



**AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY  
(AUTONOMOUS)**  
Gudur, Nellore Dist - 524101, A.P (India)

**ACADEMIC REGULATIONS**

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

**(Applicable for the batches admitted from the academic year 2014-15  
and B.Tech Lateral Entry Scheme from the academic year 2015-16)**

**1. INTRODUCTION:**

Academic Programmes of the institute are governed by rules and regulations approved by the Academic Council, which is the highest Academic body of the Institute. These academic rules and regulations are applicable to the students admitted from the academic year 2013-14 onwards into four year B.Tech Programmes.

Audisankara College of Engineering & Technology shall follow Year-wise pattern for First year courses and Semester pattern for II, III and IV year courses of all B.Tech Programmes being offered. An academic year for semester pattern shall consist of two semesters (I & II Semesters) from the second year onwards of each B.Tech Programme.

**2. DURATION OF THE PROGRAMME:**

The duration of the UG Programme is for four academic years. A student is permitted to complete the B.Tech Programme in a stipulated time frame of Eight consecutive years from the joining Academic Year. Students joining the B.Tech Programme in the first semester of second year directly through Lateral Entry Scheme (LES) shall have to complete the Programme in a stipulated time frame of Six consecutive years from the joining Academic Year. Otherwise they shall forfeit their seat in B.Tech Programme and their admission shall stand cancelled.

**3. MINIMUM INSTRUCTION DAYS:**

The first year of four year B.Tech Programme shall have a minimum of 180 instruction days and from second year onwards each semester shall have 90 instruction days with atleast 100 contact hours per each theory subject for yearly pattern and 50 for semester pattern. However, contact hours are generally three for a practical subject per week.

**4. PROGRAMMES OFFERED (UNDER GRADUATE LEVEL):**

Currently Audisankara College of Engineering & Technology is offering,

B.Tech Under Graduate Programmes in the following Engineering disciplines:

- Civil Engineering (**CE**)
- Electrical and Electronics Engineering (**EEE**)
- Mechanical Engineering (**ME**)
- Electronics and Communication Engineering (**ECE**)
- Computer Science and Engineering (**CSE**)

## **5. ELIGIBILITY CRITERION FOR ADMISSION:**

### **5.1 ADMISSION CATEGORY:**

Admissions are made under two categories for B.Tech (Regular) Programmes.

The eligibility criterion for admission into 1<sup>st</sup> year B.Tech. (Regular) Programme shall be as mentioned below:

Admissions in each Programme in the Institution are classified into

- **CATEGORY-A : (EAMCET Convener Quota)**
- **CATEGORY-B : (NRI/Management)**
- Admissions are made as per the guidelines of A.P State Council of Higher Education (APSCHE), Government of Andhra Pradesh.

### **5.2 LATERAL ENTRY CATEGORY:**

The candidates having passed the qualifying exam (B.Sc., Graduation & Diploma holders) shall be admitted into the II year I Semester directly, based on the rank secured by the candidate at Engineering Common Entrance Test (ECET (FDH)) in accordance with the instructions received from the Convener, ECET and APSCHE. The candidate shall also satisfy any other eligibility requirements stipulated by the JNTUA, Anantapur and / or the Government of Andhra Pradesh from time to time.

## **6. COURSE STRUCTURE:**

Each Programme of study shall consist of:

- General Courses: Humanities and Social Sciences: (5 to 10%)
- Basic Sciences: (15 to 20%)
- Engineering Sciences: (15 to 20%)
- Professional Subjects - Core :( 50 to 60%)
- Professional Subjects - Electives: (10 to 15%)
- Personality Development Courses: (1%)

## **7.0 CONTACT PERIODS AND CREDITS:**

Depending upon the complexity and volume of the course, the number of contact periods per week will be assigned. The Course Credits are broadly fixed based on the following norms:

- Lectures – One Lecture period per week is assigned one credit.
- Tutorials - Two tutorial periods per week are assigned one credit.
- Practical – 3 periods per week are assigned two credits.
- Practical course/ Personality Development course/ Technical Seminars/ Comprehensive Viva-Voce shall have 2 credits each in semester.
- Project Work Phase-I shall have 2 credits.
- Project Work Phase-II shall have 10 credits.
- However, some courses are prescribed with fixed number of credits depending on the complexity of the subject and relative importance.

### **7.1 Theory / Tutorial classes:**

Each course is prescribed with a fixed number of lecture periods per week. During each lecture period, the course instructor shall deal with the concepts of the course content with the required analysis and applications. For certain courses, tutorial periods are prescribed in order to give exercises to the students and to closely monitor their learning ability and achievement to strengthen the subject knowledge.

