C  
3 2 0 3

**Course Prerequisites:** 14MAT101& 14MAT102

#### **Course Description:**

Probability, Conditional probability, Bayes theorem, One dimensional and Two dimensional Random Variables, Mathematical Expectation, Theoretical Discrete and Continuous distributions, Simulating discrete and continuous distributions, Interval Estimation and Testing of Hypothesis, Multiple Linear Regression.

#### **Course Objectives:**

The objectives of this course are

1. To revise the elementary concepts of probability and to extend and formalize knowledge of the theory of probability and random variables.
2. To introduce new techniques for carrying out probability calculations and identifying probability distributions.
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To understand the concepts of the sampling distribution of a statistic and estimation of parameter.
5. To understand the foundations for statistical inference involving confidence intervals and hypothesis testing.

#### **UNIT I: PROBABILITY AND RANDOM VARIABLES**

Introduction to Probability, Axioms of probability, Conditional Probability, Independence and Multiplication Rule, Bayes theorem, Random Variable, discrete probability densities, continuous densities, cumulative distribution, Expectation, variance and standard deviation.

#### **UNIT II: DISCRETE AND CONTINUOUS DISTRIBUTIONS**

Moment generating function, Binomial distribution, Poisson distribution, Geometric distribution, Hyper geometric distribution, Uniform distribution, Normal distribution, Normal Probability rule, Chebychev's inequality, Normal approximation to Binomial distribution, Gamma distribution, Chi-Square distribution and Exponential distribution, transformation of random variables, Simulating discrete and continuous distributions.

#### **UNIT III: MULTIVARIATE RANDOM VARIABLES**

Joint density and Independence, marginal distribution: discrete & continuous, Expectation, conditional densities (omit regression), Transformation of random variables.

#### **UNIT IV: SAMPLING DISTRIBUTION AND ESTIMATION**

Random sampling, sample statistics, Point estimation, distribution of  $\bar{X}$ , Interval estimation and the central limit theorem, interval estimation of variability, Estimating the mean and student's t-distribution.

## **UNIT-V: TESTS OF HYPOTHESIS**

Hypothesis testing, Significance testing, hypothesis test on the mean, hypothesis test on the variance, Estimating proportions, testing hypotheses on a proportion, comparing two proportions and its testing. Correlation (omit interval estimation & hypothesis tests on  $\rho$ ), model and parameter estimation, properties of least square estimators, Least squares procedure for model fitting: A matrix approach to least square.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate an understanding of the concepts of probability and random variables.
2. Apply discrete and continuous probability distributions in solving various problems in engineering.
3. Understand density functions, distribution functions to the Random Variables and analyze the multivariate problems of engineering & industry.
4. Devise the concept of the sampling distribution of a statistic, and in particular describe the behaviour of the sample mean.
5. Apply of statistical inference in practical data analysis and extend the statistical way of thinking to solve the problems in Science & Technology.

### **Text Books:**

J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4th edition, 2003 Tata McGraw-Hill Publications.

### **Reference Books:**

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Elsevier, Academic Press, 2010.
2. Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8th ed., Pearson Education, 2008.
3. Johnson, R.A. Miller Freund's: Probability and Statistics, 7th Edition, PHI, 2005.
4. Sheldon Ross: A First Course in Probability, 6th Edition, Pearson Education, 2002.

**Mode of Evaluation:** Assignments, Internal Mid Examinations, External End Examination.



## B. Tech. II Year II Semester

### 14ME106 FLUID MECHANICS

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME104

#### **Course Description:**

Properties of fluids; fundamental laws of fluids in motion; differential and integral expressions for conservation of mass, momentum and energy; applications of conservation laws to solve the transport phenomena involving mass, momentum and energy interactions in a given system, Differential relations for a fluid particle, Dimensional analysis and similarity, Internal flows through pipes and ducts, External flows past immersed bodies, boundary layer concepts and equations.

#### **Course Objectives:**

1. To provide a basic understanding of the properties and behavior of matter (fluids) by means of analytical equations.
2. To introduce the governing equations and their applications, pressure measurements.
3. To provide a basic understanding of the similar phenomena of mass, momentum and energy transfer using an integrated approach.
4. Understanding of fluids and its motion in a given system.
5. To provide a basic knowledge on the importance of dimensional analysis and similarity techniques.  
To provide a basic knowledge of CFD and its importance.

#### **UNIT I: INTRODUCTION AND PROPERTIES OF FLUIDS**

The Concept of a Fluid, The Fluid as a Continuum, Dimensions and Units, Properties of the Velocity Field, Thermodynamic Properties of a Fluid, Viscosity and Other Secondary Properties, Basic Flow-Analysis Techniques, Flow Patterns: Streamlines, Streak lines, and Path lines.

#### **UNIT II: PRESSURE DISTRIBUTION IN A FLUID**

Pressure and Pressure Gradient, Equilibrium of a Fluid Element, Hydrostatic Pressure Distributions, Application to Manometry, Hydrostatic Forces on Plane Surfaces, Hydrostatic Forces on Curved Surfaces, Hydrostatic Forces in Layered Fluids, Buoyancy and Stability, Pressure distribution in Rigid-Body Motion, Pressure Measurement; Problems.

#### **UNIT III: INTEGRAL RELATIONS FOR A CONTROL VOLUME**

Basic Physical Laws of Fluid Mechanics, The Reynolds Transport Theorem, Conservation of Mass, The Linear Momentum Equation, The Angular-Momentum Theorem, The Energy Equation, Frictionless Flow: The Bernoulli Equation; Problems.

#### **UNIT IV: INTERNAL AND EXTERNAL FLOWS**

**Internal flows:** Reynolds-Number Regimes, Internal versus External Viscous Flows, Flow in a Circular Pipe, Pipe-Flow Problems, Introduction to flow in Noncircular Ducts, Minor Losses in Pipe Systems, Pitot tube, venturimeter, orifice meter, flow nozzle and turbine flow meter; Problems

**External flows:** Reynolds-Number and Geometry Effects, Momentum-Integral Estimates, the Flat-Plate Boundary Layer, Boundary Layers with Pressure Gradient; Problems.

#### **UNIT V: DIMENSIONAL ANALYSIS & SIMILARITY**

Introduction to dimensional analysis, The Principle of Dimensional Homogeneity, The Pi Theorem, Non dimensionalization of the Basic Equations, Modeling and its Pitfalls, Similitude – type of similarities.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Define the fluid properties like density, vapor pressure, compressibility, surface tension and their significance in fluid mechanics.
2. Apply fundamentals principles in fluid mechanics, including mass and momentum conservation along with control volume approach to solve problems.
3. Apply the Bernoulli equation to solve problems in fluid mechanics.
4. Analyze problems in fluid mechanics using stream function and vorticity.
5. Perform dimensional analysis for problems in fluid mechanics.
6. Calculate drag and lift forces on surfaces using principles from theory of laminar and turbulent boundary layers.

#### **Text Books:**

Frank M White, “Fluid Mechanics”, Tata McGraw-Hill, 7th Edition, 2012.

#### **References:**

1. Robert W. Fox and Alan T. Mc Donald, “Introduction to Fluid Mechanics”, John Wiley & Sons Private Ltd., 2009, 7th Edition.
2. James R. Welty, Charles E. Wicks and Robert E. Wilson, “Fundamentals of Momentum, Heat and Mass transfer”, John Wiley & Sons (Asia) private limited., 2008, 5th Edition.
3. James. A. Fay, “Introduction to Fluid Mechanics”, Prentice Hall of India, 2007.
4. Milton Van Dyke, “An Album of Fluid Motion”, Parabolic Press, 12th Edition.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. II Year II Semester

### 14ME107 MACHINE DESIGN - 1

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

#### **Course Description:**

The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied. This subject will help to the students to learn to analyse and design basic machine elements in mechanical systems. Course covers Fundamentals and principles of Design. Design and selection of Machine elements such as bolts, rivets, welded joints, Permanent joints, and Springs etc.

#### **Course Objectives:**

1. Fundamental concepts of Machine Design.
2. Failure from static & variable (fatigue) load case.
3. To design a Bolted & Riveted joints.
4. To design Welded and Permanent joints.
5. Design of Helical, Torsional and Leaf springs.

#### **UNIT I: INTRODUCTION**

**MACHINE DESIGN INTRODUCTION:** General considerations of design, design process. Selection of Engineering Materials - properties – Manufacturing considerations in the design.

**STRESSES IN MACHINE MEMBERS:** Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

#### **UNIT II: FATIGUE**

**FATIGUE CONCEPTS:** Failure from Static loading, variable (fatigue) loading, and Stress concentration – notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line Soderberg's line.

#### **UNIT III: DESIGN OF JOINTS**

**DESIGN OF BOLTED JOINTS:** Forms of Screw threads. Stresses in Screw fasteners. Design of bolts With pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

**DESIGN OF RIVETED JOINTS:** Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

#### **UNIT IV: WELDING**

**WELDING, BONDING AND DESIGN OF PERMANENT JOINTS:** Introduction to welding, Stresses in Welded Joints in Torsion & bending, Types of loading, The Strength of Welded Joints, Adhesive Bonding.

## **UNIT V: SPRINGS**

**MECHANICAL SPRINGS:** Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Leaf springs.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Describe general design principles like design process, material selection, manufacturing considerations, combined stresses, impact stresses, theories of failure, and factor of safety.
2. Evaluate simple components under cyclic loading using the concepts of stress concentration, notch sensitivity, endurance limit and Goodman and Soderberg criteria.
3. Design riveted joints and bolted joints subjected to direct loading and eccentric loading for applications like boiler shell joints.
4. Design welded joints, Adhesive Bonding and Permanent joints subjected Torsion & bending.
5. Design helical, co-axial and leaf springs for automobile applications with considerations of stress-deflection relations, fatigue loading, natural frequency and energy storage capacity.

### **Text Books:**

Budynas R. G. and Nisbett J. K., “Shigley’s Mechanical Engineering Design” Tata–McGraw Hill, 9th SI Edition, New Delhi, 2011.

### **References:**

1. Norton Robert L., “Machine Design: An Integrated Approach”, Second Edition, Pearson Education Asia, New Delhi, 2001.
2. Hall A. S., Holowenko A. R. and Bennett M. D., “Machine Design”, Tata McGraw Hill (Schaum’s Outline Series), (SI Units), New Delhi, 2008.
3. M. F. Spotts, “Design of Machine Elements”, Prentice Hall of India, New Delhi
4. V.B.Bhandari, Design of Machine Elements, TMH Publishers, New Delhi.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**B. Tech. II Year II Semester**

**14ME108 DYNAMICS OF MACHINERY**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Description:**

The course is to give an insight into the basic concepts of Dynamic analysis of machines.

**Course Objectives:**

1. To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines.
2. To understand the concept of vibratory systems and their analysis and also the principles of governors.

**UNIT I: FRICTION, CLUTCHES, BRAKES AND DYNAMOMETERS**

Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, and Centrifugal Clutch.

Simple block brakes, Band brake, internal expanding brake, Braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

**UNIT II: PRECISION, FORCE ANALYSIS, TURNING MOMENT DIAGRAMS AND FLYWHEELS**

Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Dynamic force analysis – Inertia force and Inertia torque– D'Alembert's principle – Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads Crank shaft torque – Turning moment diagrams – Flywheels – Flywheels of punching presses.

**UNIT III: GOVERNORS**

Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronisms and hunting. Effort and power of a governor.

**UNIT IV: BALANCING AND BALANCING OF RECIPROCATING MASSES**

Introduction, Dynamic Unbalance, Single Plane Balancing and Multi-plane Balancing of both graphical and analytical methods for rotating masses balance. Reciprocating Mass Balancing, Multi-Cylinder Balancing, Balancing V and radial engines balancing.

## UNIT V: VIBRATIONS

Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

### Course Outcomes:

The students after completing the course will be able to:

1. Estimate the gyroscopic couple and its effects in equipment like motor cars, motorcycles, airplanes and ships.
2. Calculate the force required in friction based equipment like screw jacks, clutches, brakes, and rope brake dynamometer.
3. Design a flywheel for a given application using the concept of turning moment diagram.
4. Design various types of governors like Watts governor, Porter governor, Proell governor, Hartung governor and Hartnell governor for speed control.
5. Estimate the balancing mass and the location where it is to be added for balancing of rotating and reciprocating systems.
6. Calculate the natural frequency and maximum amplitude and damping coefficient under forced vibration for single degree of freedom (transverse, longitudinal and torsional) mechanical components using Dunkerly's Method and Rayleigh's Method.

### Text Books:

1. Uicker J.J., Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms", Oxford Univ. Press, NY, 3rd Ed., 2003.
2. Theory of Machines, S.S. Rattan, MGH Publishers, 3rd Edition, 2013

### References:

1. Ghosh A., Mallik A.K., "Theory of Mechanisms and Machines", Affiliated East West Press Pvt. Ltd., New Delhi. 3rd Ed., 1998.
2. S S Rattan, "Theory of Machines", Tata McGraw Hill publishing Company Limited, New Delhi. 3rd Ed.
3. J.S Rao & R.V. Dukkipati, "Mechanisms and Machines Theory", New Age international Publishers, New Delhi, 2nd Edition, 2011.
4. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition, 2012.
5. The theory of Machines, J.E. Shiegley, McGraw Hill .
6. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.

### URL

<http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt2.html>,

<http://www.mhprofessional.com/downloads/products/0071704426/0071704426-ch01.pdf>

<http://www.freestudy.co.uk/dynamics/velaccdiag.pdf>,

[http://ebooks.library.cornell.edu/k/kmoddl/pdf/013\\_005.pdf](http://ebooks.library.cornell.edu/k/kmoddl/pdf/013_005.pdf)

[http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Machine\\_Design\\_II/pdf/2\\_1.pdf](http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_1.pdf),

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**B. Tech. II Year II Semester**

**14ME109 APPLIED THERMODYNAMICS**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** 14ME104

**Course Description:**

Ideal gas and vapor cycles, Combined power generation cycles, gas mixtures, Refrigeration cycles, Psychrometrics and introduction to heat load calculations, Gas turbine cycles, Compressors, Boilers and accessories, Steam turbines.

**Course Objectives:**

1. To acquaint the students with the thermodynamics of power developing and power absorbing machines.
2. To discuss the gas and vapour cycles, combined power generation cycles, refrigeration cycles, psychrometry and basic air conditioning concepts, gas turbine cycles, steam turbines.
3. To cover the topics of thermodynamic relations, gas mixtures, exergy and gas dynamics fundamentals.

**UNIT I: BOILERS AND ACCESSORIES**

Boiler classification, Functions, Nomenclature, Mountings and accessories, Circulation.

Draught classification, height of chimney for given draught and discharge, efficiency of chimney – Artificial draught, induced draught and forced draught.

**UNIT II: VAPOUR POWER AND REFRIGERATION CYCLES**

Rankine cycle, Actual vapour cycle and comparison with Carnot cycle, Mean temperature of heat addition, Reheat cycle, Regenerative cycle, Feed water heaters, Exergy analysis, Binary vapour cycles, Process heat and by-product power, Efficiencies in steam power plant

Refrigeration Cycles: Reversed Heat Engine Cycle, Vapor Compression Cycle, Absorption Cycle, Heat pump system, Gas cycle refrigeration, Liquefaction of gases.

Psychrometrics: Properties of air, Psychrometry chart, Psychrometric processes

**UNIT III: STEAM TURBINES**

Steam turbines: Mechanical details with principle of operation-velocity diagram, effect of friction – power developed, axial thrust, blade or diagram efficiency-condition for maximum efficiency, De-Laval turbine-its features.

Reaction turbine: Mechanical details with principle of operation, thermodynamic analysis of a stage, degree of reaction – velocity diagram – Parsons Reaction turbine – condition for maximum efficiency.

#### **UNIT IV: GAS COMPRESSORS AND COMPRESSIBLE FLUID FLOW**

Compressors: Single-stage and Multi-Stage Compression, Volumetric efficiency, Rotary compressor.

Compressible Fluid Flow: Stagnation properties, one dimension steady isentropic flow, Normal shocks, Adiabatic flow with friction, Adiabatic flow without friction.

#### **UNIT V: GAS TURBINES AND JET PROPULSION**

Gas Turbines: Simple Gas Turbine Plant – ideal cycle – parameters of performance – regeneration, intercooling and reheating – closed and semi-closed cycles – merits and demerits

Jet Propulsion: Classification – working principles of Turbo jet, Turbo Prop, Pulse Jet Engines with schematic diagram - Introduction to Rocket propulsion.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Describe boiler, nomenclature of boilers, mountings and accessories
2. Estimate the performance of heat engines and refrigerators using vapour power cycles and refrigeration cycles
3. Estimate the power developed, axial thrust and efficiency of the steam turbines by using the velocity diagrams
4. Estimate power required and efficiency of single and multi-stage air compressors
5. Estimate the performance of gas turbines by using the intercooler, regenerator and reheating
6. Describe the basic concepts of Jet and Rocket propulsion system

#### **Text Books:**

1. P.K. Nag, “Basic & Applied Thermodynamics” – Tata McGraw-Hill Publishing Company Ltd., 5th Ed., 2013
2. Er.R.K.Rajput, “Thermal engineering” Laxmi publications., 9th Ed., 2014

#### **References:**

1. R.S.Khurmi&J.K.Gupta, “A text book of thermal engineering”-S.Chand& company ltd., 1st Ed re-print 2010
2. T. D. Eastop& A. McConkey, “Applied Thermodynamics” – Pearson Education, 5th Ed., 2008.
3. Rayner J., “Basic Engineering Thermodynamics” – Pearson Education, 5th Ed., 2008.
4. Claus Borgnakke& Richard E. Sonntag, “Fundamentals of Thermodynamics”, John Wiley & Sons, 7th Ed., 2009.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination



**B. Tech. II Year II Semester**

**14ME110 PRODUCTION TECHNIQUES - I**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Description:**

An introduction to the basic concepts of manufacturing and operation of machine tools. Topics covered include various machining processes and manufacturing methods.

**Course Objectives:**

1. This course is designed to enrich theoretical and analytical knowledge about common production techniques used in manufacturing.
2. Methods of selection of proper production techniques are also included.

**UNIT I:METAL CASTING**

Manufacturing properties of materials, control of manufacturing properties of materials

Pattern and mould, melting, pouring, gating design, riser design. Various casting processes, casting defects & inspection of castings.

**UNIT II:METAL FORMING**

Plastic deformation and yield criteria, mechanics forming processes (rolling, forging, drawing, deep drawing, bending, extrusion, punching & blanking). Various forming operations, hot and cold forming, friction and lubrication in forming, forming defects.

**UNIT III:METAL MACHINING**

Mechanics of basic machining processes, various machining processes, abrasive machining and finishing operations, surface finish, economics of machining operations.

**UNIT IV:JOINING PROCESSES**

Principles of solid phase welding and liquid phase welding, soldering, brazing and adhesive bonding, various welding processes, weld defects and inspection.

**UNIT V:MANUFACTURING OF NON-METALLIC PRODUCTS**

Powder metallurgy, forming and shaping of plastics, composite materials and ceramics and glass, rapid prototyping.

**Jigs and Fixtures**

Use and design principles.

**Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate knowledge on materials for controlling manufacturing properties.
2. Understand the fundamentals of manufacturing of metals and nonmetals.
3. Understand the various forming methods and forming defects.
4. Demonstrate knowledge on various machining process of conventional and unconventional machining process.
5. Understand the concepts of metal joining techniques and concepts of jigs and fixtures.

**Text Books:**

1. Amitabha Ghosh and Asok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press, New Delhi, 1985.
2. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology," Pearson Education (Low Cost Indian Edition), 4/e, 2001, New Delhi.

**References:**

1. Roy A. Lindberg, "Processes and Materials of Manufacture," PHI, New Delhi, 2004.
2. P. N. Rao, "Manufacturing Technology: Foundry, Forming & Welding," TMH, New Delhi, 2000.
3. P. N. Rao, "Manufacturing Technology: Metal Cutting & Machine Tools," TMH, New Delhi, 2000.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. II Year II Semester

### 14ME204 PRODUCTION TECHNIQUES PRACTICALS - I

L	T	P	C
0	0	3	2

**Course Prerequisite:** None

#### **Course Description:**

Production Techniques practicals lab contains Metal casting, Welding, Mechanical Press working and processing of Plastics. These practicals inculcates the skill to the students starting from preparing a wooden pattern to completion of a casting which also comprises different Sand testing techniques. Students will also get good skill on Welding and mechanical press working which will be helpful to get an employment in Industries.

#### **Course Objectives:**

This practical course is designed to enrich practical knowledge about common production techniques used in manufacturing.

#### **List of Experiments**

##### **I. METAL CASTING LAB:**

- Pattern Design and making - for one casting drawing.
- Sand properties testing - Exercise -for strengths, and permeability – 1
- Moulding: Melting and Casting - 1 Exercise

##### **II. WELDING LAB:**

- Arc Welding: Lap & Butt Joint - 2 Exercises
- Spot Welding - 1 Exercise
- TIG Welding - 1 Exercise
- Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

##### **III. MECHANICAL PRESS WORKING:**

- Blanking & Piercing operation and study of simple, compound and progressive press tool.
- Hydraulic Press: Deep drawing and extrusion operation.
- Bending and other operations

##### **IV. PROCESSING OF PLASTICS:**

- Injection Moulding
- Blow Moulding

**Course Outcomes:**

The students after completing the course will be able to:

1. Produce real time casting on his own
2. Prepare various joints by using various welding process
3. Perform blanking, piercing and deep drawing operations on the sheet.
4. Prepare bottle with cape by using injection and blow molding process.
5. Bend a pipe to the required angle.

**Text Books:**

Manual provided by the department

**Mode of Evaluation:** Practical

## B. Tech. II Year II Semester

### 14ME205 DYNAMICS LAB & ELECTRICAL MACHINES PRACTICALS

L	T	P	C
0	0	3	2

**Course Prerequisite:** 14EEE101& 14ME108

#### Course Objectives:

1. To equip students with understanding of the fundamental principles and techniques for Identify different types of dynamic systems and classify them by their governing equations
2. To develop a model of a mechanical system using a free body diagram
3. To develop equations of motion for translational and rotational mechanical systems
4. To develop an understanding of how property data is generated and reported.
5. To create a bridge between theoretical knowledge and application.

#### Course Outcomes:

At the end of the course, students should be able to

1. Plan, conduct, analyze and evaluate experiments
2. Compare analytical and theoretical results
3. Produce reports
4. Communicate test results through presentation (graphical or oral)

#### List of experiments - Dynamics Lab Practicals:

1. Study of gyroscopic effect and determination of gyroscopic couple
2. Watt governor
3. Proell governor
4. Porter governor
5. Hartnell governor.
6. Static and dynamic balancing of rotating masses.
7. To verify the relation  $t = 2\pi\sqrt{l/g}$  for a simple pendulum
8. Forced vibration of equivalent spring mass system
9. Longitudinal vibration
10. Torsional vibration of single rotor shaft system
11. Torsional vibration of two rotor shaft system
12. Single rotor system with viscous damping
13. Whirling speed of shaft
14. Determination of jump speed of cam-follower system

#### List of experiments – Electrical Machines Practicals:

1. Magnetization Characteristics of DC Shunt Generator. Determination of Critical Field Resistance and Critical Speed.
2. Brake Test on DC Shunt Motor. Determination of Performance Curves.
3. Load Test on DC Compound Generator. Determination of Characteristics.
4. Hopkinson's Test on DC Shunt Machines. Predetermination of Efficiency.
5. Fields Test on DC Series Machines. Determination of Efficiency.
6. Swinburne's Test and Speed Control of DC Shunt Motor. Predetermination of Efficiencies.

**Additional Experiments:**

1. Load Test on DC Series Generator. Determination of Characteristics.
2. Retardation Test on DC Shunt Motor. Determination of Losses at Rated Speed.
3. Separation of Losses In DC Shunt Motor.

**Course Outcomes:**

The students after completing the course will be able to:

1. Estimate the frequency response of 1DOF systems.
2. State the mode shapes of the 1DOF forced vibration systems.
3. Describe the equations of motions of forced damped vibration systems both analytical and graphical methods.
4. Analyze natural frequency of multi degrees of systems.
5. Estimate the natural frequencies of continuous systems.
6. Illustrate the static and dynamic balancing simple system.
7. Describe the static and dynamic balancing of reciprocating engines.

**Text Books:**

Manual provided by the department

**Mode of Evaluation:** Practical

**B. Tech. III Year I Semester**

**14ENG103 SOFT SKILLS**

**L T P C**  
**2 0 3 3**

**Course Prerequisite: 14ENG102**

**Course Description:**

This course intends and aims to enhance the confidence of the student by exposing them to various situations and contexts which they would face in their career. This course is very important because at this stage it is imperative for the student to start preparing for the ever growing competition in the Job market. The course focuses on the practical aspects of English incorporating all the soft skills relevant to the requirements of the prospective employers in view of globalization.

**Course Objectives:**

1. To expose the students to those soft skills which are crucial to an employee's ability to work smarter.
2. To enhance Art of Communication, Team Skills, Presentation & GD handling skills and preparing resume & Interview Skills.

**UNIT I:**

Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback  
Non Verbal Communication - Body Language of self and others Greetings, Introductions, Small Talk (Findings common grounds to build a conversation).

**UNIT II:**

Self Enhancement - importance of developing assertive skills- developing self confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved working with Groups – Dealing with People- Group Decision Making - Leadership skills- Empathy, self-realization(Identifying strengths and weaknesses), Motivation.

**UNIT III:**

Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback.

**UNIT IV:**

Types of resumes – Resume preparation- Tips in writing resume - Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback Goal setting.

**UNIT V:**

Grooming etiquette – Telephone etiquette – E-mail etiquette, Professional electronic communication – Dining etiquette – do's & Don'ts in a formal setting – how to impress.

**Course Outcomes:**

The students after completing the course will be able to:

1. Communicate effectively and enhance their interpersonal relationship building skills with renewed self-confidence.
2. Work together in teams and accomplish objectives in a cordial atmosphere.
3. Face presentations and Group Discussions
4. Prepare resume and face interviews.
5. Understand and develop the etiquette necessary to present oneself in a professional setting.

**Text Books:**

“Soft Skills”. Dr K Alex. S Chand Publications, New Delhi

**References:**

1. The Seven Habits of Highly Effective People by Stephen R. Covey, Covey Leadership Center, 2005.
2. Negotiate to Close by Gary Karnass, Simon and Schuster, 1987.
3. The greatest miracle in the world – OgMandino, Random House Publishing Group, 2009.
4. Working with Emotional Intelligence - Daniel Goleman, A&C Black, 2009.
5. Developing Communication Skills by Krishna Mohan and MeeraBanerji; MacMillan India Ltd., Delhi, 2000.
6. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India, 1993.
7. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel, Crisp Publications, 1996.
8. “Strategic interviewing” by Richaard Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd, 2007.
9. “Effective Group Discussion: Theory and Practice” by Gloria J. Galanes, Katherine Adams , John K. Brillhart, Tata McGraw-Hill, 2010.

**Mode of Evaluation:** Written Examination, Day-to-day Assessment



## B. Tech. III Year I Semester

### 14HUM102 PRINCIPLES OF MANAGEMENT

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** None

#### **Course Description:**

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

**Course Objectives:** The course is intended to

1. To make understanding of basic concepts of Management and their application with organizations around us. Acquainting the students about various theories and approaches of management and their relevance in the new business environment. To learn and understand about the basic concepts of organization and types and structure of organization.
2. Enabling the students to understand the concept of planning, manager as decision makers, foundations of planning and strategic management.
3. To learn and understand about the basic concepts of organization and types and structure of organization. Explaining the students about the various concepts of HRM and their essence in new business environment.
4. Facilitating the students to learn about the leading, managers and communication, motivating employees and managers as leaders.
5. To make aware of the students about controlling, managing operations and functional areas of management-marketing and financial management.

#### **UNIT I: DEFINING THE MANAGER'S TERRAIN**

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Management History- Historical background, Classical Approach, Quantitative approach, Behavioral approach, Contemporary approach - Organizational Culture and Environment- Manager: omnipotent or symbolic, organization's culture, current organizational culture issues, specific and general environments - Managing in a Global Environment- Global Perspective, Understanding the global environment, Doing Business globally, managing in a global environment - Social Responsibility and Managerial Ethics- Social responsibility, views of social responsibility, social responsibility and economic performance, greening of management, managers and ethical behavior.

#### **UNIT II: PLANNING**

Managers as Decision Makers- The decision-making process, manager as decision maker, Types of decisions and decision making conditions, styles, biases and errors, decision making in today's world - Foundations of Planning- Meaning of planning, why and how managers plan, establishing goals and

developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management.

### **UNIT III: ORGANIZING**

Organizational Structure and Design- Designing organizational structure, Mechanistic and organic structures, Common Organizational Designs - Managing Human Resources HRM importance, HRM process, HR planning, recruitment and decruitment, selection, Employee training, Employee Performance Management, Compensation and Benefits, Contemporary issues in HRM - Managing Teams- Understanding Groups, Explaining Work Group Behavior, Turning Groups into Effective Teams, and Current Challenges in Managing Teams - Managing Change and Innovation- Forces for change, two views of the change process, managing organizational change, contemporary issues in managing change, stimulating innovation.

### **UNIT IV: LEADING**

Managers and Communication- Meaning of communication, functions of communication, Inter-personal communication, organizational communication, understanding information technology, communication issues in today's organizations - Motivating Employees- Basics of motivation, early theories of motivation, contemporary theories of motivation, and current issues in motivation - Managers as Leaders - Leaders and Leadership, Early leadership theories, contingency theories of leadership, contemporary views of leadership, leadership issues in the twenty first century.

### **UNIT V: CONTROLLING**

Introduction to Controlling - Basics, importance and process of control, controlling for organizational performance, tools for controlling: feed-forward, concurrent and feedback controls, contemporary issues in control - Managing Operations-What and why of Operations Management, Strategic Role of Operations Management, Value Chain Management and its goal requirements, current issues - Functional Areas of Management- 1. Marketing management 2.Financial management.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Understand the various concepts, approaches and theories of management in the real situation.
2. Analyse the concept of planning and apply on the decisions in strategicmanagement.
3. Compare organization structure designs and chart diligently with theoretical learning concepts.
4. Apply communication and theories of motivation in an organization.
5. Understand various tools for controlling organizational performance and apply to achieve the corporate objectives.

**Text Book:**

Stephen P. Robbins, Mary Coulter “Management”, Pearson Education, 2010, 10th edition.

**References:**

1. Gary Dessler, “Management”, Prentice Hall, Inc., 1998, 1st edition.
2. Daft Richard L. ‘Management’ Thomson South Western, 5th edition.
3. Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6th edition.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination.

**B. Tech. III Year I Semester**

**14ME111 MACHINE DESIGN - II**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** 14ME107

**Course Description:**

This course deals with the mechanical design methodology, procedure and techniques, fundamentals as well as application to various groups of machine elements. First the general principles of welding conditions are taught and then application to selected machine elements is covered. The prerequisites are knowledge of mechanics of solids, structure and properties of materials and mathematics, studied by students in the previous years.

**Course Objectives:**

1. Design of Ball, Rolling contact bearings and journal bearings
2. Design of Spur and Helical Gears.
3. Design of Shafts, Keys and Couplings.
4. Design of various Power Screws and Power Transmissions Systems.
5. Design of Piston, Cylinder, Cylinder block, Connecting Rod, Crank and Crank shafts

**UNIT I: DESIGN OF BEARINGS**

Types of Journal bearings – Lubrication – Bearing Modulus–bearingmaterials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings,bearing life –Failure of bearings.

**UNIT II: DESIGN OF SPUR & HELICAL GEARS**

Spur gears- Helical gears – Load concentration factor –Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur andHelical gears – Estimation of centre distance, module and face width. Check for dynamic and wearconsiderations.

**UNIT III: DESIGN OF SHAFTS, KEYS AND COUPLINGS**

Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads.Design of Muff, Split muff and Flange couplings.Protected type of flange coupling, rigid flange coupling, and bushed pin type flexible coupling.

**UNIT IV: DESIGN OF POWER TRANSMISSIONS SYSTEMS**

Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

Design of Flat belt drives, V-belt drives & ropedrives. Selection of wire ropes, design procedure for chain drives.

**UNIT V: DESIGN OF IC ENGINE PARTS**

Pistons– Construction, Design of piston. Cylinder, Cylinder block,Connecting Rod. Cranks and Crank shafts.

*Note: Design data books are permitted in the examinations.*

**Course Outcomes:**

The students after completing the course will be able to:

1. Design various types of sliding contact and rolling contact bearings like journal bearings, ball bearings and roller bearings with considerations of lubrication, bearing materials, bearing life and failure.
2. Design spur and helical gears for different input conditions using the concepts of load concentration factor, dynamic load factor, bending strength, dynamic considerations and wear considerations.
3. Design various types of keys, Rigid & flexible couplings like Muff, Split muff and Flange couplings.
4. Calculate the strength and rigidity of solid & hollow shafts subjected to combine bending and axial loads.
5. Design various types of power screws like compound screw, differential screw, ball screw and nuts with consideration of efficiency.
6. Design flat belt drives, V-belt drives & rope drives for simple power transmission systems.
7. Design major components of an IC engine such as piston, cylinder, connecting rod, crank and crank shaft using the knowledge of forces acting on these components and standard proportions.

**Text Books:**

Budynas R. G. and Nisbett J. K., "Shigley's Mechanical Engineering Design" Tata-McGraw Hill, 9th SI Edition, New Delhi, 2011.

**References:**

1. Norton Robert L., "Machine Design: An Integrated Approach", Second Edition, Pearson Education Asia, New Delhi, 2001.
2. Hall A. S., Holowenko A. R. and Bennett M. D., "Machine Design", Tata McGraw Hill (Schaum's Outline Series), (SI Units), New Delhi, 2008.
3. M. F. Spotts, "Design of Machine Elements", Prentice Hall of India, New Delhi
4. V.B.Bhandari, Design of Machine Elements, TMH Publishers, New Delhi.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**B. Tech. III Year I Semester**

**14ME112 HEAT TRANSFER**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** 14ME104

**Course Description:**

Fundamental concepts of heat transfer; steady-state and unsteady-state heat conduction; analytical and empirical relations for forced and free convection heat transfer; heat exchanger analysis and design; Heat transfer by radiation; condensation and boiling, associated laboratory.

**Course Objectives:**

1. To understand the concepts of different modes of heat transfer mechanisms
2. To estimate the rate of heat transfer for different situations of conduction convection radiation
3. To understand the concepts of condensation and boiling and estimate the rate of heat transfer
4. To know the analysis of heat exchangers.

**Unit I:**

Introduction to conduction, convection and radiation modes of heat transfer; basic laws of conduction, convection and radiation; heat conduction equation in Cartesian, cylindrical and spherical coordinates; simplification for one dimensional steady state conduction; Initial and boundary conditions

Steady state one dimensional conduction in plane walls, composite walls, Insulation, electrical analogy, R values; Radial conduction in cylinders and spheres, critical radius of insulation; overall heat transfer coefficient; one dimensional conduction with heat sources

**Unit II:**

Fins, governing equation, Temperature distribution in long fin, short fin and fin with insulated tip; efficiency and effectiveness of fins.

Lumped heat capacity system, governing equation, Biot and Fourier numbers; Transient heat flow in semi-infinite solid, governing equation, analytical solutions for constant temperature and constant flux conditions, Heisler charts.

**Unit III:**

Viscous and Inviscid flows; laminar and turbulent boundary layers over a flat plate, boundary layer momentum and energy equations, thermal boundary layer, boundary layer heat transfer; heat transfer in laminar and turbulent pipe flows, hydrodynamic and thermal entry lengths.

Empirical relationships for forced convection in pipe flows, flow across cylinders, spheres, and tube banks.

Natural convection heat transfer on a vertical plate; empirical relations for natural convection on plates and cylinders in horizontal, vertical and inclined orientation.

**Unit IV:**

Radiation, physical mechanism, Stefan Boltzmann law, Kirchoff's identity, Planck's distribution law, Wein's displacement law, shape factor, reciprocity relation, heat exchange between gray bodies, electric network analogy, infinite parallel planes, radiation shields.

**Unit V:**

Condensation heat transfer mechanism, film and dropwise condensation, condensation on a vertical plate, condensation number, film condensation inside horizontal tubes; boiling heat transfer, simplified relations; Boiling heat transfer, pool boiling, different regimes, simplified relations for heat transfer.

Heat exchanger, overall heat transfer coefficient, fouling factors, types of exchangers, LMTD and NTU analyses of heat exchangers.

**Course Outcomes:**

The students after completing the course will be able to:

1. Estimate heat transfer rate due to conduction, convection and radiation under simple conditions using Fourier's Law, Newton's Law, Stefan-Boltzmann Law and three dimensional conduction equation.
2. Calculate the temperature distribution and rate of heat transfer in one dimensional heat conduction problems (Cartesian, polar and spherical coordinates) like composite walls, cylinders, and extended surfaces.
3. Calculate temperature evolution in lumped and one dimensional systems using Newton's law of cooling and chart solutions.
4. Identify the governing equations for convection heat transfer and the relevant non-dimensional numbers in a given convection problem using Buckingham Pi theorem.
5. Calculate the heat transfer and temperature distribution in external and internal fluid flow with or without phase change using Nusselt number correlations.
6. Design an appropriate heat exchanger, like condenser, evaporator, radiator etc., for a given heat transfer requirement using LMTD and NUT-e methods.
7. Calculate heat transfer due to radiation under simple conditions using the concepts of black and grey bodies, shape factor and electrical network analogy.

**Text Books:**

1. J.P. Holman, Heat Transfer, McGraw Hill, 2002, 9th Edition.
2. Mittal RK, Lab Manual, EDD Notes 2007.
3. Srinivas, M & R.K. Mittal Transport Phenomena-II Notes-EDD, 2003

**References:**

1. F. P. Incropera & D. P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 2001, 5th edition.
2. F. Kreith & M. S. Bohn, Principles of Heat Transfer, Brooks Cole, 2000, 6th edition.
3. J.R. Welty and others, Fundamental of Momentum, Heat and Mass Transfer, John Wiley & Sons, 2000, 4th edition.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. III Year I Semester

### 14ME113 PRODUCTION TECHNIQUES - II

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME110

#### **Course Description:**

This course is designed to enrich theoretical, analytical as well as practical knowledge about common production techniques used in machining. Methods of selection of proper production techniques, CAM and micro manufacturing technologies are also included.

#### **Course Objectives:**

1. To know the basic principles in theory of metal cutting and to get basic knowledge in machine tools.
2. To get knowledge about principles of all machine tools
3. To know Construction details and principles of machine tools
4. To know a suitable machine tool for the specific application
5. To get knowledge of micro-manufacturing technologies
6. Students are able to write CNC part programming

#### **UNIT I: METAL CUTTING THEORY**

A brief overview of different metal cutting processes, Analysis of mechanics of metal cutting in turning, milling and drilling, cutting force calculation, power estimation, cutting temperature calculation, Lee-Shafer theory, Ernest-Merchant theory, chip separation, tool life, Machining with controlled contact tools

#### **UNIT II: DIFFERENT MACHINE TOOLS; THEIR DESCRIPTION AND OPERATION**

Turning, shaping, slotting, planning, Milling, drilling, Shaping, Abrasive machining processes..

#### **UNIT III: ECONOMICS AND QUALITY CONTROL OF METAL CUTTING**

Costs of single pass turning operation, optimum cutting speed for maximum profit rate in turning, restrictions on optimum cutting speed, Introduction, aims of inspection, scope, essentials and principles, Tool wear, surface finish, key way production

#### **UNIT IV: NON-TRADITIONAL MACHINING PROCESSES**

Introduction, Ultrasonic Machining, Abrasive Jet Machining, EDM, ECM, LBM, EBM, ECG and Chemical Machining, Introduction, Chemistry-based, Electron-beam lithography, Introduction, developments in conventional machine tools, CIM, FMS, Modern developments in machine tools

#### **UNIT V: CNC MACHINES AND CNC PART PROGRAMMING**

NC and CNC Machines, Operation of NC/CNC, Definition of terms often used in numerical control, Positional control, Introduction, Programming for NC/CNC Machining, Some commonly used G codes.



**Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate knowledge about principles of all machine tools
2. Demonstrate basic principles in theory of metal cutting and to get basic knowledge in machine tools
3. Identify a suitable machine tool for the specific application
4. Demonstrate knowledge on NC/CNC machines and CNC part programming

**Text Books:**

1. Amitabha Ghosh and Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press, New Delhi, 1985.
2. Serop Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology," Pearson Education (Low Cost Indian Edition), 4/e, 2001, New Delhi.
3. Production Technology, R.K. Jain & S.C. Gupta.
4. Work Shop Technology-Vol-II, B.S. Raghuvamshi.

**References:**

1. Roy A. Lindberg, "Processes and Materials of Manufacture," PHI, New Delhi, 2004.
2. P. N. Rao, "Manufacturing Technology: Foundry, Forming & Welding," TMH, New Delhi, 2000.
3. P. N. Rao, "Manufacturing Technology: Metal Cutting & Machine Tools," TMH, New Delhi, 2000.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. III Year I Semester

### 14ME206 HEAT TRANSFER PRACTICALS

L T P C  
0 0 3 2

**Course Prerequisite:** 14ME104& 14ME112

#### Course Objectives:

1. To enable the students to do experimentation on heat transfer equipment and gain practical knowledge about heat transfer in thermal systems
2. To develop trouble shooting abilities of students for practical heat transfer systems.
3. To teach students how to measure heat transfer through various systems.