## 7.2 Laboratory / Workshop Courses:

A minimum prescribed number of experiments / jobs / programs in each of these courses have to be performed by the students, who shall complete these in all respects and get each experiment evaluated by teacher concerned and certified by the Head of the Department concerned at the end of the year/ semester.

## 7.3 Programme Credits:

Each discipline of the B.Tech (Regular) Programme is designed to have a total of 200 credits, and the student shall have to complete the courses and earn all the credits to get B.Tech degree awarded.

However, B.Tech (Lateral Entry Scheme) student shall have to acquire 154 credits for the degree to be awarded.

## 7.4 Scheme of Instruction for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Years

The scheme of instruction and syllabi of all B.Tech Programmes are given separately.

# **8. EXAMINATIONS AND SCHEME OF EVALUATION:**

## 8.1 INTERNAL EXAMINATIONS:

### 8.1.1 Theory Courses:

Each course is evaluated for **30 marks (a+b+c)**.

**a) 5 marks** in each theory course shall be given to those students who put in attendance of that subject in a graded manner as given in Table 1. This incentive is aimed to motivate the students to become regular and not to miss instruction classes.

**Table 1: Attendance based marks system**

S. No	Attendance Range	Marks Awarded
1	Attendance of 75% and above but less than 78%	2 Marks
2	Attendance of 78% and above but less than 80%	3 Marks
3	Attendance of 80% and above but less than 90%	4 Marks
4	Attendance of 90% and above	5 Marks

**b) (i) Yearly Pattern:** For I B.Tech (Yearly pattern) there shall be three midterm examinations each for **20 marks** and 90 minutes duration in each theory subject as per the academic calendar announced in advance giving a test performance weightage of 80% for the highest test score and 20% for the average of remaining two midterm examinations for a total of 20 marks. Internal marks are awarded by conducting three midterm examinations as mentioned below:

- Midterm-I is designed and conducted covering first unit of syllabus.
- Midterm-II is conducted covering unit –II and half of unit-III contents.
- Midterm-III is conducted covering second half of unit-III and unit-IV contents.

**ii) Semester Pattern:** Two midterm examinations each for **20 marks** with the duration of 90 minutes each will be conducted for every theory course in a semester. The midterm marks shall be awarded giving a weightage of 80% in the midterm examination in which the student scores more marks and 20% in the remaining midterm examination.

**Internal Examination Pattern for 20 Marks:**

- Each Internal Examination Question Paper comprises of three questions covering the two units.
- Answering all the three questions is compulsory.
- Question 1 contains six one mark questions covering three questions from each unit and student has to answer four questions (4 Marks).
- Question 2 is from one unit and question 3 from the other unit. Questions 2 & 3 will have internal choice (Either/or). Each question is allotted 8 Marks.

**c) 5 marks are allocated for Assignment tests.**

- There will be four Assignment tests per subject in year/semester pattern.
- One Assignment test is conducted from each unit.
- Five Assignment questions are given in advance from each unit out of which two questions given by the concerned teacher has to be answered during Assignment test.
- Average of Assignment tests marks is considered.

**NOTE:** A student who is absent for any Mid Term Examination/ Assignment Test, for any reason whatsoever, shall be deemed to have scored zero marks in that Mid Term Exam/ Assignment Test and no make-up test shall be conducted.

**8.1.2 Drawing Subjects:**

For subjects such as Engineering Drawing/ Building Drawing etc. the distribution of internal marks is as given below:

**Table 2: Distribution of Internal Marks**

Sl. No.	Criterion	Marks
1	Attendance	5
2	Day - to - Day Evaluation	10
3	Internal Examination	15

**a) Engineering Drawing (Yearly pattern):**

Three internal tests are conducted spanned at equal intervals. Test performance weightage of 80% for the highest test score and 20% for the average of remaining two midterm examinations for a total of 15 marks. Internal marks are awarded by conducting three midterm examinations as mentioned below:

- Midterm-I is designed and conducted covering first unit of syllabus.
- Midterm-II is conducted covering unit –II and half of unit-III contents.
- Midterm-III is conducted covering second half of unit-III and unit-IV contents.

**b) Building Drawing etc., (Semester pattern):**

Two internal tests are conducted spanned at equal intervals. Test performance weightage of 80% for the highest test score and 20% for the average of remaining midterm examination for a total of 15 marks. Internal marks are awarded by conducting two midterm examinations as mentioned below:

- Midterm-I is designed and conducted covering first unit of syllabus.
- Midterm-II is conducted covering the second unit of syllabus.