#### LIST OF EXPERIMENTS

1. Thermal conductivity of metal bar (brass)
2. Thermal conductivity of insulating powder
3. Overall heat transfer coefficient of composite slab apparatus
4. Thermal conductivity of insulating material through lagged pipe apparatus
5. Heat transfer coefficient in transient heat conduction
6. Heat transfer coefficient in natural convection
7. Heat transfer coefficient in forced convection
8. Efficiency and effectiveness of a pin-fin
9. Stefan Boltzmann constant for radiation heat transfer
10. Emissivity of gray body
11. Experiment on critical heat flux apparatus
12. Study of two- phase flow
13. Heat transfer in drop and film wise condensation
14. Performance test on parallel and counter flow heat exchanger

#### Course Outcomes:

The students after completing the course will be able to:

1. Estimate the thermal conductivity of solids and over all heat transfer coefficient of composite systems.
2. Estimate the convective heat transfer coefficient co-efficient for various internal and external flow situations
3. Estimate the emission characteristics of a surface for radiation heat transfer.
4. Demonstrate the mechanisms of boiling and condensation heat transfer.
5. Test practical heat transfer systems like heat exchanger, condenser, evaporator etc.

#### Text Books:

Lab manual provided by the department

**Mode of Evaluation:** Practical

## B. Tech. III Year I Semester

### 14ME207 PRODUCTION TECHNIQUES PRACTICALS - II

L T P C  
0 0 3 2

**Course Prerequisite:** 14ME113

#### Course Objectives:

1. The “Production Techniques-II” lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of “Production Techniques-II” in the field of engineering.
2. To train the students understand the basic cutting operations involved on various machine Tools such as Lathe, shaper, slotter, miller and grinding machine, etc.
3. To enable the students in measuring various measurements by using metrology instruments.

#### LIST OF EXPERIMENTS

##### Metrology

1. Measurement of lengths, heights, diameters by verniercalipers, micrometerS etc.
2. Measurement of bores by internal micrometer and dial bore indicatorsr
3. Chrodal addendum, chrodal height of spur gear by gear teeth vernier calipers
4. Alignment test on Lathe Machine
5. Alignment test on Milling Machine
6. Study of Toolmakers Microscope and its applications
7. Angle and Taper Measurements by Bevel Protractor, sine bar etc.
8. Finding the Flatness of surface plate by spirit level.
9. Thread measurement by two/three wire method.
10. Surface roughness measurement by Talysurf instrument

##### Machine Tools

1. Demonstration of construction and operations of general purpose machines: Lathe, drilling machines, Milling machine, shaper, planer, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Job on step turning and taper turning on Lathe machine.
3. Job on thread cutting and knurling on Lathe machine.
4. Job on drilling and tapping.
5. Job on shaping.
6. Job on slotting.
7. Job on milling.
8. Job on grinding of tool angles.

##### Additional Experiments

1. Multi start thread cutting, drilling on lathe machine.
2. Comparators.

**Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate knowledge about metal cutting process.
2. Apply knowledge of metrology and machine tools for practical applications.
3. Understand and build their abilities for running of metrology and machine tools lab.
4. Manufacture various mechanical components such as Gear wheels, Bolts, Nuts, etc.

**Text Books:**

Lab manual provided by the department

**Mode of Evaluation:** Practicals.

## B. Tech. III Year II Semester

### 14ME114 PRIME MOVERS & FLUID MACHINES

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14ME104&14ME106

#### **Course Description:**

The course familiarizes students with basic facts relating to working principles of hydraulic machines and equipment used in all industrial fields. It deals with pumps, hydraulic motors, water turbines and fluid mechanisms (hydraulic and pneumatic elements, hydraulic transmissions and couplings).

#### **Course Objectives:**

1. The Course is intended to familiarize the students with theoretical analysis of energy and momentum transfer between the fluid and rotor.
2. The working principles, design considerations, performance and application aspects of turbo machines will be dealt with.
3. Classification, descriptive details and performance of rotary machines and reciprocating machines will be discussed.

#### **UNIT I: FUNDAMENTALS FLUID MACHINERY**

Fundamentals of fluid machines, theoretical analysis of energy and momentum transfer between fluid and rotor.

#### **UNIT II: COMPRESSORS**

Introduction, classifications of compressors, principles of axial, mixed and radial flow compressors; numerical problems.

#### **UNIT III: TURBINES AND PUMPS**

Introduction to turbines, Classification of hydraulic turbines; Pelton wheel, Radial flow reaction turbines, Francis turbine, axial flow reaction turbine, design considerations; cascade aerodynamics and performance limitations.

Centrifugal pumps and Reciprocating pumps

#### **UNIT IV: POWER PLANT SYSTEMS**

Introduction to Power plant systems; Applications to power plant systems.

#### **UNIT V: RECIPROCATING AND ROTARY MACHINES**

Reciprocating machines, rotary machines and refrigeration plants.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Explain fundamentals, basic principles and applications of fluid machines
2. Design various components of hydraulic turbines, pumps and compressors
3. Describe the applications of fluid machines in power plant systems.
4. Describe the working principles of reciprocating and rotary machines.

**Text Books:**

1. Jagdishlal; Hydraulic Machines; Metropolitan Book Company Private limited, New Delhi; 1975; 6th Edition.
2. Kadambi V and Manohar Prasad, An Introduction to Energy Conversion NAIL, VolIII ,2nd Ed., 2011
3. S. S. Deshmukh& M. S. Soni; Laboratory manual for prime movers and fluid machines; EDD notes.

**References:**

1. Agarwall S K; Fluid Mechanics and Machinery; Tata McGrawhill publishing company limited, New Delhi; 1997.
2. Venkanna B K; Fundamentals of Turbomachinery, PHI, 2009.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. III Year II Semester

### 14ME115 INSTRUMENTATION & CONTROL SYSTEMS

L T P C  
3 2 0 3

**Course Prerequisite:** None

#### **Course Description:**

Instrumentation engineering refers to the design, maintenance and production of electromechanical devices, which are used in various circumstances that require precise control and measurement. In this student undergo Function, operation, and application of common mechanical engineering instruments, measurement principles of Sensors and Transducers and Control System.

#### **Course Objectives:**

To provide knowledge on the fundamentals of measurement science and measuring instruments To provide a knowledge on the basics of control system theory.

#### **UNIT I: FUNDAMENTALS OF MEASUREMENTS**

Methods of measurements-the generalized measurement system-calibration-types of input quantities-analog and digital measurements-standards –dimensions and units of measurements treatment of uncertainties-nomenclature of terms in measurement-errors and classification of errors-single test data – variable sample and replicated test data-treatment of uncertainties propagation of uncertainty.

#### **UNIT II: SENSORS AND MEASUREMENT OF TEMPERATURE**

Sensors and transducers-primary and secondary transducers-classification of first stage devices variable resistance transducers-variable inductance elements-the differential transformer-variable reluctance transducers-capacitive transducers-piezo electric and photo electric transducers measurement of temperature-liquid in glass thermometers -pressure thermometers-resistance thermometers-lead wire compensation –thermoelectric thermometers-laws of thermocouples-lead wires for thermocouples – ambient temperature compensation -pyrometers-total radiation and optical pyrometers-infrared pyrometers.

#### **UNIT III: MEASUREMENT OF PRESSURE AND FLOW**

Measurement of pressure-bourdon tube pressure gauge-calibration of bourdon tube pressure gauge-elastic diaphragms-corrugated diaphragms-strain gauge pressure cells-bulk modulus gauge-the McLeod gauge –thermal conductivity gauges and ionization gauges-measurement of flow-classification of flow meters-obstruction flow meters-variable area flow meters-turbine type flow meters-thermal flow meters-magnetic flow meters-ultrasonic flow meters.

#### **UNIT IV: MEASUREMENT OF STRAIN AND MISCELLANEOUS MEASUREMENTS**

Measurement of strain-electrical resistance strain gauges-bonded and unbonded strain gauges metallic resistance strain gauges-gauge factors-specifications and installation of factors for strain gauges-bridges with two and four arms sensitive to strain-calibration of strain gauges strain gauge rosettes-measurement of humidity-hair hygrometers-measurement of PH-PH meters-measurement of air pollution-Orsat apparatus-nuclear instrumentation-Geiger Muller counter-scintillation counter.

## **UNIT V: BASICS OF CONTROL SYSTEM THEORY**

Control systems-open and closed loop control systems-servomechanisms and regulators-control system fundamentals-block diagrams-block diagram reduction-simple problems signal flow graphs Masons gain formula-mathematical models of control systems-stability of control systems-Routh and Hurwitz stability criteria Text Books 1. Thomas .G. Beckwith, Lewis Buck and Roy D Maraga

### **Course Outcomes:**

The students after completing the course will be able to:

1. Explain the methods of measurement, measurement systems both the analog and digital standards along with the errors.
2. Explain various temperature measurement sensors based on classification and working.
3. Explain various pressure measurement sensors based on classification and working.
4. Explain various strain gauges based on classification and working.
5. Explain the fundamentals of control systems like open loop and closed loop.

### **Text Books:**

1. Thomas .G. Beckwith, Lewis Buck and Roy D Maragani- Mechanical Measurements Narosa publishing house-2000
2. NagoorKani ,A, Control Systems, RBA Publicatrions-2000

### **References:**

1. Instrumentation, Measurement & Analysis, B.C.Nakra&K.KChoudhary, TMH
2. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers
3. Instrumentation & Mechanical Measurements, AK. Tayal, GalgotiaPubl
4. Principals of Industrial Instrumentation and Control Systems, Chennakesava, R.A., Cengage Learning, 2008.
5. Benjamin C KUO ,Faridgolnaraghi ,Automatic control Systems –John Wiley and Sons 2002
6. Holman J P, Experimental methods for Engineers, TataMCGraw Hill publishers 2000
7. R.K. Jain, “Mechanical and Industrial Measurements” Khanna Publishers, 2002

**Mode of Evaluation:** Assignment, Mid Examination, End Examination



**B. Tech. III Year II Semester**

**14ME116 FINITE ELEMENT METHODS**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** 14MAT101, 14MAT103 &14ME102

**Course Description:**

Basic concepts of finite element methods; element equations for basic structural elements; implementation and application of FEM in 1-D and 2-D structural, dynamics analysis and heat conduction

**Course Objectives:**

1. To teach students the basic principles of finite element methods.
2. To teach students the basic implementation method of finite element methods
3. To teach students how to perform 1-D and 2-D structural analysis using finite element methods.
4. To teach students how to perform 1-D and 2-D heat conduction analysis using finite element methods.
5. To teach students how to perform 1-D and 2-D dynamic analysis using finite element methods.

**UNIT I: INTRODUCTION TO FEM**

Basic concepts, application of FEM, general description, advantages of FEM, comparison of FEM with other methods: finite difference method, variational method, Galerkin Method, basic element shapes, interpolation function. Virtual energy principle, treatment of boundary conditions, solution of system of equations, basic equations of elasticity, strain displacement relations.

**UNIT II: 1-D STRUCTURAL PROBLEMS**

Axial bar element – stiffness matrix, load vector, temperature effects, quadratic shape function, analysis of trusses – plane truss and space truss elements.

Analysis of beams and frames – Hermite shape functions, stiffness matrix, load vector problems, analysis.

**UNIT III: 2-D PROBLEMS**

Introduction to CST, force terms, stiffness matrix and load vector, boundary conditions, Iso-parametric element, quadric element, shape functions and problems.

**UNIT IV: AXIS SYMMETRIC FORMULATIONS AND HEAT AND MASS TRANSFER ANALYSIS**

Axis Symmetric formulations, Finite Element Modeling- Triangular element, Problem modeling and Boundary conditions.

Heat and Mass Transfer analysis: Derivation of the basic differential equation, heat transfer with convection, typical Unit's thermal conductivities, K: and heat transfer coefficients, h, one-dimensional finite element formulation using a variational method.

## **UNIT V: FEM FOR MODAL ANALYSIS**

Dynamic considerations, Dynamic equations, consistent mass matrix, Eigen values, Eigen vector, natural frequencies, mode shapes, modal analysis.

### **Course Outcomes:**

The students after completing the course will be able to:

1. State the applications of FEM in various engineering fields.
2. Calculate stress strain relations for the one dimensional problems using finite element methods.
3. Analyze the 2-D and axisymmetric problems using FEM.
4. Describe the 1D, 2D heat transfer and fluid flow problems.
5. Analyze the frequency response and mode shapes of the bar element and beam structures

### **Text Books:**

1. A first course in Finite Element Method, Daryl L Logan, Cengage Learning
2. Finite Element Methods in Engineering , SS Rao , Pergamon,
3. Introduction to Finite Elements in Engineering, Chandraputla, A and Belegundu, PHI.

### **References:**

1. An introduction to Finite Element Method, JN Reddy, TMH
2. Finite Element Method, its basics and fundamentals, O.C. Zienkiewicz, Elsevier
3. Fundamentals of Finite element analysis, David V Hutton, TMH
4. Finite Element Analysis, G.Lakshminarasaiah, B.S.Publ., 2008
5. The Finite Element Method for Engineers, Kenneth H. Huebner, Donald Byrom,
6. John Wiley & Sons (ASIA) Pte Ltd

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**B. Tech. III Year II Semester**

**14ME117 IC ENGINES**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** 14ME104

**Course Description:**

Working cycles and operation of two stroke, four stroke SI and CI engine cycles. Ignition, combustion, alternative fuels, emission and their control.

**Course Objectives:**

1. To familiarize with the working principles of an internal combustion engines.
2. To understand the principle of operations, fuels, combustion and performance of an internal combustion engines; along with working analysis and design of various systems.

**UNIT I: INTRODUCTION**

I C Engines: Introduction, classification, different parts of IC engine, Working principle- Two stroke & Four stroke I.C. Engines. Comparison of SI and CI engines & two stroke and four stroke engines. Conventional fuels, Liquid fuels, possible alternative fuels.

**UNIT II: AIR STANDARD CYCLES AND THEIR ANALYSIS**

Air standard cycles and their analysis, Otto, Diesel, Dual cycle, Comparison, Brayton cycle

Fuel-air cycles and their analysis: Variable specific heats, Dissociation, Comparison of air standard and fuel air cycles

Actual cycle and their analysis: Valve-timing diagram, Time loss factor, Heat loss factor, Exhaust blow down

**UNIT III: BASIC SYSTEMS IN IC ENGINE**

Fuel system: Simple carburetor-Engine mixture requirements-Calculation of air fuel ratio, injection system-Classification, Fuel feed Pump, Injector, Nozzle, MPFI and ECU

Ignition System: Battery ignition system, Magneto ignition system, Modern ignition systems

Cooling system: Temperature distribution, Liquid and Air cooling system.

Lubrication system: Need of lubrication and types of lubrication systems – working

**UNIT IV: TESTING AND PERFORMANCE OF IC ENGINE**

Parameters of performance of IC Engine – measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, brake power – determination of frictional losses and indicated power – performance test – heat balance sheet and chart. Problems.

## **UNIT V: COMBUSTION EMISSIONS AND THEIR CONTROL**

Combustion and Combustion Chambers: Stages of combustion in SI and CI engines, Knocking.

Hydrocarbon and other emissions – their conversion.

Supercharging and Turbo charging:supercharger- working, turbocharger- working.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Describe the basic concepts of IC engines and fuels
2. Analyze the performance of the engine by using ideal and actual air standard cycles and fuel air cycles.
3. Describe the basic systems of IC engine such as fuel supply system, ignition system, cooling systems etc.
4. Estimate the performance of IC engines using the experimental techniques like Morse test, motoring test etc.
5. Describe the combustion techniques and emission control techniques in IC engine

### **Text Books:**

V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill, 2012

### **References:**

1. M. L. Mathur and R. P. Sharma, A course in Internal Combustion Engines,
2. DhanpathRai and Sons.
3. A. R. Rogowski, Elements of I. C. Engines, Tata McGraw-Hill.
4. R.S. Khurmi and J.K. Gupta, Thermal Engineering, S. Chand, 2010.
5. Er. R.K. Rajput, Thermal Engineering, Laxmi Publications, Ninth Edition.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## B. Tech. III Year II Semester

### 14ME208 IC ENGINES PRACTICALS

L T P C  
0 0 3 2

**Course Prerequisite:** 14ME104&14ME117

#### Course Objectives:

1. To understand the working principles of an IC engine.
2. To Analyze the losses of work, due to heat at various components of an IC engine
3. Developing theoretical/practical capabilities of students so that they can characterize, transform and use I.C ENGINES, AIR COMPRESSORS, and BOILERS in Engineering and Apply knowledge gained in solving related Engineering problems.

#### LIST OF EXPERIMENTS

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

#### Course Outcomes:

The students after completing the course will be able to:

1. Draw Valve/Port timing diagrams and estimate the various performance parameters for two stroke and four stroke IC engines.
2. Estimate the energy losses due to heat lost to various engine components.
3. Conduct performance test on Air compressors
4. Describe various types of boilers used in steam power plants
5. Describe the basic systems of IC engines such as fuel supply system, ignition system, cooling system etc.

#### Text Books:

Lab manual provided by the department

**Mode of Evaluation:** Practical

**B. Tech. III Year II Semester**

**14ME209 FLUID MECHANICS & MACHINES PRACTICALS**

**L T P C**  
**0 0 3 2**

**Course Prerequisite:** 14ME106&14ME114

**Course Objectives:**

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

**LIST OF EXPERIMENTS**

**Fluid Mechanics Practicals:**

1. Calibration of Venturimeter
2. Calibration of Orificemeter
3. Impact of jet on vanes
4. Determination of friction factor for a given pipe line.
5. Determination of loss of head due to sudden contraction in a pipe line.
6. Turbine flow meter.
7. Flow through notches (Rectangular & V-type)
8. Verification of Bernoulli's theorem

**Fluid Machines Practicals**

1. Performance test on Pelton wheel.
2. Performance test on Francis turbine.
3. Performance test on Kaplan turbine.
4. Performance test on single stage centrifugal pump.
5. Performance test on multi stage centrifugal pump.
6. Performance test on reciprocating pump.

**Course Outcomes:**

The students after completing the course will be able to:

1. Verify the Bernoulli's theorem for incompressible flows.
2. Determine the co-efficient of discharge for a flow measuring devices like Venturimeter and Orificemeter.
3. Determine the co-efficient of vanes like flat and curved vanes.
4. Determine the performance and draw operating characteristic curves for Pelton wheel, Reciprocating pump and Multi-stage Centrifugal pump.
5. Determine the loss of head in pipe lines due to friction, sudden contraction, enlargement, bends and elbows.

**Text Books:**

Lab manual provided by the department

**Mode of Evaluation:** Practical

**B. Tech. IV Year I Semester**

**14ME118 ENGINEERING OPTIMIZATION**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Description:**

Engineers, scientists, analysts and managers are often faced with the challenge of making trade-offs between different factors in order to achieve desirable outcomes. Optimization is the process of choosing these trade-offs in best way. Optimization problems, having reached a degree of maturity over the past several years, are encountered in physical sciences, engineering, economics, industry, planning, and many other areas of human activity.

This course deals with details of various aspects associated with Optimization. These include description of optimization techniques, namely, linear programming methods, simplex method, transportation model and its variants, PERT/CPM, inventory models, queuing systems, nonlinear optimization algorithms and evolutionary algorithms.

**Course Objectives:**

1. Set to familiarize the students with standard methods of solving Optimisation problems
2. Optimum utilization of available resources

**UNIT I:**

Introduction to optimization, two variable LP model, Graphical LP solution, selected LP applications. LP model in equation form, transition from graphical to algebraic solution. The simplex method, Generalized simplex table in matrix form, artificial starting solution, special cases, dual properties of LPP.

**UNIT II:**

Definition of transportation problem, the transportation algorithm, Degeneracy, optimal solution, the assignment problem. Solving linear programming, transportation, network problem, queuing problems.

**UNIT III:**

Definition, minimal spanning tree algorithm, shortest route problem, CPM and PERT.

**UNIT IV:**

Deterministic inventory models, price break problems, Random variables, binomial, Poisson, exponential and normal distribution, probability. Definition, birth and death process, role of exponential distribution, generalized Poisson queuing models, specialized Poisson Queues.

**UNIT V:**

Unconstrained problems, unconstrained algorithms. Karush-Kuhn-Tucker (KKT) conditions, quadratic programming. Introduction to nontraditional optimization techniques (Genetic algorithms, simulated annealing, etc)

**Course Outcomes:**

The students after completing the course will be able to:

1. Apply different methods for optimization like simplex method, Big M methods, classical optimization techniques, method of Lagrange multipliers.
2. Solve assignment problems using Hungarian's algorithms and traveling salesman problems.
3. Use numerical optimization methods like Simplex search methods, steepest descent method, Newton's methods and penalty method for constraints.
4. Describe principles, working and application of GA and GP Methods including multi objective GA concepts like Pareto's analysis.
5. Describe application of optimization techniques in design and manufacturing systems like path synthesis of mechanisms, weight minimization and optimization of machining process parameters.

**Text Books:**

1. HA Taha, operation Research: An introduction, Pearson/PHI, 8/E, 2007.
2. SD Sharma Operations Research.

**References:**

1. SS Rao, engineering optimization: Theory and practice, new age international (p) limited, third edition 1996.
2. FS Hillier and GJ Lieberman, introduction to Operation Research, TMH, 8/E, 2006.
3. WL Winston, Operations Research: Applications and algorithms, Thomson learning, 4th Edition, 2004.
4. A ravindran, DT Philips and Solberg, Operations Research: Principles and Practice, John Wiley & Sons, Singapore, Second Edition, 1987.
5. GC Onwubolu and BV Balu, New Optimisation Techniques in engineering, Springer-Verlag, Heidelberg, Germany, First edition, 2004.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination



## B. Tech. IV Year I Semester

### 14ME119 METROLOGY AND MEASUREMENTS

L	T	P	C
3	2	0	3

#### *Course Objectives:*

1. To give an insight into the various terminologies used in metrology
2. To give an insight about hole and shaft basis systems
3. To provide a clear understanding about linear, angular measurements and instruments used.
4. To provide a clear understanding about the types and applications of optical measuring instruments.
5. To provide a clear understanding about various measurements like surface roughness, screw thread and gear elements.
6. To give an insight on machine tool alignment tests and surface treatment processes.

#### **UNIT I**

##### **SYSTEMS OF LIMITS AND FITS**

Introduction, Definitions, Fits and Allowances, Indian standard Institution system and International Standard system for plain and screwed work.

##### **GEOMETRIC DIMENSIONING AND TOLERANCING**

Introduction and benefits of GD & T, Maximum and Minimum material condition, Position tolerancing, Tolerance of orientation and form, Applications of GD & T

#### **UNIT II**

**LINEAR MEASUREMENT:** Length, line, end & wavelength standards, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

**MEASUREMENT OF ANGLES AND TAPERS:** Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

**LIMIT GAUGES:** Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principle. Design of Go and No Go gauges.

#### **UNIT III**

**SURFACE ROUGHNESS MEASUREMENT:** Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

**MEASUREMENT THROUGH COMPARATORS:** Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

#### **UNIT IV**

**OPTICAL MEASURING INSTRUMENTS:** Tool maker's microscope – collimators, optical projector – optical flats and their uses, interferometer.

**FLATNESS MEASUREMENT:** Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimator.

**ALIGNMENT TESTS:** Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools. Preparation of acceptance charts.

## **UNIT V**

**FORM MEASUREMENTS**-Screw thread measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

**ADVANCES IN METROLOGY:** Basic concept of CMM, Types of CMM, Constructional features and Applications of CMM, Basic concept of machine vision system and applications.

### ***Course Outcomes:***

At the end of the course, students will be able to:

1. Explain the concept of limits, fits and geometric dimensioning and tolerancing.
2. Explain the concept of linear, angular measurements and measuring instruments and limit gauges.
3. Discuss the concept of surface roughness measurement and comparators.
4. Discuss the concept of optical measuring instruments, flatness measurement and machine tool alignment tests.
5. Explain the concept of screw thread measurement, gear measurement, coordinate measuring machine and machine vision system.

### **TEXT BOOKS:**

- 1) James D. Meadows, “Geometric Dimensioning and Tolerancing”, Marcel Dekker Inc., 1997.
- 2) Alex Krulikowski, “Fundamentals GD&T”, Delmar Thomson Learning, 1997.
- 3) Beckwith.T.G, Roy D. Marangoni, John H. Lienhard, “Mechanical Measurements”, Prentice Hall, 2005.
- 4) Gupta.I.C, “A text book of Engineering Metrology”, DhanpatRai publications, New Delhi, 2005.
- 5) R.K. Jain, “Engineering Metrology”, Khanna Publications, 2005.

### **REFERENCES:**

- 1) BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
- 2) Spotts M F, “Dimensioning and Tolerance for Quantity Production”, Prentice Hall Inc., 1983.
- 3) Connie Dotson, “Fundamentals of Dimensional Metrology”, Thomson publications.
- 4) M Mahajan, “Engineering Metrology”, DhanpatRai publications, 2007.

## B. Tech. IV Year I Semester

### 14ME120 CAD/CAM

L T P C  
3 2 0 3

**Course Prerequisite:** None

**Course Description:** The course is aimed at providing the knowledge related to Computer Aided Design and Manufacturing as the industry is demanding more. There is an increased number of application softwares and computer-controlled machine tools, an appearance of industrial robots in the production lines. This trend towards computerized manufacturing is leading to a demand for appropriately trained engineers to design and maintain these systems. The course aims to provide an introduction to the theory and applications in the fields of design and manufacturing. It presents concepts of computer Graphics and modeling in Computer Aided Design section and control as applied to stand-alone manufacturing systems, computer aided process planning, production control, inspection & quality control and provides a useful approach to their implementation in the field of Computer Aided Manufacturing.

#### **Course Objectives:**

1. To acquire knowledge for generating high quality images of massive geometric models in a short time.
2. To learn about the concepts of surface modeling, physically based modeling and surface visualization
3. To provide leading edge technology in the focus areas of machining, tool design, CNC programming and applications.
4. To gain a basic understanding of computer numerical control (CNC) machining processes and operations using a combination of G-codes, milling and turning equipment.
5. To provide the knowledge about GT, Process Planning and Computer Aided Quality Control.

#### **UNIT I: INTRODUCTION TO CAD/CAM**

Introduction – Product Life Cycle – Computer Aided Design – Computer Aided Manufacturing – The Design Process – Applications of CAD – Computer Configurations for CAD Applications – Computer Hardware in CADD – CAD Software – operating software – Graphics Software – Application Software – Programming support software.

#### **UNIT II: COMPUTER GRAPHICS & DRAFTING**

Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, Geometric commands, layers, display control commands, editing, dimensioning.

**Geometric Modeling:** Introduction- Wire Frame entities – Representation of Curves – non parametric and parametric. Synthetic Curves – Hermite Cubic spline –Bezier Curves – B-Spline Curves.

#### **UNIT III: SURFACE AND SOLID MODELING**

Surface Modeling: Surface entities –Plane Surface –Ruled Surface – Surface of Revolution – Tabulated Cylinder.Synthetic Surfaces – Hermite Bi-cubic Surface – Bezier Surface – B – Spline Surface and Surface Manipulations.

Solid Modeling: Fundamentals – Half spaces – Boundary representation - CSG – other representations – Solid manipulations.

#### **UNIT IV: NUMERICAL CONTROL**

Fundamentals of NC – NC positioning – open loop and closed loop – CNC Structure – Machining Centers – Automatic Tool Changers.

Manual Part Programming – Computer Aided part programming.

#### **UNIT V: COMPUTER AIDED PROCESS PLANNING**

Group Technology - Part family- coding and classification - production flow analysis - advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type - Application programs

**Computer Aided Quality Control:** Terminology in quality control, the computer in QC, contact inspection methods, non-contact inspection methods-optical non-contact inspection methods-non-optical computer aided testing, integration of CAQC with CAD/CAM

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Create surface entities and solid models using various CAD techniques.
2. Manipulate the objects by using various transformations.
3. Demonstrate a basic understanding of machining fundamentals including speed and feed calculations, tooling systems, and work-holding systems for CNC milling and turning equipment.
4. Derive a part family code based on design/manufacturing attributes of the part using different techniques.

#### **Text Books:**

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI
2. CAD/CAM Theory and Practice, Ibrahim Zeid and R. Sivasubramanian, Mcgraw Hill Education.
3. CAD/CAM - Principles and applications, P.N. Rao, TMH

#### **References:**

1. Automation, Production systems & Computer integrated Manufacturing, Groover, P.E
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age
3. Computer Aided Design and Analysis ,SrinivasaPrakashRegalla, IP.
4. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson
5. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH
6. Computer Aided Design and Manufacturing, Lalit Narayan, PHI.
7. Computer Aided Manufacturing, T.C. Chang, Pearson
8. A text book of CAD/CAM, CSP Rao, Hitech Publications.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## **B. Tech. IV Year I Semester**

### **14ME210 CAD/CAE/CAM PRACTICALS**

**L T P C**  
**0 0 3 2**

**Course Prerequisite:** 14ME116

#### **Course Description:**

The course work can show the prime importance of simulation software like ANSYS which enables to confidently predict the behavior of the product for different conditions.

The use of G & M codes in CNC machines which are used in the manufacturing sector .

#### **Course Objectives:**

1. To gain practical experience in FEA software systems.
2. To gain the knowledge for writing of programs for CNC machines.

#### **LIST OF EXPERIMENTS**

Introduction to Analysis Software Packages

##### **I. Structural analysis: (Any Five exercises)**

1. Stress analysis of cantilever beam.
2. Analysis of a bracket plate with axial loading.
3. Analysis of a truss member under loading
4. Analysis of plate with hole.
5. Static analysis of a bicycle frame
6. Static analysis simple bracket
7. Modal Analysis of Cantilever beam for natural frequency determination.

##### **III. Thermal analysis:(Any two exercises)**

1. Analysis of a square plate considering conduction
2. Analysis of a square plate considering conduction and convection
3. Analysis of a compound bodies considering conduction and convection

##### **IV. CAM (Any four exercises)**

1. Introduction to CNC & NC Machines
2. Introduction to CNC & NC part programming (G-Codes & M-Codes)
3. Developing program codes for Threading, Milling, Drilling etc., (G-Codes & M-Codes)
4. Experiments on CNC lathe -Turning, Threading operations
5. Developing a CNC code for a given job using
  - i) Solid works- CAM
  - ii) PRO-E- CAM
  - iii) MASTER CAM
  - iv) Edge CAM

**Course Outcomes:**

1. Student should be able to do analysis on FEA software.
2. Student should be able to Write part programs for lathe and milling operations

**Text Books:**

1. Lab manual provided by the department

**Mode of Evaluation:** Practical

## **B. Tech. IV Year I Semester**

### **14ME211 INSTRUMENTATION & CONTROL ENGINEERING PRACTICALS**

**L T P C**  
**0 0 3 2**

**Course Prerequisite:** 14ME118

#### **Course Objectives:**

Instrumentation & control engineering refers to the design, maintenance and production of electromechanical devices, which are used in various circumstances that require precise control and measurement.

#### **LIST OF EXPERIMENTS**

##### **List of experiments – Fluid Mechanics Practicals:**

1. Study and calibration of LVDT transducer for displacement measurement.
2. Calibration of Thermocouple for temperature measurement.
3. Calibration of Strain gauge for Strain measurement.
4. Calibration of Thermistor for temperature measurement
5. Calibration of Resistance temperature detector for temperature measurement
6. Calibration of Capacitive Transducer for displacement measurement.
7. Measurement of speed by Magnetic pickup and Photo electric pickup.
8. Vibration analyzer.
9. Calibration of Rotameter.
10. Calibration of Dead weight Pressure gauge.
11. Calibration of Mcleod gauge.
12. Study of anemometer.
13. Load Cell.

#### **Course Outcomes:**

The students after completing the course will be able to:

1. Select proper instrumentation for measuring pressure, strain, temperature etc.
2. Apply the fundamentals of control systems.
3. Apply the concepts of measurements and sensor selection.
4. Perform measurement of pressure, strain, temperature etc.
5. Calibrate instruments used for measuring pressure, strain, temperature etc.

#### **Text Books:**

Lab manual provided by the department

**Mode of Evaluation:** Practical

## **DISCIPLINE ELECTIVES**



**I never teach my pupils.  
I only attempt to provide the  
Conditions in which they can learn.**

*Albert Einstein*

## Discipline Elective – I

### 14ME401 COMPOSITE MATERIALS & DESIGN

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME103 &14ME105

#### Course Description:

Composite material consists of both fiber and matrix. This course is designed to understand the composite materials used in automobiles, aerospace and chemical industries. Since the materials are selected based on specific strength/stiffness, corrosion resistance and complex designs, composite materials are gaining popularity over monolithic materials.

#### Course Objectives:

1. To be able to understand the fibers such as Glass, Carbon, Armed, Alumina, Silicon nitride and Natural fibers used as reinforcements.
2. To study these fibers in detail including their processing and properties.
3. To understand the matrix materials (metals, ceramics, and polymers) and their bonding with fibers during composite manufacturing.
4. To study the mechanical aspects at micro and macro level on composite materials.
5. Case studies such Carbon-epoxy used in aerospace and glass-polyester used in pressure vessels.

#### UNIT I: REINFORCEMENT OF COMPOSITE

Definition & types of Composites, advantages of composites over monolithic materials, case studies in automobile, Types of Reinforcements, Fiber spinning/stretching/orientation, Reinforcement – Glass: Fabrication, Structure, properties (E-glass), Reinforcement – Carbon: Fabrication, Structure, properties (PAN, PITCH based), Reinforcement – other fibres: Structure, properties (Aramid, Polyethylene, Cellulose based), Reinforcement – Alumina, Si<sub>3</sub>N<sub>4</sub>: Fabrication, Structure, properties.

#### UNIT II: MATRIX MATERIAL

Matrix Materials- Polymers: Glass transition temperature, Thermoplastics, Thermosets, Stress-Strain behavior, Epoxy, Polyester, PE, PP, PEEK, PES, Matrix Materials- Metals: Structure, Strengthening methods, Properties of metals (Al, Ti, Mg), Matrix Materials- Ceramics: Bonding and structure, Fracture toughness, Properties of ceramics (Glass, Alumina, SiC, Si<sub>3</sub>N<sub>4</sub>), Fibre-Matrix Interface: Wettability, Surface roughness, Mechanical bonding, Chemical bonding, Single fibre fragmentation test, Microbond test.

#### UNIT III: PROCESSING, PROPERTIES AND APPLICATIONS

Polymer Matrix Composites (PMC): Processing of thermoset matrix composites (Filament winding, Pultrusion, RTM), thermoplastic matrix composites (Film stacking, Injection molding, SMC), Structure, properties and application; Metal Matrix Composites (MMC): Processing (Liquid state, Solid state, in-situ), Interface in MMC's, Structure, properties and application (Automobile components); Ceramic Matrix Composites (CMC): Processing ( Hot pressing, reaction bonding, Infiltration, CVD, Solgel),

Interface in CMC's, Structure, properties and application; Carbon-Carbon Composites (CCC): Structure, properties and application (Defence and Aerospace).

#### **UNIT IV: MICRO AND MACRO-MECHANICS OF COMPOSITES**

Micromechanics of Composites: Density, Elastic constants (transverse modulus, shear modulus, poisson's ratio), Halpin-Tsai equations, Thermal expansion coefficient & Thermal conductivity of composites, Mechanics of load transfer F-M; Macromechanics of Composites: Elastic constants of isotropic materials & lamina, reduced stiffness and compliance, Laminated composites; Mechanical Properties of Composites: Tensile & Compressive strengths, Fracture modes, Damage of Composites by Impact, etc.

#### **UNIT V: DESIGN AND RECYCLING OF COMPOSITES**

Designing with Composites: Design procedures, Design of tensile members, Design of automobile components, aerospace components, pressure vessels, storage tanks, joints and other equipment's; Recycling of Composites: Chemical & Mechanical methods, incineration, recovery, Policies.

#### **Course Outcomes:**

1. An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and find residual stresses from curing and moisture.
3. An exposure to recent developments in composites, including metal, polymer and ceramic matrix composites.
4. Ability to design and recycling of composites towards using composites in aerospace design.

#### **Text Books:**

Krishan K. Chawla, "Composite Materials: Science and Engineering", Second edition. Springer-Verlag, Newyork, 2010.

#### **References:**

1. B.D. Agrawal L.J. Broutman and K. Chandrashekhara "Analysis and Performance of Fiber Composites", John Wiley & Sons, 2006.
2. William D. Callister, Jr. Callisters Materials Science and Engineering. John Wiley & Sons, 2008.
3. Sanjay K. Majumdar, "Composites manufacturing- materials, product, and process engineering" CRC Press, 2001.
4. Robert M. Jones "Mechanics of Composite Materials", Second edition, CRC Press, 1998.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – I

### 14ME402 POWER PLANT ENGINEERING

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME104, 14ME102 & 14ME109

#### Course Description:

Classification of power plants. Components and layout of thermal, nuclear, hydroelectric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economic loading of power stations. Load curve analysis, load factor, diversity factor. Power plant instrumentation and controls.

#### Course Objectives:

1. This course has been designed to make the students familiar with the power plant engineering and technology. It deals with the thermal, hydro, and nuclear power plants.
2. The course also discusses non-conventional power generation.
3. It also focuses on economic analysis, economic loading, load curve analysis will also be discussed.

#### UNIT I: INTRODUCTION

Power scenario of India-sources of Energy-Resources and Development of power in India.

**Steam power cycles:** Steam power cycles, Efficiency improvement of steam power cycles, working of fluid power cycles, binary vapor cycles, GT-ST power plant.

#### UNIT II: STEAM GENERATORS

Boilers, Efficiency improvement of boilers, Pollution control of boilers, Feed water treatment.

Important fuels, Stoichiometry, Control of excess air, Draught systems, Kinetics, fluidized bed combustion, coal gasification.

#### UNIT III: STEAM TURBINES

Turbine blading, Electrical energy generation. Condenser, Feed Water, Circulating Water

System. **Nuclear Power Plant:** Basics, Components and layout, Nuclear reactors-PWR, BWR, fast breeder Reactor, Homogeneous Reactor, and Gas cooled Reactor.

**Hydroelectric Power Plant:** Components and layout, classification – typical layouts – plant operation pumped storage plants.

#### UNIT IV: DIESEL ENGINE POWER PLANT

Components and layout -IC engines, types **Gas Turbine Power Plants:** Introduction-classification – construction – layout with auxiliaries **Magneto Hydro Dynamics (MHD) systems-** layout-types

#### UNIT V: POWER PLANT ECONOMICS

Economics of power generation, economic loading of power stations. Load curve analysis, load factor, diversity factor Power plant instrumentation and controls. **Non-Conventional Power Generation:** Renewable energy sources, Solar and Wind based power generation, Biomass, Geothermal & other sources for power generation.

**Course Outcomes:**

At the end of the course, student should be able to

1. Know various types of power plants to be used for power generation,
2. Type of fuel used for respective power plant, what exactly a stoker is, and how does it work.
3. The student should be able to know the different factors that may affect power plant economies, economic loading, and load curve analysis.

**Text Books:**

P.K. Nag, Power Plant Engineering, Tata McGraw-Hill Publishing Company Ltd, Third Ed., 2008.

**References:**

1. Bernhardt G.A. Strotzki and William A. Vopat, "Power Station Engineering and Economy", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1960.
  2. M.M. EI-Wakil, "Power Plant Technology", McGraw-Hill International Edition, 1984.
  3. Domkundwar, "Power Plant Engineering", DhantpatRai and Co. (P) Ltd., New Delhi, 2001.
- Mode of Evaluation: Assignment, Seminar, Written Examination, Practical

## Open Elective – I

### 14ME402 POWER PLANT ENGINEERING (Common to EEE,ECE,CIVIL,CSE)

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME104, 14ME102 &14ME109

#### Course Description:

Classification of power plants. Components and layout of thermal, nuclear, hydroelectric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economic loading of power stations. Load curve analysis, load factor, diversity factor. Power plant instrumentation and controls.

#### Course Objectives:

1. This course has been designed to make the students familiar with the power plant engineering and technology. It deals with the thermal, hydro, and nuclear power plants.
2. The course also discusses non-conventional power generation.
3. It also focuses on economic analysis, economic loading, load curve analysis will also be discussed.

#### UNIT I: INTRODUCTION

Power scenario of India-sources of Energy-Resources and Development of power in India.

**Steam power cycles:** Steam power cycles, Efficiency improvement of stem power cycles, working of fluid or vapor power cycles. GT-ST power plant.

#### UNIT II: STEAM GENERATORS

Boilers, Efficiency improvement of boilers, Pollution control of boilers, Feed water treatment. Important fuels, Stoichiometry, Control of excess air, Draught systems

#### UNIT III: STEAM TURBINES

Turbine blading, Electrical energy generation. Condenser, Feed Water, Circulating Water System. **Nuclear Power Plant:** Basics, Components and layout, Nuclear reactors

**Hydroelectric Power Plant:** Components and layout

#### UNIT IV: DIESEL ENGINE POWER PLANT

Components and layout -IC engines, types **Gas Turbine Power Plants:** Introduction-classification – construction – layout with auxiliaries **Magneto Hydro Dynamics (MHD) systems-** layout-types

#### UNIT V: POWER PLANT ECONOMICS

Economics of power generation, economic loading of power stations. Load curve analysis, load factor, diversity factor Power plant instrumentation and controls. **Non-Conventional Power Generation:** Renewable energy sources, Solar and Wind based power generation & other sources for power generation.

**Course Outcomes:**

**At the end of the course, student should be able to**

1. Know various types of power plants to be used for power generation,
2. Type of fuel used for respective power plant, what exactly a stoker is, and how does it work.
3. The student should be able to know the different factors that may affect power plant economies, economic loading, and load curve analysis.

**Text Books:**

P.K. Nag, Power Plant Engineering, Tata McGraw-Hill Publishing Company Ltd, Third Ed., 2008.

**References:**

1. Bernhardt G.A. Strotzki and William A. Vopat, “Power Station Engineering and Economy”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1960.
2. M.M. EI-Wakil, “Power Plant Technology”, McGraw-Hill International Edition, 1984.
3. Domkundwar, “Power Plant Engineering”, DhanpatRai and Co. (P) Ltd., New Delhi, 2001.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – I

### 14ME403 COMPUTATIONAL FLUID DYNAMICS & APPLICATIONS

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME102, 14ME112 & 14MAT103

#### Course Description:

The equations that govern fluid flow have been known to scientists for about 150 years but given their complex nature, finding analytical solutions to them has been limited to very simple problems. Over the recent decades the advent of computers has enabled finding numerical solutions to complex fluid flow problems and this area of study has come to be known as Computational Fluid Dynamics (CFD). Today CFD has become a particularly effective tool for engineers in the many fields such as automobiles, aerospace, energy, biomedical research and manufacturing.

This course is intended to give students a brief introduction to vast and emerging field of CFD. The fundamental topics of governing equations (Partial Differential Equations) for fluid flow and numerical techniques for solving them will be covered. Basics of different possible techniques that can be used to solve fluid flow problems will be elucidated. A brief introduction will be presented on turbulent flows, compressible flows and their numerical solutions.

#### Course Objectives:

1. To give the students necessary exposure to the CFD techniques such that they can solve basic fluid flow problems using CFD
2. To provide the students with the necessary general background information on CFD so that they are prepared to learn advanced topics in niche areas of CFD.

#### UNIT I: GOVERNING EQUATIONS

Models of flow; Governing equations: Continuity equation, Momentum equation, Energy equation. Parabolic, elliptic and hyperbolic equations; Well posed and ill posed problems; Initial and boundary conditions.

#### UNIT II: SOLVING SYSTEM OF LINEAR EQUATIONS AND FINITE DIFFERENCE METHODS

Direct solvers (Gauss elimination, LU decomposition, tri-diagonal algorithm); Iterative solution methods (under and over relaxation); Well-conditioned and ill-conditioned.

Taylor's series: Finite difference formulation, 1D & 2D steady state heat transfer problems; Boundary conditions; Unsteady state heat conduction.

Errors associated with FDM; Explicit method; Stability criteria; Implicit method; Crank Nicolson method; ADI

#### UNIT III: FINITE VOLUME METHOD AND SOLVING NAVIER STOKES EQUATIONS

Basic rules for control volume approach; Steady and unsteady heat conduction: 1-D, Extension to 2D & 3D problems

1D convection diffusion, Discretization schemes and their assessment, Treatment of boundary conditions



#### **UNIT IV: USING CFD SOFTWARE ANSYS FLUENT**

Creating/Importing model geometry, Meshing, physical model selection and setup, numerical scheme selection, monitoring the solution, data visualization and exporting, interpretation and analysis of results and solution refinement. Example problems from tutorials

#### **UNIT V: ADVANCED TOPICS**

Turbulent flow: Basics; DNS, LES and RANS models; Compressible flows: Introduction, Pressure, velocity and density coupling. Solving problems in FLUENT.

#### **Course Outcomes:**

1. Describe the set of equations that govern the fluid motion
2. Apply appropriate computational methods to obtain numeric solutions to fluid flow problems
3. Use a commercial CFD software to solve fluid flow problems
4. Analyze the numerical solutions obtained from CFD techniques

#### **Text Books:**

1. John D Anderson, "Computational Fluid Dynamics", Tata-McGraw Hill Publisher, 1st Edition, 1995.
2. K Muralidhar & T Sundararajan, "Computational Fluid Flow and Heat Transfer", Narosa Book Distributors Pvt Ltd, 2nd Edition, 2009.
3. H K Versteeg & W Malalasekara, "Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearson Education (Indian Reprint), 2nd Edition, 2007.

#### **References:**

1. ANSYS FLUENT User Manual.
2. S V Patankar, "Numerical Heat Transfer and Fluid Flow", Taylor & Francis, 1st Edition, 1980.
3. R H Pletcher, J C Tannehill & D A Anderson, "Computational Fluid Mechanics and Heat Transfer", CRC Press, 3rd Edition, 2012.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – II

### 14ME404 INTRODUCTION TO MEMS

L	T	P	C
3	2	0	3

**Course Prerequisite:** None

#### **Course Description:**

This course covers the fundamental basis of MEMS and devices, such as micro-actuators and micro-sensors, as well as their principles of operation. The course will introduce the state-of-the-art micromachining techniques including surface micromachining, bulk micromachining, and related methods.

#### **Course Objectives:**

**This course is designed such that students will**

1. Gain a fundamental understanding of standard micro fabrication techniques and the issues surrounding them
2. Know the major classes, components, and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
3. Understand the unique requirements, environments, and applications of MEMS
4. Apply knowledge of micro fabrication techniques and applications to the design and manufacturing of a MEMS device or a microsystem
5. Foster interest for further study

#### **UNIT I: OVERVIEW AND WORKING PRINCIPLES OF MEMS AND MICROSYSTEMS**

MEMS and Microsystems, Evolution of Micro fabrication, Microsystems and Microelectronics, Microsystems and miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

#### **UNIT II: ENGINEERING SCIENCE FOR MICROSYSTEMS DESIGN AND FABRICATION**

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

**UNIT III:** Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

#### **UNIT IV: MATERIALS FOR MEMS**

Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers.

#### **UNIT V: MICROSYSTEMS AND THEIR FABRICATION**

Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

**Course Outcomes:**

**At the end of the course, student will be able to**

1. Understand working principles of currently available micro sensors, actuators, and motors, valves, pumps, and fluidics used in microsystems.
2. Apply scaling laws that are used extensively in the conceptual design of micro devices and systems. Students will be able to differentiate between the positive and negative Consequences of scaling down certain physical quantities that are pertinent to microsystems.
3. Use materials for common micro components and devices.
4. Choose a micromachining technique, such as bulk micromachining and surface micromachining for a specific MEMS fabrication process.
5. Understand the basic principles and applications of micro-fabrication processes, such as photolithography, ion implantation, diffusion, oxidation, and etching.
6. Consider recent advancements in the field of MEMS and devices.

**Text Books:**

1. MEMS and Microsystems. Design and Manufacturing, Tia-Ran Hsu, TMH 2002
2. Foundation of MEMS, Chang Liu, Pearson, 2012

**References:**

1. An Introduction to Microelectromechanical Systems Engineering. Maluf, M., Artech House, Boston 2000
2. “Micro robots and Micromechnaical Systems”, Trimmer , W.S.N., Sensors & Actuators, Vol 19, 1989
3. Applied Partial Differential Equations, Trim., D.W., PWS-Kent Publishing, Boston, 1990

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – II

### 14ME405 MECHANICAL VIBRATIONS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14ME106 & 14MAT103

#### Course Description:

This course is designed to acquaint the students with topics in vibrations. The emphasis is on application to common engineering situations and prepare students to tackle free and forced vibration problems. Free and forced (damped and undamped) Vibration Problems with different numerical methods, Instruments used in measuring the vibrations.

#### Course Objectives:

1. Perform vibration design of simple mechanical systems that can be approximated by one, two, or infinite degree of freedom systems.
2. Perform basic free vibration analysis of multi- and infinite-degree of freedom systems.
3. Demonstrate knowledge of simple methods of vibration control

#### UNIT I: FUNDAMENTALS OF VIBRATIONS

**Introduction to Vibration:** Basic Concepts of Vibration, Types of Vibrations, Basic Elements in vibrations, Springs, Springs in series and Parallel, simple problems in springs, Degree of freedom, Natural frequency of spring mass system and simple pendulum.

**Damping:** Damping, simple problems in vibrations. Types of damping, energy dissipated by damping (Viscous), friction or Coulomb damping, and structural damping. Damping ratio. Over damping system, Critical damping and Under damping system. Equation of motion of spring mass with damper. Simple problems.

#### UNIT II: SINGLE DEGREE OF FREEDOM SYSTEMS

**Free Vibration:** Free vibration of an undamped systems, Free vibration of damped (viscous damper) systems, Logarithmic decrement, Torsional system with viscous damping, problems on single DOF System.

**Forced Vibration:** Single DOF forced undamped vibration systems and damped vibration Transient vibrations, vibration isolation. Critical speed of shaft, Rotating unbalanced problem,. Laplace Transformation methods, Transmissibility

#### UNIT III: TWO DEGREE OF FREEDOM SYSTEMS

Free vibration of 2- DOF system, Analysis of Coupled pendulum, principle of coordinator, Normal modes, initial conditions, coordinate coupling, Principle of orthogonality. Numerical problems

**Forced vibration:** Forced vibrations of two degree of freedom. Eigan values, Eigan vector, mode shapes, Dynamic vibration absorber, Problems.

#### UNIT IV: MULTI DEGREE OF FREEDOM SYSTEMS & VIBRATION MEASURING INSTRUMENTS

Multi DOF free vibration systems, Eigen values and vectors, Matrix formulation, Multi Degree of Freedom forced harmonic vibration, Orthogonality relations, Numerical problems, Vibration measuring instruments.

## **UNIT V: NUMERICAL METHODS**

**Numerical Methods:** Energy method, Rayleigh method, Dunkerley's equation, principle of virtual work, Lagrange Equation of motion, Mechanics, Generalized Coordinates.

### **Course Outcomes:**

1. Perform free-vibration analysis of one, two, and multi degree of freedom systems.
2. Perform forced-vibration analysis of one and two degree of freedom systems
3. Design simple mechanical systems for vibrations and vibration measuring instruments.

### **Text Books:**

1. Theory of Vibrations with Applications, William T. Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, Pearson, Sixth Ed.
2. Mechanical Vibrations, R.VenkataChalam, PHI Publications.

### **References:**

1. Mechanical Vibrations, Singiresu S Rao, Pearson, 4th Ed.
2. Mechanical Vibrations - Theory and Application", Francis S. Tse, Ivan E. Morse and Rolland T. Hinkle, Allyn and Bacon Inc. London, 1983.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – II

### 14ME406 FLUID POWER SYSTEMS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14ME102

#### **Course Description:**

Fluid power systems are the systems that use pressurized fluids for generation, control and transmission of power. Such systems are extensively used in automobiles, heavy machinery and in control systems. This course is intended to provide the students with necessary background in the fluid power so that they acquire a working knowledge of the typical fluid power systems. The fundamental concepts required for design, analysis, application, operation and maintenance of fluid power systems will be covered.

#### **Course Objectives:**

To review the fluid mechanics principles that is relevant to fluid power systems

1. To teach basic components of fluid power systems and their working
2. To elucidate the working of hydraulic pumps, motors, valves, actuators and their use in hydraulic circuits
3. To elucidate the working of compressors, pneumatic actuators, valves and their use in pneumatic circuits.
4. To describe the implementation logic control using fluid circuits

#### **UNIT I: INTRODUCTION TO HYDRAULIC POWER**

Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of units. Structure of Hydraulic Control System. The Source of Hydraulic Power: Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps.

Hydraulic Actuators and Motors: Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

#### **UNIT II: CONTROL COMPONENTS IN HYDRAULIC SYSTEMS**

Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.

Hydraulic Circuit Design and Analysis: Control of single and double – acting Hydraulic Cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, and Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

#### **UNIT III: MAINTENANCE OF HYDRAULIC SYSTEMS**

Hydraulic oils; Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting.

## **UNIT IV: INTRODUCTION TO PNEUMATIC CONTROL**

Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders– Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod-less cylinders, types, working advantages. Rotary cylinder types construction and application. Design parameters, selection.

Directional Control valves: Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve. Signal processing elements: Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the use of logic gates. Pressure dependent controls types construction–practical applications. Time dependent controls – Principle, construction, practical applications.

## **UNIT V: MULTI-CYLINDER APPLICATIONS**

Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method – principle. Practical application examples (up to two cylinders) using cascading method (using reversing valves). Electro-Pneumatic control: Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications. Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.

### **Course Outcomes:**

At the end of the course, student will be able to

1. Describe the base fluid mechanics principles used in design and analysis of fluid power systems
2. Distinguish between different types of fluid power systems and list their relative merits and demerits
3. Design and analyze components of hydraulic systems like pumps, hydraulic motors, cylinders, valves and actuators.
4. Design and analyze hydraulic circuits.
5. Design and analyze components of pneumatic systems like compressors, valves and actuators.
6. Describe the working principles of controls for fluid power circuits.

### **Text Books:**

1. Fluid Power with applications, Anthony Esposito, Fifth edition pearson education, Inc. 2000.
2. Pneumatics and Hydraulics, Andrew Parr. Jaico Publishing Co. 2000.

### **References:**

1. Pinches, Industrial Fluid Power, Prentice hall
2. D. A. Pease, Basic Fluid Power, Prentice hall
3. J. J. Pipenger, Industrial Hydraulics, McGraw Hill
4. H. L. Stewart, Hydraulics and Pneumatics, Industrial Press

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**Discipline Elective – II**

**14ME407 AUTOMATION & ROBOTICS**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Objectives:**

1. The student should understand the some fundamental aspects of an overview of robotics& automation, including Components of the Industrial Robotics, arms, architecture, end effectors, actuators& feedback components.
2. Emphasis is placed on understanding motion analysis described mathematically.
3. The Manipulator Kinematics, D-H notation joint coordinates and world coordinates, forward and inverse kinematics are also considered in some detail.
4. The Differential transformation and Trajectory planning, different motions should be able to apply to the analysis of robotics.
5. The student should able to apply the knowledge to solve more complicated problems and study the effect of problem parameters and able to describe the construction and working of different types of robots.
6. The student should be prepared to continue the study and analyze the robotics to solve the complicated practical problems.

**UNIT I: INTRODUCTION TO AUTOMATION**

Need ,Types,Basic elements of an automated system, levels of automation, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

**UNIT II: AUTOMATED FLOW LINES & ASSEMBLY LINE BALANCING**

Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, qualitative analysis.

Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**UNIT III: INTRODUCTION TO INDUSTRIAL ROBOTS**

Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

**Manipulator Kinematics:**Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.

**UNIT IV: MANIPULATOR DYNAMICS, TRAJECTORY PLANNING AND ROBOT PROGRAMMING**

Differential transformation, Jacobians. Lagrange – Euler and Newton – Euler formations.

**Trajectory Planning:** Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.

**Robot programming-**Types – features of languages and software packages.



## **UNIT V: ROBOT ACTUATORS**

**Robot actuators and Feedback components:** Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, tactile sensors, Proximity sensors.

**Robot Application in Manufacturing:** Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

### **Course Outcomes:**

The students after completing the course will be able to:

1. Demonstrate knowledge of Robotics and learning the design of such systems.
2. Demonstrate Cognitive skills (thinking and analysis).
3. Link the scientific concepts they are learning with real applications by giving live examples where the subject concepts are applied.
4. Understand the practical importance of Robot in industry and is of importance also for other advanced courses.

### **Text Books:**

1. Automation, Production systems and CIM, M.P. Groover/Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.

### **References:**

1. Robotics, Fu K S, McGraw Hill.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal, Oxford Press
5. Robotics and Control, Mittal R K & Nagrath I J, TMH.
6. Introduction to Robotics – John J. Craig, Pearson Edu

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – III

### 14ME408 SOLAR THERMAL PROCESS ENGINEERING

L T P C  
3 2 0 3

**Course Prerequisite:** 14ME104&14ME112

#### **Course Description:**

Fundamentals of solar energy, earth-sun angles, solar spectrum, solar radiation, measurement and estimation of solar energy on horizontal and tilted surface, conversion routes and technologies, Standards and Performance Testing, thermal utilization of solar energy, modes of heat transfer and equations for performance calculations of systems- conduction, convection and radiation of heat, Flat plate collectors, solar concentrator systems, geometric optics, tracking methods, thermal analysis, energy storage, materials and properties, solar process loads and system calculations for time dependent loads, Life cycle cost analysis and economic analysis for various applications of solar thermal processes, solar water heating, space heating and cooling in Buildings, Industrial process heating, solar air-conditioning and refrigeration.

#### **Course Objectives:**

1. To give a comprehensive knowledge on design, analysis of solar thermal technologies used for various low temperature as well as high temperature applications.
2. To provide hands on experience on designing and analysis of these systems would be imparted with the associated software and laboratory based exercises.

#### **UNIT I:GENERAL INTRODUCTION**

Overview of various renewable energy technologies, importance and historical development of Solar energy applications. **Environmental characteristics associated with solar energy utilization:** Sun-earth relationships, Solar angles, calculations of solar energy available at a particular location, on a particular surface, thermal radiation and associated calculations, solar energy measuring techniques.

#### **UNIT II:SOLAR ENERGY COLLECTORS**

Engineering and technological considerations of various collectors used for solar energy harnessing, such as flat plate collectors, dish collectors, trough collectors, etc. and associate thermal analyses **Performance of collectors:** Characteristics of various collectors, Critical factors affecting the performance of various collectors, Different kinds of tests to assess the performance of collector.

#### **UNIT III:SOLAR WATER HEATING SYSTEMS**

Engineering and technological considerations of Analysis and design of different kinds of SHWS; Storage systems used for SHWS applications.

#### **UNIT IV:SOLAR SPACE HEATING AND COOLING SYSTEMS**

Thermal load estimations, passive space heating design, Engineering and technological considerations of Analysis and design various Solar space heating and cooling systems, heat pumping systems.

## **UNIT V: DESIGNING AND MODELING SOLAR ENERGY SYSTEMS**

f-chart method and program, Utilizability method, Modeling and simulation of solar energy systems. Solar Economic Analysis: Life cycle analysis, Time value of money, Description of the life cycle analysis method etc.

### **Course Outcomes:**

At the end of the course students will be able to

1. Estimate solar thermal energy available by applying radiation principles.
2. List the functional differences of various solar energy related applications.
3. Design appropriate solar collectors required in various applications.
4. Analyze heat transfer phenomena in solar energy systems.

### **Text Books:**

1. Soteris Kalogirou, "Solar Energy Engineering : Processes and Systems", First edition, Academic Press (an Imprint of Elsevier), USA, 2009
2. Garg .H.P., Prakash. J, "Solar Energy fundamentals and Applications" Twelfth reprint, Tata McGrawhill, New Delhi, 2010.

### **References:**

1. John Twidell, Anthony D. Weir, Renewable Energy Resources, 2nd Ed, Taylor & Francis, NY, 2006
2. Aldo V. Da Rosa, "Fundamentals of Renewable Energy Processes", Second Edition, Academic Press (an Imprint of Elsevier), MA, USA, 2009.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – III

### 14ME409 REFRIGERATION AND AIR CONDITIONING

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14ME104& 14ME112

#### **Course Description:**

This course explains the principles of Refrigeration and Air Conditioning and help to design any R&AC system through comprehensive explanations of the fundamental principles. It also provides the criteria to select the refrigerant for a particular application.

#### **Course Objectives:**

1. The course is designed to give an in-depth study of theory of refrigeration and air-conditioning and their applications.
2. The techniques of analysis and design of refrigeration and air-conditioning systems will also be discussed.

#### **UNIT I: INTRODUCTION & REVIEW**

Necessity and applications - Unit of refrigeration and COP - Methods of refrigeration - Ideal cycle of refrigeration - Its limitations

**Air Refrigeration:** Bell coleman cycle and Brayton cycle-Open and Dense air systems-Actual air refrigeration system-Refrigeration needs of Air crafts-Adoption of Air refrigeration, Justification-Types of systems- Problems on Gas Cycle refrigeration.

#### **UNIT II: VAPOR COMPRESSION AND ABSORPTION REFRIGERATION SYSTEMS**

Working principle and essential components of the plant – simple vapour compression refrigeration cycle – Representation cycle on T-S, P-h and h-s charts – COP - Effect of sub cooling and super heating – Cycle analysis – Actual cycle of operation - Influence of various parameters on system performance - Use of p-h charts - Multi-pressure systems, Problems on vapour compression system – Vapor absorption system – Working – Types of Absorption systems – Estimation of maximum COP.

#### **UNIT III: SYSTEM COMPONENTS**

Compressors – General classification – Comparison – Advantages and disadvantages

Condensers - Classification – Working

Evaporators- Classification – Working

Expansion Valves – Types -Working

**Refrigerants:** Desirable properties – Common refrigerants used - Nomenclature

#### **UNIT IV: INTRODUCTION TO AIR CONDITIONING**

Psychrometric properties - Psychrometry of air-conditioning processes - Problems on Psychrometry – Need for ventilation and Infiltration – Concepts of RSHF, GSHF, ERSHF and ADP- Air conditioning load Calculations - Problems on load calculations - Design of air-conditioning systems.

## **UNIT V: TRANSMISSION AND DISTRIBUTION OF AIR**

Introduction – Classification of ducts – Governing equations used for the air flow analysis through ducts – Pressure losses in duct flows – Equivalent diameter for a rectangular duct – Methods of Duct design - Grills and Registers.

### **Course Outcomes:**

1. Describe the principles of Refrigeration and Air Conditioning.
2. Perform basic design calculations for various components of refrigeration systems including compressors, condensers, expansion valves, evaporators and refrigerant.
3. Perform basic design of air conditioning systems based on psychrometric principles and data.
4. Perform design calculations for air conditioning ducts and diffusers.

### **Text Books:**

Arora C.P. 'Refrigeration and Air-conditioning', 3rd Ed Tata McGraw Hill Co, 2000

### **References:**

1. Manohar Prasad, 'Refrigeration and air-conditioning', Wiley Eastern Ltd, 1983
2. Roy J. Dossat, 'Principles of Refrigeration', 4th Ed, Pearson Education Asia, 2002
3. Edward G. Pita, 'Air Conditioning Principles and Systems', 4th Ed, Pearson Education Asia, 2003

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – III

### 14ME410 PRODUCTION PLANNING & CONTROL

L T P C  
3 2 0 3

**Course Prerequisite:** None

#### **Course Description:**

Rationale for the inclusion of the course/module in the programme: The rationales of the course are such below:

1. To highlight student the importance and relevance of manufacturing planning concept.
2. To describe the nature and scope of manufacturing planning and control system.

#### **Course Objectives:**

1. To plan production facilities in the best possible manner along with the proper systematic planning of production activities.
2. To make adequate arrangement of men, money, materials, machines tools, implements and equipment relating to production.
3. To make all arrangements to remove possible obstacles in the way of smooth production.
4. To decide about the production targets to be achieved by keeping in view the sales forecast.

#### **UNIT I:INTRODUCTION TO PPC**

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

#### **UNIT II:FORECASTING**

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles offorecasting – Forecasting techniques – qualitative methods and quantitative methods.

#### **UNIT III:INVENTORY MANAGEMENT**

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VEDanalysis – EOQ model – Inventory control systems – P–Systems and Q-Systems – Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

#### **UNIT IV:ROUTING AND SCHEDULING TECHNIQUES**

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading, Scheduling Policies – Techniques, Standard scheduling methods, Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.

#### **UNIT V:DISPATCHING AND ITS RULES**

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason forexistence of functions – types of followup, applications of computer in production planning and control.

**Course Outcomes:**

**At the end of the course, student will be able to**

1. Interpret the role and importance of manufacturing planning & control system processes.
2. Demonstrate manufacturing planning & control system processes in industry.
3. Compare good manufacturing planning & control system processes in industry.
4. Examine manufacturing planning & control system practices in industry

**Text Books:**

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa&RakeshSarin
3. Operations Management – S.N. Chary.
4. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.

**References:**

1. Reliability Engineering & Quality Engineering by Dr. C. Nadha Muni Reddy and
2. Dr. K.Vijaya Kumar Reddy, Galgotia Publications, Pvt., Limited.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Production Control / Moore.
5. Operations Management / Joseph Monks.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Discipline Elective – III

### 14ME411 NON DESTRUCTIVE TESTING

L T P C  
3 2 0 3

#### Course Objectives:

1. Introduce the common NDT techniques and impart their basic functions.
2. Impart knowledge regarding different surface NDT techniques.
3. Impart knowledge regarding mechanism of ultrasonic mode of NDT techniques.
4. Impart knowledge regarding the principles radiographic NDT techniques.
5. Impart knowledge regarding advanced NDT techniques like SAFT, EMAT and Halogen diode leak testing.

#### UNIT-I: SURFACE NON DESTRUCTIVE EVALUATION TECHNIQUES

Introduction to NDE techniques- need of NDE techniques, scope and advantage, comparison of NDT with DT, Types of surface NDE techniques-Visual testing, liquid penetration techniques, magnetic particle testing, Eddy current testing, Visual testing-visual optical methods, Liquid penetration techniques-basic principles, dye types and properties, developers, Magnetic particle testing-basic theory of magnetization, magnetization methods, field indicators, particle application, inspection, Eddy current testing-Faraday's law, inductance, Lenz's law, self and mutual inductance, impedance plane.

#### UNIT-II: ULTRASONIC TESTING

Fundamentals of ultrasonic waves, Generation of ultrasonic waves-piezo electric effect, piezo electric materials and their properties, Ultrasonic inspection methods-pulse echo method, through transmission method, resonance method, Testing method- welding inspection, distance and area calibration.

#### UNIT-III: RADIOGRAPHIC TESTING AND SAFETY

Basic principles of radiography- X rays and their properties, X ray generation, X ray absorption and scattering, Radiographic image-image formation and quality, image interpretation, radiography of weldments, Radiation safety- radiation detectors, radiation shielding.

#### UNIT-IV: ADVANCED NDE TECHNIQUES-I

Phased array techniques- Principles of phased array inspection, Theory and principles of time of flight diffraction- Synthetic Aperture Focusing Technique (SAFT), Ultrasonic guide waves- Electro Magnetic Acoustic Transducer (EMAT), Laser ultrasonics-Laser Shearographics, Non-linear Ultrasonics and structural health monitoring.

#### UNIT-V: ADVANCED NDE TECHNIQUES-II

Acoustic emission inspection-Basic principles, sources of acoustic emission, Source parameters, Kaiser-Felicity Theory, Leak testing-measurement of leak, types of leak, leak testing of pressure systems without and with tracer gas, Halogen diode leak testing, Digital radiography, Computer Tomography.



**Course Outcomes:**

After completion of this course, students can able to

1. Apply the knowledge of surface NDE techniques to solve the surface related failures in the real-time environment.
2. Apply the knowledge of ultrasonic testing methods to inspect the welding defects and other subsurface defects.
3. Apply the knowledge of radiographic testing methods for welding inspections and suggest the appropriate safety measures for using this technique.
4. Apply the knowledge of advanced ultrasonic testing techniques like phase array techniques SAFT and laser ultrasonics to detect defects in plates and tubes in various depths with high accuracy.
5. Apply the knowledge of various leak testing methods to detect the leaks in the pipelines and pressure vessels.

**Reference Books:**

1. X. P.V. Maldague, Non-Destructive Testing Handbook; Infrared and Thermal Testing , Vol-3, series III, American Society for Non-Destructive Testing, 3rd edition (2001).
2. C. N. Jackson and N.Sherlock , Non-Destructive Testing Handbook; Leak Testing , Vol - 1, , series VI, American Society for Non-Destructive Testing, 3rd edition, (1998).
3. R. K.Miller and V.K.Hill, Non-Destructive Testing Handbook; Acoustic Emission Testing, Vol-6, series V, American Society for Non-Destructive Testing, 3rd edition, (2005).
4. L. E. Bryant and P. McIntire, Non-Destructive Testing Hand Book: Radiography and Radiation Testing, Vol.3, American Society for Non-Destructive Testing, 2nd edition (1985)

**Discipline Elective –IV**

**14ME412 ENTREPRENEURSHIP**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Description:**

This course is designed to ignite the entrepreneurship idea into the young minds of engineers. Gives the complete details to setup an enterprise which includes the generating the business ideas, writing a business plan executing the plan successfully.

**Course Objectives:**

1. Understand the basic development of entrepreneurship as a profession.
2. Understand business models.
3. Write a business plan describing a new business venture.
4. Understand business development and marketing strategies for small businesses.
5. Identify capital resources for new ventures and small businesses.

**UNIT I:**

Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur.

**UNIT II :**

Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

**UNIT III:**

Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising.

**UNIT IV:**

Choosing location and layout, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance

**UNIT V:**

Designing the work place, Inventory control, material handling and quality control.

Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

**Course Outcomes:**

At the end of the course, students should be able to

1. Describes the sources of new business ideas, methods to develop new ideas and use the
2. problem solving techniques
3. Able to Write a business plan which includes Financial plan, Organizational Plan and
4. Marketing Plan
5. Able to identify the financial sources for new business ventures
6. Able to select a plant layout and draw a plant layout
7. Design a work place

**Text Books:**

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

**References:**

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J. Calvin, TMH, 2004.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**Discipline Elective –IV**

**14ME413 AUTOMOTIVE TECHNOLOGY**

**L T P C**  
**3 2 0 3**

**Course Prerequisite:** None

**Course Description:**

Automotive vehicle: layout, operating systems, components, materials and production processes; Power unit: IC engine, working principles, performance, systems and the associated parts; Mechanical unit: transmission, drive train, steering, chassis, suspension, brakes, wheels and tyres; Electric unit: battery, charging, starter and lighting; Electronic control unit: application of electronics and computers, sensors, actuators and on-board diagnostics; Latest Trends: advanced combustion systems and hybrid/fuel-cell/electrical power systems, alternate fuels and the emissions.

**Course Objectives:**

1. This is an introductory multi-disciplinary course aimed at providing a comprehensive overview of the operating systems of a modern automobile.
2. It also aims at analyzing the working features of an automobile vehicle with the technologies, materials and processes associated with it.

**UNIT 1:**

Automobile history, vehicles classification, layout; Introduction systems and their functions; components, materials and production processes; latest trends. Classification of IC engines, air standard cycles, 2- IC Engine Operation stroke & 4-stroke engines, SI & CI engines, and engine performance evaluation.

**UNIT 2:**

Cylinder block, crankcase, cylinder head, piston, piston rings, piston pin, connecting rod, crankshaft, fly wheel, valves and valve timing.

**UNIT 3:**

Multi-Cylinder Engines Engine balance, cylinders arrangement, firing order Air-fuel mixture requirements for SI engines, Fuel Supply Systems Carburetion; CI engine fuel injection systems and the latest trends.

**UNIT 4:**

Lubrication and Cooling Systems Engine friction, factors affecting the friction, lubrication systems and their mechanism; Need for cooling system, types, water jackets and radiators.

**UNIT 5:**

Transmission System Clutch: location, types, construction; Gears: classification, gear ratio; Transmission: types, propeller shaft, universal joint, Differential.

**Course Outcomes:**

1. Solve the problems encountered in the automotive industry.
2. Describe the functioning of various automobile components as per the global trends.
3. Explain the advanced combustion systems, fuels and emission systems in contemporary automotive industry.

**Text Books:**

1. Sudhir Kumar Saxena, Automobile Engineering, University Science Press, 1st Edition, 2009
2. VAW Hillier, Fundamentals of Motor Vehicle Technology, Vol 1 & 2, Nelson Thornes, UK, 6th Edition, 2012

**References:**

1. V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill, 3rd Edition, 2007.
2. Kirpal Singh, Automobile Engineering, - Vol. 1 & 2, Standard Publishers & Distributors, 12th Edition, 2011.
3. N. K. Giri, Automobile Mechanics, Khanna Publishers, 8th edition, 2009.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

**Discipline Elective –IV**

**14ME 414 TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 2 0 3**

**Course Objectives:**

1. Provides an overview of Quality and TQM and the contributions of Quality Gurus like Deming, Juran and Crosby.
2. Understand and apply various Quality Control Tools.
3. Develop knowledge on Benchmarking and related methods.
4. Develop knowledge on Cost of quality and value of products.
5. Develop knowledge on Quality standardization systems.

**UNIT –I**

Introduction: Definitions of Quality, Quality control, Quality management and Quality Assurance. The impacts of Quality and continuous improvement on business performance. TQM Concepts - Quality management philosophies of Deming, Juran, Crosby, Ishikawa etc.

**UNIT- II**

Process Management, Quality Measurement Systems (QMS) Developing and Implementing QMS. TQM Tools & Techniques, 7 QC Tools, 7 New QC Tools.

Quality Circles Organization Focus Team Approach –Statistical Process Control –Process Chart - Ishikawa Diagram –Preparing and using Control Charts.

**UNIT –III**

Quality Function Development (QFD) –Elements of QFD – Continuous improvement – Benchmarking-Types-Advantages & Limitations of Benchmarking –Taguchi Analysis –Loss function -Taguchi Design of Experiments, Poka-yoke, Kaizen, Deming Cycle.

**UNIT –IV**

The Cost of Quality: Various costs of Quality, measuring Quality costs and use of Quality cost information for continuous improvement.

Value Improvement Elements –Supplier Teaming; Elements of Business Process Reengineering & Supply Chain Management.

## **UNIT – V:**

Quality Standards -Need for Standardization – Institutions or Bodies of Standardization, ISO 9000 series, ISO 14000 series, Other Contemporary Standards, ISO Certification Process, Third Party Audit. Black belt & Green belt certification outline process in Six Sigma, 5S in Six Sigma – one Case study.

### ***Course Outcomes:***

1. Define Quality terms and explain various TQM principles
2. Apply the Quality control tools for various case studies
3. Describe various methods adopted for continuous improvement and benchmarking
4. Apply the cost of quality function for continuous improvement
5. Describe the standardization implementation procedures such as ISO / Six sigma

### **TEXT BOOKS:**

1. Total Quality Management, Besterfield, Pearson Edu.
2. Total Quality Management, K. Shridhar Bhat, Himalaya.

### **REFERENCE BOOKS:**

1. Quality management, Howard Giltow-TMH
2. Total Quality management, James R. Evans, James W. Dean, Published by South Western Educational Publishing
3. Quality management, Bedi
4. Beyond TQM, Robert L. Flood

## Discipline Elective –IV

### 14ME415 PRODUCT LIFECYCLE MANAGEMENT

L T P C  
3 2 0 3

Course Objectives:

1. To study the basics of PLM and its application in industry
2. To learn various PLM strategies for business.
3. To learn implementation and change management of PLM in industries.
4. To learn the various modules in PLM software and its customisation

#### UNIT -I

**MOTIVATION AND INTRODUCTION:** The opportunities and benefits of PLM, Different views of PLM, e-commerce, B to B, B to C forms of business, extended enterprise, concepts in PDM - product life cycle, business objects, information flow model in product development, engineering bill of materials and manufacturing bill of materials.

#### UNIT -II

**PLM VISION AND STRATEGY:**Basic points about PLM Vision, The process of PLM Visioning, A strategy to achieve vision, Principles of the PLM strategy, Preparing for the PLM strategy, Developing a PLM strategy.

#### UNIT -III

**PRODUCT DATA MANAGEMENT:** PDM Systems, Reasons for implementing a PDM system, Financial justification of PDM, Barriers to successful implementation of PDM, CAD neutral environment and visualisation of products, markup - case studies.

#### UNIT -IV

**ROLE OF PLM IN INDUSTRIES:** (like auto, aero, electronic) - other possible sectors, ten step approach to PLM, benefits of PLM. Change management for PLM

#### UNIT -V

**MODULES IN A PDM/PLM SOFTWARE:** CAD, CAE, manufacturing process management, Enterprise system integration, supplier management, Data retrieval.

#### **CUSTOMISATION OF PDM/PLM SOFTWARE:**

Understanding of business objectives, project data management, product data management, process management.



**Course outcome:**

- 1. Describe the basics of PLM and its application in industry**
- 2. Developing a PLM strategy for the given business model**
- 3. Explain the basics of PDM and its implementation**
- 4. Describe the Change management in PLM**
- 5. Describe and customize the various modules in leading PLM software**

**TEXTBOOK:**

1. John Stark, “Product Lifecycle Management: 21 Century Paradigm for Product Realisation”, Springer Publisher, 2005.

**REFERENCES:**

1. Lihui Wang and Andrew Y C Nee, “Collaborative Design and Planning for Digital Manufacturing”, Springer-Verlag London Limited, 2009.
2. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007.
3. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.
4. Cortada and James W, “The Digital Hand : How Computers Changed the Work of American Manufacturing, Transportation and Retail Industries, Oxford University Press Inc., 2004.
5. Leon Alexis, “Enterprise Resource Planning”, Tata McGraw Hill, 2002.
6. Kevin N Otto and Kristin L Wood, “Product Design”, Pearson, 2001.
7. David Ferris and Larry Whipple, “Building an Intelligent E-Business”, Premier Press, 2001.
8. DamerAmer, “The E-business Revolution”, Prentice Hall, 2000.
9. Faisal Hoque and David Orchard, “e-Enterprise: Business Models, Architecture and Components (Breakthroughs in Application Development)”, Cambridge University Press, 2000.

## **OPEN ELECTIVES**

**The task of the excellent teacher is to stimulate  
“Apparently ordinary” people to unusual effort.  
The tough problem is not in identifying winners;  
it is in making winners out of ordinary people.**

*K. Patricia Cross*

**Open Elective - I**

**14HUM401 PROFESSIONAL ETHICS**

**L T P C**  
**3 0 0 3**

**Course Prerequisite:** None

**Course Description:**

Professionally accepted standards of personal and business behavior, values and guiding principles. Codes of professional ethics are often established by professional organizations to help guide members in performing their job functions according to consistent ethical principles.

**Course Objectives:**

The course is intended to

1. To provide a formal acquaintance with the ethical concepts and frameworks.
2. To enable the students to recognize the codes of ethics and moral values relevant to the experience of being a professional.
3. To develop among the students an understanding of various ethical issues relating to professions in general and business, management, education, engineering and computers in particular.
4. To enable the students to develop the awareness needed to understand the role of moral reasoning in the framework of professional life with the help of real time case studies.

**UNIT I: PROFESSIONAL ETHICS-INTRODUCTION**

The basic nature of ethics- Ethics, Applied Ethics and Professional Ethics, Concept of a Profession, Ethics and Professions, unique status and issues of professional ethics, Across the Professions, the nature and role of moral theories, Ethical Theories- Indian Ethics.

**UNIT II: SOME THEORIES AND WOMEN RELATED ISSUES**

Utilitarian Theory- Deontological Theory- Virtue Theory- Ethical codes for various professions, Employer-Employee Relation, peculiar moral right of a professional- Whistle-Blowing, the ethical nuances of women related issues in professions- Women and Family Issues, moral implications in concrete situations- Case Studies.

**UNIT III: BUSINESS ETHICS AND CORPORATE SOCIAL RESPONSIBILITY**

Business- the nature and value of business ethics, Corporate Social Responsibility and Stakeholders, the role of ethics in marketing and advertising and their relevance for professionals, the right of a professional to a safe workplace- Occupational Health, Case-Studies.

**UNIT IV: ETHICS IN MANAGEMENT AND EDUCATION**

Management- management ethics and its importance for professionals, the value of an ethical approach in management- Efficiency and Effectiveness, the moral implications of an unjust dismissal- Discrimination and Unjust Dismissal- Case-Studies. Education- the role of ethics in the field of education, the need for ethical codes in the educational system- Educator and Educational Institutions- Case-Studies.

## **UNIT V: ETHICS IN ENGINEERING AND COMPUTERS**

Engineering- the nature of engineering ethics, the inter-dependence of standards and values in engineering profession- Standards and Values for Engineers, ethical practices in engineering- Engineers and Public Interest- the ethical issues concerning the use of professional information in engineering, Case-Studies. Computers- the ethical impacts of computerization on a society, Ethical Problems in Information and Communication, the ethical impacts of internet on a society, some peculiar moral issues raised by the use of internet- Privacy, Security, and Moral Wrongdoing, Case-Studies.

### **Course Outcomes:**

Upon completion of this course, students will be able to

1. Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
2. Identify the multiple ethical interests at stake in a real-world situation or practice
3. Articulate what makes a particular course of action ethically defensible
4. Assess their own ethical values and the social context of problems
5. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
6. Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
7. Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

### **Text Book:**

Boatright, John R., Ethics and the Conduct of Business, Pearson Education, Fifth Edition, Indian Reprint, 2007

### **References:**

1. Rowan, John, and Zinaich, Jr., Ethics for the Professions, Wadsworth, 2003.
2. Sekhar, R.C., Ethical Choices in Business, Response Books, Sage Publications, 1997.
3. Harris, Charles, E. Jr., Michael S. Pritchard, Michael J. Rabins, Engineering Ethics: Concepts & Cases, Wadsworth Publishing Company, 1995
4. Erwann, M.David, Williams, Masy B and Gutierrez, Claudio, Computers, Ethics, and Society, Oxford University Press, 1990
5. Langford, Duncan (ed.), Internet Ethics, Macmillan Press Ltd, 2000
6. Sachdev, Kumar Neeraj, Ethics: A Virtue Theoretic Approach, Delhi: Adhyayan Publishers & Distributors, 2005.

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Open Elective -I

### 14MAT401 NUMERICAL ANALYSIS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14MAT102 & 14MAT103

#### **Course Description:**

Numerical approach to find errors, calculation of roots; solving system of linear equations; interpolation, trapezoidal rule and Simpson's rule; Taylor Series, Finite difference methods for ordinary differential equations; Wave, heat and poisson equations.

#### **Course Objectives:**

1. To avail knowledge in solving nonlinear equations through Numerical methods.
2. To familiarize the student in the fields of finite difference methods and Numerical calculus.
3. Our emphasis will be more on the logical and problem solving techniques in numerical methods for differential equations.
4. To introduce finite difference methods and its applications in technical fields.

#### **UNIT I: SOLUTIONS OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS**

Introduction to Numerical analysis, Errors, Sources of errors, Floating point arithmetic, Significant digits, Relative error, Propagation of errors, how to avoid loss of significant digits, evaluation of polynomial.

Bisection, False-position, Fixed point iteration method, Newton's method, Secant, Order of convergence, Multiple roots by Newton's method.

#### **UNIT II: SYSTEM OF SIMULTANEOUS LINEAR EQUATIONS**

Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss seidel method, Power method leading to Eigen values and eigenvectors of matrices.

#### **UNIT III: INTERPOLATION & NUMERICAL CALCULUS**

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.

#### **UNIT IV: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS**

The Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems. The shooting method, Finite difference method for boundary value problems.

#### **UNIT V: NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS**

Finite difference method of Wave, Heat and Poisson equations (initial and boundary).

**Course Outcomes:**

At the end of this course, students should be able to obtain

1. The student becomes familiar with the applications of numerical techniques in solving the nonlinear equations of engineering problems.
2. Ability to solve the system of linear equations using Numerical methods.
3. The student knows how to solve the calculus problems using Numerical techniques.
4. The student gains the knowledge to tackle the engineering problems using concepts of differential equations and numerical methods.
5. The student is capable of solving partial differential equations numerically, which finds its applications in different fields of engineering.

**Text Book:**

Applied Numerical Analysis by Curtis F. Gerald, Patrich O. Wheatley Pearson Education, 7th Edition, 2003.

**References:**

1. Numerical Analysis by Burden and Faires, 7th ed., Thomson Learning, 2001.
2. A Friendly Introduction to Numerical Analysis by Brain Bradie, 1sted., Pearson, 2005.
3. Elementary Numerical Analysis by K. Atkinson & Weimin Han, 3rd ed., Wiley, 2004.
4. Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.
5. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., McGraw Hill, 2012.

**Mode of Evaluation:** Assignments, Internal Mid examinations, External End Examination.

## Open Elective -I

### 14CHE401 INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY

L T P C  
3 0 0 3

**Course Prerequisites:** 14CHE101

#### **Course Description:**

This is primarily a course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology. It will also be a forum for discussion on the possible consequences of such technological development. This multidisciplinary course will bring together discipline based knowledge and skills and which will show how this expertise can be applied to Nano-technological problems.

#### **Course Objectives:**

1. This course is designed to provide students with an overview of current topics and challenges in Nanoscience and Technology.
2. To introduce various synthetic strategies of nanomaterials.
3. To familiarize the existing types of nanostructured materials.
4. To analyze the properties and characterization techniques of nanomaterials.
5. To sensitize students with the exhaustive applications of nanomaterials and their current role in the modern technology.

#### **UNIT I: BACKGROUND TO NANOTECHNOLOGY**

Scientific revolution- Atomic structures-Molecular and atomic size-Bohr radius – Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon, graphene sheet, CNT.

#### **UNIT II: SYNTHESIS OF NANOMATERIALS**

Types of simple crystal structures, top-down and bottom-up approaches, self assembly process-grain boundary volume in nanocrystals-defects in nanocrystals-surface effects on the properties.Self-assembly of nanoparticles on surfaces like silica surfaces and stainless steel surfaces.

#### **UNIT III: TYPES OF NANOSTRUCTURES**

Definition of a Nano system – Nanoscale building blocks, Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials - Quantum dots (OD)-Quantum wire-Core/Shell structures.

#### **UNIT IV: NANOMATERIALS AND PROPERTIES**

Carbon Nanotubes (CNT) - Metals (Au, Ag) – Phase diagram of simple binary systems, Metal oxides (TiO<sub>2</sub>, CeO<sub>2</sub>, ZnO) -Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites - Dilute magnetic semiconductor.The Nanoscale and colloidal systems, characterization techniques, optical properties, LED application.



## **UNIT V: APPLICATIONS OF NANOMATERIALS**

Molecular electronics and nanoelectronics – Quantum electronic devices - CNT based transistor and Field Emission Display - Biological applications - Biochemical sensor - Membrane based water purification, Targeted base drug delivery system.

### **Course Outcomes:**

Upon completion of this course the students should be able to:

1. Demonstrate a working knowledge of nanotechnology principles and industry applications.
2. Identify current nanotechnology solutions in design, engineering and manufacturing.
3. Explain the nanoscale paradigm in terms of properties at the nanoscale dimensions.
4. Apply key concepts in materials science, chemistry, physics, biology and engineering to the field of nanotechnology.
5. Search, read and present current nanotechnology literature applied to a particular problem domain.

### **Text Books:**

1. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C.N.R.Rao, A.Muller, A.K.Cheetham (Eds), the chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH VerlagGmbH&Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, Inc, 2001.
4. C.S.S.R.Kumar, J.Hormes, C.Leuschner, Nanofabrication towards biomedical applications, Wiley – VCH Verlag GmbH & Co, Weinheim, 2004.

### **References:**

1. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
2. K.E.Drexler, Nano systems, Wiley, 1992.
3. G.Cao, Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperial College Press, 2004.
4. T. Pradeep, Nano: The Essentials, Understanding Nano science and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007

**Mode of Evaluation:** Assignments, Internal Mid Examinations and Semester end examination.

## Open Elective -I

### 14PHY401 PHYSICS OF LASER AND APPLICATIONS

L	T	P	C
3	0	0	3

**Course Prerequisite:** None

**Course Description:**

This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

**Course Objectives:**

1. Make the student to understand the principle of laser.
2. Explain the properties of laser light and to make them understand the operations of different types of lasers.
3. Students are aware of latest developments in certain areas of Physics which have important applications for societal needs. Explain how material processing is accomplished with lasers.
4. Estimate laser operation parameters for material processing.
5. Introduce basic fiber optic communication systems using laser, and to make the students learn about their important applications for societal needs.

#### UNIT I: INTRODUCTION

Laser characteristics, Spontaneous and Stimulated emission of radiation, Einstein's Coefficients, Population inversion, Methods of Population Inversion Gaussian beam and its properties, Stable two minor optical resonators, Longitudinal and transverse modes of laser cavity, Mode selection, Gain in the regenerative laser cavity.

#### UNIT II: TYPES OF LASERS AND THEIR CONSTRUCTION

Basic principles of lasers, Solid-state lasers, Gas lasers, Ruby laser, Nd-YAG Laser, He-Ne laser, Carbon dioxide laser, Nitrogen laser.

#### UNIT III: TYPES OF LASERS- II

Semiconductor lasers, free electron lasers, Liquid, Dye and Chemical lasers. High power laser systems. Laser spectroscopic techniques and other applications.

#### UNIT IV: LASER OPTICS

Laser fluorescence and Raman scattering and their use in pollution studies, Laser induced multi-photon processes and their applications. Ultra high resolution spectroscopy with lasers and its applications.

#### UNIT V: LASER SPECTROSCOPY AND OPTICAL FIBERS

Propagation of light in a medium with variable refractive index, Construction and principle of optical fiber, light wave communication, medical and engineering applications of lasers.

**Course Outcomes:**

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the four elements of different lasers.
2. Estimate stability requirements introducing laser light by different types of sources.
3. Describe the structure and working of various types of lasers and their means of excitation.
4. Assess which laser would best meet the need for a particular industrial or research task.
5. Understands and appreciates components of optical fiber communication system and its important applications for societal needs.

**Text books:**

1. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan
2. Optics: Ghatak, 4th Edition, Tata McGraw Hill.

**References:**

1. Principles of Laser: O. Svelto
2. Laser spectroscopy: Demtroder
3. Laser Applications: Monte Ross

**Mode of evaluation:** Assignment, Seminar, Written Examination.

## Open Elective - II

### 14HUM402 HUMAN RESOURCE DEVELOPMENT

**L T P C**  
**3 0 0 3**

**Course Prerequisite:** None

#### **Course Description:**

The course content includes : Introduction to HRM, strategic human resource challenges , work flows, job analysis, managing diversity, concepts, goals , mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline ,and workplace safety and health.

#### **Course Objectives:**

The course is intended to

1. Every Organization (industrial, educational, medical etc.) had to depend on the co-operation of its personnel for accomplishing its set objectives.
2. This course aims at providing understanding of various human resource management concepts to obtain necessary co-operation and commitment of the organizational personnel
3. Performance management
4. Training programs & Succession plans
5. Motivation and employee engagement
6. Career development
7. Coaching and mentoring
8. Leadership development

#### **UNIT I: INTRODUCTION**

Understanding the nature and scope of Human Resource Management- Definition, Functions/objectives, organization of department, Evolution, Context in HRM Changing role in HRM Meeting present and emerging strategic Human resource challenges- Human resource management, planning and implementing strategic HR Policies, selecting HR strategies to increase firm performance.

#### **UNIT II: HUMAN RESOURCE PLANNING**

Human Resource Planning- Nature and importance of HR planning, Factors affecting HRP, the planning process, managerial succession planning. Analysis Work and Designing Jobs- Process of Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

#### **UNIT III: RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL**

Recruiting and selecting employees- Recruiting Human resource, recruitment process, Evaluation process, Selection process, Barriers, selection in India. Appraising and Managing Performance- Basic Concept of Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

#### **UNIT IV: TRAINING AND DEVELOPMENT**

Training the workforce- Training v/s development, challenges in training, managing training process. Developing careers- Career development, effective career development, managing compensation- Designing, compensation tools. Rewarding performance & designing benefits- Designing pay for performance, types of Pay for performance, benefits strategy, administering benefits.

#### **UNIT V: INDUSTRIAL RELATIONS, TRADE UNIONS, EMPLOYEE SAFETY AND HEALTH**

Industrial Relations, Trade unions, Resolving dispute- Labor Movement - Trade Union in India, Collective Bargaining: Process and Methods, Grievance: Sources and process of Redressal, Managing Ethical issues in Human Resource Management- Ethics and fair treatment at work.- Human Resource Management's role in promoting ethics and fair treatment, Employee Discipline and Privacy, Managing Dismissal. Employee Safety and Health- Safety, Types of accidents, Need for safety. Safety Programme, Health.

#### **Course Outcomes:**

Upon completion of this course, students will be able to

1. Formulate Human Resource Development strategies that attract, develop, and retain the best human capital and talent.
2. Design and implement workplace learning and performance interventions to achieve employee and organizational goals.
3. Develop effective consulting, coaching, and mentoring skills to sustain learning, performance, and change in the workplace.
4. Lead strategic change initiatives and manage projects in any organizational setting.
5. Evaluate Human Resource Development programs and interventions to determine their quality, value, and effectiveness.

#### **Text Books:**

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010
2. Gomez-Mejia, L.R., Balkin, D.B., & Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.

#### **References:**

1. Garry Dessler, Biju Varkkey, Human Resource Management, 11th Edition, Pearson Education, 2009.
2. R. Wayne Mondy, Human Resource Management, 10th Edition, 2010

**Mode of Evaluation:** Assignment, Mid Examination, End Examination

## Open Elective - II

### 14MAT402 ENGINEERING OPTIMIZATION

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Prerequisite:** 14MAT101, 14MAT102 & 14MAT103

#### **Course Description:**

Linear programming problem, Goal programming, transportation and assignment problems, unconstrained and constrained optimization, project management and queuing models.

#### **Course Objectives:**

1. Provide students with the basic mathematical concepts of optimization.
2. Understand the theory of optimization methods and algorithms for solving various types of optimization problems.
3. Emphasize the modeling skills necessary to describe and formulate optimization problems.
4. Avail knowledge to solve and interpret optimization problems in engineering.
5. Analyze the techniques of project management and Queuing models.

#### **UNIT I: LINEAR PROGRAMMING PROBLEM**

Introduction to optimization, Linear Programming Problem (LPP), Mathematical formulation, Graphical solution, convex set, simplex method, artificial variable technique - Big M-method and two phase simplex method.

#### **UNIT II: DUALITY IN LINEAR PROGRAMMING PROBLEM**

Duality: formulation of dual Problem, Primal-Dual Relationships, Dual Simplex method, Sensitivity analysis and Post optimal analysis.

#### **UNIT III: TRANSPORTATION PROBLEM AND GOAL PROGRAMMING PROBLEM**

Transportation problem: definition and algorithm, Assignment problem. Goal Programming - formulation, Goal programming algorithms: The weights method and the preemptive method.

#### **UNIT IV: UNCONSTRAINED & CONSTRAINED OPTIMIZATION**

Unconstrained optimization, constrained multivariable optimization with equality constraints- Direct substitution method and Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions. Elimination Methods- Interval Halving Method, Fibonacci Method and Golden Section Method, Gradient of a Function, Descent Methods - Steepest Descent Method and Conjugate Gradient (Fletcher-Reeves) Method.

#### **UNIT V: PROJECT MANAGEMENT & QUEUING MODELS**

Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to Queuing system, single server queuing models (M/M/1): ( $\infty$ /FCFS), (M/M/1): (N/FCFS), Multi-server queuing models (M/M/s): ( $\infty$ /FCFS), (M/M/s): (N/FCFS).

**Course Outcomes:**

The student will be able to

1. Understood the importance of Optimization.
2. Get an idea about the Unconstrained and Constrained Optimization Techniques.
3. Applying Transportation & Assignment Problems in Engineering
4. Analyze the problems of Network Analysis for Project Management and Queuing Systems Engineering & Industry.
5. Think to solve the various problems in Engineering using the suitable Optimization techniques.

**Text Books:**

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th Edition, 2013.

**References:**

1. SS Rao, Engineering Optimization: Theory and Practice, New Age International (P) Limited, Third Edition, 1996 (R1)
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley & Sons, Singapore, Second Edition. (R5).

**Mode of Evaluation:** Assignments, Internal Mid Examinations, External End Examination.

## Open Elective - II

### 14CHE402 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L T P C  
3 0 0 3

**Course Prerequisite:** 14CHE101

#### **Course Description:**

This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies. This course covers feed stocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts and solvents and green processes for Nanoscience.

#### **Course Objectives:**

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience.

#### **UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

#### **UNIT II: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C-C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

#### **UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

#### **UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feed stocks: Chemicals from Renewable Feed stocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals



from Natural Resources, Alternative Economies: The Syngas Economy, The Bio-refinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

#### **UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials.

#### **Course Outcomes:**

Upon completion of this course the students should

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nano science.

#### **Text Books:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA.

#### **Reference:**

Edited by Alvise Perosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanosciences, Wiley-VCH.

**Mode of evaluation:** Assignments, Internal Mid examinations and semester end examination.

## Open Elective - II

### 14PHY402 OPTICAL PHYSICS AND APPLICATIONS

L T P C  
3 0 0 3

**Course Prerequisite:** None

**Course Description:**

The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

**Course Objectives:**

1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration.
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field.
4. Provide a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

**UNIT I: INTRODUCTION**

Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigen values and Eigenvectors.

**UNIT II: ABERRATIONS AND OPTICAL INSTRUMENTS**

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

**UNIT III: WAVE OPTICS & INTERFERENCE**

Huygens' Principle, Superposition of waves, Fourier transforms, representation of slits and apertures, two beam interference by Division of wave front. Applications of Interference, Non linear interaction of light with matter (self-study).

**UNIT IV: DIFFRACTION & POLARISATION**

Fraunhofer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

**UNIT V: OPTICAL FIBERS**

Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communication, sensors and medicine.

**Course Outcomes:**

Upon completion of this course the students shall be able to:

1. Understand the fundamental characteristics of light and their mathematical principles.
2. Demonstrate an understanding of defects in optical instruments.
3. Describe optical phenomena and the principles of interference, diffraction and polarization in terms of the wave model.
4. Apply optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

**Text Book:**

Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

**References:**

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).
2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

**Mode of evaluation:** Assignment, Seminar, Written Examination.

## **AUDIT COURSES**

**Don't watch the clock;  
Do what it does. Keep going.**  
*Sam Levenson*

**Audit Course -I**

**14ENG301 EFFECTIVE PUBLIC SPEAKING**

**L T P C**  
**2 0 0 0**

**Course Prerequisite:** None

**Course Description:**

This course provides effective presentation training tools and skills include good content, organization, delivery, audience, and analysis. These enhance students' traits in becoming a more critical consumer of information and delivery of speeches within a public setting and group discussion. Emphasis is on research, preparation, delivery, and evaluation of informative, persuasive, and special occasion public speaking.

**Course Objectives:**

1. To improve student's speaking skills in various professional contexts and enable one to develop the art of public speaking.
2. To improve student's speaking skills in various professional contexts and enable one to develop the art of public speaking.
3. To develop the necessary skills through actual practice in presenting information, giving seminars, participating in group talk etc.

**UNIT I:**

Public Speaking- an overview- Significance to professionals- Importance of Listening and Speaking Skills.

**UNIT II :**

Credibility & Confidence- Preparation of Speech & Audience Analysis.

**UNIT III :**

Organization of Speech- Platform Manners & Use of Microphones- Modes of Delivery.

**UNIT IV:**

Use of Visual Aids- Psychology of Persuasion- Speeches for Special Occasions.

**UNIT V:**

Speech Practice.

**Course Outcomes:**

At the end of this course, students will be able to

1. Understand public speaking and its significance to professionals.
2. Know the importance of listening for effective speaking.
3. Develop speeches that can increase self-confidence and credibility.
4. Understand how to prepare, rehearse and present a speech.
5. Become aware of the different nuances involved in the speeches for different occasions such as giving seminars and participating in group talks etc.

**Text Book:**

PushpLata and Sanjay Kumar. Communicate or Collapse New Delhi: Prentice Hall of India, 2007.

**References:**

1. Lucas, Stephen E. The Art of Public Speaking. Third Edition, Singapore: McGraw- Hill, 1989.
2. Deanna D Sell now Public Speaking A Process Approach Media Edition, Wadsworth/Thomson, 2003.
3. Jaffe, Clella. Public Speaking New Delhi: Cengage Learning India Pvt. Ltd, 2008.
4. Bellingham, Jo. Giving Presentations Delhi: Oxford University Press. 2003.
5. Qubein, Nido. How to be a Great Communicator New Delhi: Viva. 1997.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

**Audit Course - I**

**14ENG302 CREATIVE WRITING**

**L T P C**  
**2 0 0 0**

**Course Prerequisite:** None

**Course Description:**

The course functions as a broad-based introduction to various forms of creative writing, such as short fiction, poetry and drama. Short story writing is geared toward creative writing so that students learn about character, dialogue, voice, style and description in fiction. The course provides them with the opportunity to delve deeper into the analysis of selected short fiction and to work on stories of their own. Students explore the genre of poetry in-depth through their own writing and that of published poets. The study of playwriting involves many of the same focuses as short story writing, such as dialogue, character and plot. Students also experiment with writing these genres. The class is usually comprised of technique and style discussions, reading assignments and writing exercises.

**Course Objectives:**

1. To familiarize the students with different forms of writing: poetry, scene writing, and vignette and feature writing.
2. Apart from writing, the course will also encourage students to read and acquaint, appreciate and respond to different genres of writing.

**UNIT I:**

Introduction to creative writing and reading, Poetry, Short Story, Drama, Fiction, Non Fiction, Feature Writing, etc.

**UNIT II:**

Poetry, Scenario writing, feature and vignette writing, Haiku, Object Poem, List Poem, Visual Poem, Nature Poem, Scanning a poem and understanding its meaning

**UNIT III:**

Writing a scene, finding sources from which to draw ideas to write scenes, creating an effective setting for a scene to take place; creating strong, believable characters in a scene.

**UNIT IV:**

Learning how a scene can drive the plot of a story, how to effectively use point of view to enhance a scene, how to write interesting and useful dialogue, self-editing own writing.

**UNIT V:**

Writing a vignette, finding sources from which to draw ideas to write a vignette, organizing one's time and ideas to produce a longer piece of writing.



**Course Outcomes:**

At the end of this course, students will be able to

1. Develop skills in writing, editing, and revision in the literary genre.
2. Analysis to inform appreciation and understanding of poetry.
3. Demonstrate the ability to read and respond thoughtfully.
4. Develop plot of the story and sketch characters with relevant dialogues; overall script writing and editing skills are imparted.
5. Understand the effective writing skills such as good essays and projecting scholarly ideas to the mass media.

**Text Book:**

Mills, Paul. 2006. Creative Writing Course Book. New York: Routledge.

**References:**

1. Jaron, Philip K. and Allan B. Lefcowitz. 2004. Creative Writer's Hand Book. 4th ed. Prentice Hall.
2. Bulman, Colin. 2007. Creative Writing: A guide and glossary to fiction writing. Polity Press.
3. Coles Notes. 1991. Dictionary of Literary Terms. Delhi: Chaman Enterprises.
4. Minot, Stephen. 1971. Three Genres: The Writing of Poetry, Fiction, and Drama. Englewood Cliffs: Prentice-Hall.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

## Audit Course - I

### 14HUM301 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
2	0	0	0

**Course Prerequisite:** None

#### **Course Description:**

The objective of this course is to inculcate in students the skills necessary to craft strategies and initiatives which can enable growth and sustainability in an entrepreneurial venture, to include the effective management of inventory, receivables, production, human resources, financial resources, and risk. Students will develop higher-level critical thinking skills, evidenced by analysis, evaluation, and synthesis.

#### **Course Objectives:**

The course is intended to

1. Identify legal issues affecting development, ownership and operation of commercial property.
2. Understand strategies to manage and/or exit from distressed properties.
3. Addressing the development challenges that start-ups face.
4. Build skills needed to create high-value technology companies.
5. Analyze prospective venture capital investments.
6. Work in an entrepreneurial firm with instructor coaching.
7. In-depth research regarding a specific business opportunity.
8. Opportunity identification & evaluation.
9. Steps required to start a business.
10. Creativity techniques at the individual and organizational level to identify and capitalize on innovative opportunities.
11. Develop skills to translate patents and other intellectual property into viable business opportunities.
12. Analytic techniques to determine highest and best use of property.
13. Understand venture capital and angel investor funding criteria and contractual terms.

#### **UNITI: INTRODUCTION**

Nature of Entrepreneurship- Features - Entrepreneur's competencies, attitude, qualities, functions. Entrepreneurial scenario in India and Abroad. Forms of Entrepreneurship: Small Business, Importance in Indian Economy, Types of ownership, sole trading, partnership, important features of various types of businesses -corporate entrepreneurship, intrapreneurship - Role of Government in the promotion of Entrepreneur, State Enterprises in India.

#### **UNITII: PROMOTIONAL & FINANCIAL ASPECTS OF ENTREPRENEURSHIP**

Idea generation– opportunities - SWOT Analysis - patents and trademarks, Intellectual Property Rights. Financial Aspects of the Entrepreneurship: Source of Capital, Debt capital, seed capital, venture capital - Informal Agencies In financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings.

### **UNIT III: PROJECT PLANNING AND FEASIBILITY STUDIES**

The Concept of Project, Project Life Cycle -Project Planning, Feasibility – Project proposal & report preparation. Entrepreneurial Strategy: Generation of new entry opportunity, Decisions under Uncertainty, entry strategy, new entry exploitation, environmental instability and First-Mover disadvantages, Risk Reduction strategies, Market scope strategy, Imitation strategies and Managing Newness.

### **UNIT IV: WOMEN ENTREPRENEURSHIP**

Scope of entrepreneurship among women, promotional efforts supporting women entrepreneurs in India - Successful cases of women entrepreneurs.

### **UNIT V: RURAL ENTREPRENEURSHIP AND EDPS**

Need, Rural Industrialization – Role of NGO's –Organising EDPs – Need, Objectives, Evaluation of EDPs.

#### **Course Outcomes:**

At the end of this course, students will be able to

1. Recognize a business opportunity that fits the individual student
2. Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career
3. Demonstrate the ability to find an attractive market that can be reached economically
4. Demonstrate the understanding of how to launch the individual's entrepreneurial career
5. Create appropriate a business model
6. Articulate an effective elevator pitches to gain support for the venture
7. Develop a well-presented business plan that is feasible for the student

#### **References:**

1. Entrepreneurial Development, S. Chand and Company Limited, S.S. Khanka, New Delhi, 2009.
2. Fundamentals of Entrepreneurship, H. Nandan, PHI, First/e, New Delhi, 2009.
3. Entrepreneurship, 6/e, Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH, 2009.
4. The Dynamics of Entrepreneurial Development and Management, Vasanth
5. Desai, Himalaya, 2009
6. Entrepreneurship Management – text and cases, Bholanath Dutta, Excel Books, 2009
7. Entrepreneurship – New venture Creation, Holt, PHI, 2009.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

## Audit Course - I

### 14HUM302 INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
2	0	0	0

**Course Prerequisite:** None

#### Course Description:

Intellectual property (IP) is a legal term that refers to creations of the mind. Examples of intellectual property include music, literature, and other artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Under intellectual property laws, owners of intellectual property are granted certain exclusive rights. Some common types of intellectual property rights (IPR) are copyright, patents, and industrial design rights; and the rights that protect trademarks, trade dress, and in some jurisdictions trade secrets. Intellectual property rights are themselves a form of property, called intangible property.

#### Course Objectives:

The course is intended to

1. This course will provide the engineering as well as management students to understand the importance of intellectual property rights protection and management.
2. It is an important part of new products/processes/ technologies development to get the competitive advantages for competing and sustaining in the competitive global business scenario.
3. This represents the Intellectual Property Rights, assets, ownership rights and valuation of property rights.
4. It represents the Filing of patent rights, acts, rules & portfolio analysis, management, patent strategy.
5. It represents the Right to Information Act, objectives, obligations, powers & functions, penalties & appeal.

#### UNIT I:

Introductory issues related to intellectual property and its protection, WTO, TRIPS Agreement & its Protection.

#### UNIT II:

Introduction to Copyrights - Principles of Copyright Principles -The subject matter of Copyright - The Rights Afforded by Copyright Law - Copyright ownership, transfers and duration - Right to prepare derivative works – Rights of Distribution - Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act – Patent - Trademark – Industrial Design – Trade Secret – Geographical indications.

#### UNIT III:

Commercialization of IP assets: Contracting, Licensing, Assignment and technology transfer; Drawing up a business strategy IP rights in export markets; Ownership of rights by employees; Valuation of intellectual property rights.

**UNIT IV:**

Procedure for filing patent in India and other countries, PCT filing, Patent Search, Patent Acts & Rules, Patent Infringement, Patent Portfolio analysis and management, Patent Strategy.

**UNIT V:**

RTI – Introduction – Objectives – Obligation of Public Authorities – The Central & State information commission – Powers & Functions – Penalties & Appeal.

**Course Outcomes:**

At the end of this course, students will able to

1. Understand the process of getting intellectual property rights and managing the IP assets strategically.
2. Broaden thinking perspective of the students that will enhance their long term planning and decision making capabilities as an R&D/Technology manager or as an Entrepreneur.
3. Sensitize the students to think on this legal as well as management aspect.
4. Know patent filing, acts & rules, Patent portfolio analysis.
5. Explain the details of Right to Information Act.

**Text Book:**

Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th Edition (2013) By Deborah E. Bouchoux, Cengage Learning.

**Reference:**

Latest Research Papers

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

**Audit Course - I**

**14CSE301 DATA ANALYSIS USING R**

**L T P C**  
**2 0 0 0**

**Course Prerequisite:** None

**Course Description:**

This course is an applied statistics course focusing on data analysis. The course will begin with an overview of how to organize, perform, and write-up data analyses. Instead of focusing on mathematical details, the lectures will be designed to help you apply these techniques to real data using the R statistical programming language, interpret the results, and diagnose potential problems in your analysis. The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code.

**Course Objectives:**

1. Students will learn techniques of statistical modeling.
2. Students will learn to communicate their results effectively to others, including non-experts.
3. Students will have hands-on experience with analyzing diverse data types, using modern statistical computer tools.

**UNIT I: INTRODUCTION TO R**

Overview of R, R data types and objects, reading and writing data.

**UNIT II: CONTROL STRUCTURES AND FUNCTIONS**

Control structures, functions, scoping rules, dates and times.

**UNIT III: LOOP FUNCTIONS AND DEBUGGING**

Loop functions, debugging tools.

**UNIT IV: PROFILING R CODE**

Simulation, code profiling.

**UNIT V: VECTOR AND VARIABLES**

Interacting with the interpreter, R Functions, Vector and Variables.

**Course Outcomes:**

At the end of this course, students will able to

1. A good understanding of data types available in R.
2. A good understanding of various control structures, scope rules present in R.
3. A good understanding of loop functions and debugging tools.
4. Simulation and code profiling capability.
5. A good understanding of R Functions, Vectors, etc.

**Text Books:**

1. R Programming for Data Science by Roger D.Peng, Lean publisher.
2. 25 Recipes for Getting Started with R, Publisher: O'Reilly Media, January 2011.
3. Learning R Paperback by Richard Cotton, Publisher: O'Reilly; 1 edition (20 September 2013).

**References:**

1. <https://www.coursera.org/course/rprog>
2. <https://www.coursera.org/course/dataanalysis>

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

**Audit Course - II**

**14ENG303 PHONETICS AND SPOKEN ENGLISH**

**L T P C**  
**2 0 0 0**

**Course Prerequisite:** None

**Course Description:**

This course aims to introduce the students the basic concepts of English phonetics and impart competence in the effective use of spoken English. To help them communicate effectively in social as well as classroom/academic settings and improve critical listening skills. Special focus on three important aspects of pronunciation: stress, rhythm, and intonation.

**Course Objectives:**

1. To deal with various articulation mechanics to get to proper pronunciation
2. To study 44 sounds of English.
3. To impart practical knowledge by providing listening sessions.

**UNIT I:**

Phonetics-an over view - Speech mechanisms - Organs of articulation.

**UNIT II:**

Pure Vowels and Diphthongs - Practice Sessions.

**UNIT III:**

Consonants - Practice Sessions.

**UNIT IV:**

Word Stress and Intonation - Process of listening and Characteristics of Voice - Practice sessions.

**UNIT V:**

Phonemic Transcription and pronunciation Practice - Spoken English Practice Sessions.

**Course Outcomes:**

At the end of this course, students will able to

1. Provides information on the sound system of English and deals specifically with some specific problems faced by the student as learner.
2. Understand the importance of phonetics for effective communication, extract precise and explicit information on pronunciation.
3. Natural process of listening and speaking since it aims to give a "systematic, conscious consideration of how speech sounds are made, what they sound like, and how they compare with each other.
4. Know the Speech and hearing disorders that can have a huge impact on his social life.
5. Explain the flexibility in incorporating words and phrases in his speech.
6. Study of accent and its neutralization enable a student to understand standard form of language while it is a predominating dialect.



**Text Books:**

1. Krishna Mohan and N.P. Singh. Speaking English Effectively 2nd ed. Macmillan India Ltd., Delhi. 2009.
2. J.Sethi, KamleshSadanand and D.V. Jindal. A Practical Course in English Pronunciation Prentice Hall of India, New Delhi, 2004.

**References:**

1. Daniel Jones. Cambridge English Pronouncing Dictionary 17 thEdition. Ed. Peter Roach et al. Cambridge University Press, 2006.
2. Meenakshi Raman and Sangeeta Sharma. Communicative English Oxford University Press, Delhi, 2009.
3. Mark Hancock. English Pronunciation in Use Cambridge University Press, 2003.
4. T. Balasubramanian. A Textbook of English Phonetics for Indian Students Macmillan India Ltd. 1985.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

## Audit Course - II

### 14ENG304 INTRODUCTORY PSYCHOLOGY

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Course Prerequisite:** None

#### **Course Description:**

The development of psychology as a science – individual and the environment; Nature, kinds and determinants of Perception; Biological bases of behavior; Consciousness; Motivation; Emotion; Modification of behavior through learning; Memory and forgetting; Thought processes, Problem solving and Creative thinking; Individual differences – Intelligence, Gender, Personality, Stress and coping; and Social thought and Social Behavior.

#### **Course Objectives:**

To develop a conceptual framework for understanding the human behavior; relevance of psychology in daily life and its application in social, educational, industrial, personal and other spheres.

#### **UNIT I:**

**Definition**-Origin- Classical Studies- Psychology in India; **Nervous System:** Neurons - The Brain- the Brain and Human Behavior; Heredity and Behavior; **Sensation:** Perception-Extrasensory Perception; Thinking- Making decisions- Problem Solving.

#### **UNIT II :**

**Biological Rhythms:** Waking States of Consciousness;**Learning:** Types of learning-Theories; Human **Memory:** Kinds of Information Stored in Memory- Forgetting- Memory Distortion- Memory Construction, Memory in Everyday Life- Memory & Brain.

#### **UNIT III:**

**Motivation:** Theories - Motives & Motivation- Extrinsic and Intrinsic Motivation; **Emotions:** Nature- Expression & Impact; **Intelligence:** Contrasting Views of its nature; Measuring Intelligence; Human Intelligence- Emotional Intelligence; **Creativity.**

#### **UNIT IV:**

**Personality:** The Psychoanalytic Approach-Humanistic Theories- Trait Theories- Learning Approaches - Measuring Modern Research on Personality; **Health Psychology:** Stress- Understanding and Communication our Health Needs- Promoting Wellness.

**Social Perception:** Attribution-Social Cognition, Attitudes; Social Behavior- Prejudice & Discrimination, Social Influence, Leadership.

#### **UNIT V:**

Psychology & the Scientific Method; **Research Methods** in Psychology- Observation, Correlation, Experimentation Method; Issues in Psychological Research.

**Course Outcomes:**

At the end of this course, students will be able to

1. Understand the rationale and application of the scientific method to behaviour, cognition, and emotions.
2. Analyze the Importance of Memory In Learning and adopt the easier methods of memorization
3. Motivated and would have the self-desire to seek out new things and new challenges, to analyse one's capacity, to observe and to gain knowledge. Intrinsically motivated students are more likely to engage in the task willingly as well as work to improve their skills, which will increase their capabilities.
4. Respect and use critical and creative thinking, apply psychological principles to personal, social, and organizational issues.
5. Understand that stress is the product of the interaction between the person and their environment. It can influence illness and the stress–illness link is influenced by coping and social support. Students will know that beliefs and behaviours can influence whether a person becomes ill in the first place, whether they seek help and how they adjust to their illness.
6. Understand and apply basic research methods in psychology, including research design, data analysis, and interpretation.

**Text Book:**

Robert A. Baron, “Psychology”, Revised 5th Edition, Pearson, 2009

**References:**

1. Ceccarelli & Meyer, Psychology, South Asian Edition, Pearson Longman, 2006
2. A. K. Singh, “Tests, Measurements and Research Methods in Behavioural Sciences”, Revised 4th Edition, Bharati Bhawan, 2009.

**Online Sources:**

1. <http://oyc.yale.edu/psychology/psyc-110>
2. <http://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-00sc-introduction-to-psychology-fall-2011/>
3. <http://www.tru.ca/distance/courses/psyc1111.html>

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

**Course Prerequisite:** None

**Course Description:**

This course will function as an introduction to ethical hacking mechanisms. Students will understand about social engineering and types of attacks. Students will begin by understanding how perimeter defenses work and then be lead into scanning and attacking their own networks, no real network is harmed. Students then learn how intruders escalate privileges and what steps can be taken to secure a system. Students will also learn about Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and Virus Creation.

**Course Objectives:**

1. To understand how intruders escalate privileges.
2. To understand Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of Attacks and their protection mechanisms.
3. To learn about ethical laws and tests.

**UNIT I: ETHICAL HACKING**

Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and Non-Repudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker, Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking & Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

**UNIT II: FOOT PRINTING AND SOCIAL ENGINEERING**

Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

**UNIT III: DATA SECURITY**

Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

**UNIT IV: NETWORK PROTECTION SYSTEM & HACKING WEB SERVERS**

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

## **UNIT V: ETHICAL HACKING LAWS AND TESTS**

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

### **Course Outcomes:**

1. Explain the concepts of intruders.
2. Understanding of foot printing tools.
3. Understand and explain about Intrusion Detection and different types of attacks.
4. Learn and implement mechanisms.
5. Understand about ethical laws.

### **Text Book:**

Michael T. Simpson, Kent Backman, James E. “Corley, Hands-On Ethical Hacking and Network Defense”, Second Edition, CENGAGE Learning, 2010.

### **References:**

1. Steven DeFino, Barry Kaufman, Nick Valenteen, “Official Certified Ethical Hacker Review Guide”, CENGAGE Learning, 2009-11-01.
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Basics Series – Elsevier, August 4, 2011.
3. Whitaker & Newman, “Penetration Testing and Network Defense”, Cisco Press, Indianapolis, IN, 2006.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

## Audit Course - II

### 14MBA301 BUSINESS ETHICS AND CORPORATE GOVERNANCE

L	T	P	C
2	0	0	0

**Course Prerequisite:** None

#### **Course Description:**

To make students aware of ethical and moral issues concerning business context and develop sensitivity in students for right ethical practices in conduct of business to understand the principles of corporate governance and to know the social responsibility of the corporate.

#### **Course Objectives:**

1. To explain students the significance of ethics in business, ethical theories and approaches.
2. To explain the significance of ethics in Marketing and HRM
3. To explain the significance of ethics in Finance and IT
4. To explain the concept, purpose, theories and Philosophies of Corporate Governance; Corporate Governance Structures and Processes
5. To explain corporate social responsibility

#### **UNIT I: INTRODUCTION**

Business Ethics: concept, need and importance, Ethical theories and Approaches-Modern Decision making- Ethical Models for Decision Making.

#### **UNIT II: ETHICS IN MARKETING AND HRM**

Marketing Ethics: Marketing ethics -advertising ethics -ethics in business competition; Ethical Aspects in HRM: Ethics in Selection-Training and Development-Ethics at work place -Ethics in performance appraisal

#### **UNIT III: ETHICS IN IT AND FINANCE**

Ethics in Finance: Insider trading -ethical investment -combating Frauds; Ethical issues in Information Technology: Information Security and Threats -Intellectual Property Rights-Cybercrime, Case: Margadarsi financiers

#### **UNIT IV: CORPORATE GOVERNANCE**

Concept, Purpose – Theories and Philosophies of Corporate Governance; Corporate Governance Structures and Processes: Directors-committees - Institutional investors –Auditors; CG Provisions under Company Act 2013, Cadbury Committee report on corporate governance

#### **UNIT V: CORPORATE SOCIAL RESPONSIBILITY**

Stakeholders –Environment –social Development, Provisions under Company Act 2013. CSR practices by Companies

**Course Outcomes**

1. To understand the significance of ethics in business, ethical theories and approaches.
2. To understand the significance of ethics in Marketing and HRM
3. To understand the significance of ethics in Finance and IT
4. To Learn the concept, purpose, theories and Philosophies of Corporate Governance; Corporate Governance Structures and Processes
5. To understand corporate social responsibility

**Text Books:**

1. Business Ethics –An Indian perspective, Fernando, Pearson Education, 2009
2. “Perspectives in Business Ethics”, Laura P Hartman, 2nded. Tata McGraw Hill.

**References:**

1. Bob Tricker, Corporate Governance, Oxford, 2009
2. Corporate Governance and Social responsibility, Balachandran, Chandrasekharan, PHI
3. Business Ethics -Concepts and Cases, Weiss, Cengage, 2009
4. Business Ethics, Himalaya, C.S.V.Murthy, 2008
5. Ethical Management, SatishModh, Mcmillan, 2005
6. The Theory and practice of Managerial Ethics, Jayashreesadri, Dastoor, Jaico, 2008.

**Mode of Evaluation:** Assignments, Written Examination (Internal Only)

## Audit Course - II

### 14HUM303 NATIONAL SERVICE SCHEME (NSS)

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**Course Prerequisite:** None

#### **Course Description:**

NSS underlines that the welfare of an individual is ultimately dependent on the welfare of society on the whole. Therefore, it should be the aim of the NSS, to demonstrate this motto in its day-to-day Programme. It needs to organize National Integration Camps, Blood Donation Camps, Health Camps, Plantation, Immunization, Shramdaan, Disaster Management and many at various places. N.S.S. volunteers need to undertake various activities in adopted villages and slums for community service. An NSS volunteer will extend his/her services for 120 hours. NSS volunteers need actively to take a role in adopted villages for eradication of illiteracy, watershed management and wasteland development, agricultural operations, health, nutrition, hygiene, sanitation, mother and child care, family life education, gender justice, development of rural cooperatives, savings drives, construction of rural roads, campaign against social evils etc.

#### **Course Objectives:**

The course is intended to

1. The National Service Scheme (NSS) is an Indian government-sponsored public service program conducted by the Department of Youth Affairs and Sports of the Government of India.
2. Its Objective is “Not Me, But You”.
3. NSS reflects the essence of democratic living and upholds the need for selfless service and appreciation of the other person’s point of view and also to show consideration for fellow human beings.
4. Adoption of Villages to make the students study about living of the people, make people literate and make them to maintain hygiene health.
5. This Represents the Water Management and agricultural management as well as disaster management.

#### **UNIT I: INTRODUCTION TO NSS & ADOPTION OF VILLAGE**

What is NSS - NSS Song – Objectives of NSS – Functions of NSS - Identifying of a Village – Interacting with village heads – Identifying of local Challenges –Identifying the native people for involvement- Division of work-Preparation of Plan Chart-Getting approval from local authorities for taking up the work.

#### **UNIT II: SRAMADHAN**

Involving of native people - Cleaning - Plantation – Kitchen Gardening – Organic Farming - Construction of rural roads.

#### **UNIT III: ORGANIZATION OF CAMPS**

Health Camps - Blood Donation Camps-Immunization Camps – Health – Nutrition – Hygiene-Sanitation – First aid Rules & Regulations.



#### **UNIT IV: LITERACY**

Eradication of illiteracy - mother and child care-family life education-gender justice-development of rural cooperatives-savings drives-campaign against social evils.

#### **UNIT V: WATER&DISASTERMANAGEMENT**

Watershed management-Wasteland development-Agricultural operations- Disaster Management – Methods of Water Conservation.

#### **Course Outcomes:**

At the end of this course, students will able to

1. Understand the rationale and application of the scientific method to behavior, cognition, and emotions.
2. Respect and use critical and creative thinking.
3. Apply psychological principles to personal, social, and organizational issues.

**Mode of Evaluation:** On Student's Performance

### **Massive Open Online Courses (MOOCS)**

MITS, in line with the developments in Learning Management Systems (LMS) intends to encourage the students to do online courses in MOOCs, offered internationally. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion of the course from the MOOCs providers.

### **Choice Based Credit System (CBCS)**

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning.

### **Audit Courses**

The students merely might have received teaching and achieved a given standard of knowledge of the subject, rather than being evaluated. In that perception, MITS has also introduced 10 Audit Courses from various fields. A student who audits a course will obtain self-enrichment and academic exploration.

### **Foreign Languages**

Apart from its Curriculum, MITS also offers two levels of certificate programmes in Japanese, German and Spanish languages. The training follows international benchmarks of teaching and learning in order to achieve international equivalency of proficiency. The certificate programme of each language is classified below.

1. JAPANESE [JLPT N-5/N4]
2. GERMAN [Levels-A1/A2]
3. SPANISH [Levels-A1/A2]

### **Certificate Courses**

To improve the technical dexterity of the students, MITS also intends to offer several Certificate Courses like J2SE (Core JAVA) & J2EE (Advanced Java), PHP and MySQL Web Development, .Net Framework, Instrumentation etc.