### 8.1.3 Laboratory Courses:

For Laboratory courses there shall be continuous evaluation during the year/semester for 30 internal marks. The break-up of internal marks to be awarded is as given below:

**Table 3: Break-up of Internal Marks**

Sl. No.	Criterion	Marks
1	Attendance	5
2	Conduct of experiments, Observation & Results in regular class work(Day-to-Day Performance)	15
3	Viva – voce and Internal Examination	10

In any semester a minimum of 90% of prescribed number of experiments/exercises specified in the syllabus for laboratory course shall be conducted. They shall complete these experiments/exercises in all respects and submit and get the record certified by the concerned internal lab teacher and the Head of the Department to become eligible to appear for the final end examination in the Laboratory Course.

### 8.1.4 Technical Seminar:

There shall be two Technical Seminars conducted in each discipline, Technical Seminar-I in the II B.Tech II semester and the Technical Seminar-II in the III B.Tech II semester. The distribution of internal marks for component of Technical seminar is given below:

**Table 5: Distribution of Marks for component of Technical seminar**

Sl. No.	Criterion	Marks
1	Seminar Report & Subject content	20
2	Seminar presentation & Viva – Voce Exam	30

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. **(Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

### 8.1.5 Comprehensive Viva-Voce:

There shall be a Comprehensive Viva-Voce in IV B.Tech II Semester. The comprehensive Viva-Voce shall be evaluated in the topics covering the core aspects of the concerned discipline in which the candidate is likely to get graduated. The marks can be awarded based on the performance in viva-voce examination conducted by a committee consisting of **i)** Head of the Department **ii)** Two Senior Faculty members of the department **iii)** External Examiner appointed by the Principal. The comprehensive Viva-Voce shall be conducted for 100 marks. Of the 100 marks, 25 marks are allocated to each member of the committee.

### **8.1.6 Project Work:**

The Project work is spread over to two semesters having Project Work Phase-I and Project Work Phase-II. Project Work Phase-I is included in IV B.Tech I Semester and Project Work Phase-II in IV B.Tech II Semester as detailed below:

A student has to select topic of his Project Work based on his interest and available facilities, in the IV B.Tech I semester which he will continue through IV B.Tech II semester also.

#### **Project Work Phase-I: IV Year I Semester**

The object of Project Work Phase-I is to enable the student to take up investigative study in the broad field of his branch of Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the department on an individual basis or three/four students in a group under the guidance of a supervisor/ guide. This is expected to provide a good initiation for the student(s) in R&D work.

*The assignment normally includes:*

- Survey and Study of published literature of on the assigned topic.
- Working out a preliminary approach to the problem relating to the assigned topic.
- Conducting preliminary analysis/ modeling/simulation/experiment/ design/ feasibility.
- Preparing a written report on the study conducted for presentation to the department.
- Final seminar presentation before Project Review Committee.

The supervisor/ guide will evaluate the execution of the project periodically.

Project Work Phase-I is allocated 100 marks with 2 credits. Out of 100, 25 marks are allocated for the supervisor/guide to be awarded based on periodical project reviews and submission of the report on the work done. 25 marks are allocated for the supervisor/guide and head of the department to be awarded based on seminar given by each student on the topic of the project. The other 50 marks shall be awarded on the basis of his presentation on the work done on his project by the Departmental committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

The candidate is declared to have passed in Project work Phase-I when he gets 40% marks given by the Departmental Committee and 50% marks overall.

#### **Project Work Phase-II: IV Year II Semester:**

The Project work Phase-II will be an extension of Phase-I project work. The object of Project work phase-II is to enable the student to extend further the investigative study taken up as the project in Phase-I under the guidance of the supervisor/ guide from the department.

*The assignment normally includes:*

- Preparing an action plan for conducting the investigation including the team work.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).

Project Work Phase-II is allocated 50 internal marks. Out of 50, 25 marks are allocated for the supervisor/guide and head of the department to be evaluated based on two seminars given by each student on the topic of the project. The other 25 marks shall be evaluated on the basis of his presentation on the work done on his project by the Departmental Committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

#### **8.1.7: Professional Ethics and Human Values / Qualitative and Quantitative Analysis:**

The subject **Professional Ethics and Human Values** is included in the B.Tech Programme under mandatory and a theory course. It is treated equivalent to any other professional theory subject but only internal evaluation.

The other subject **Qualitative and Quantitative Analysis** is introduced in to the B.Tech Programme to equip with the necessary skill sets and to enhance the placement opportunities of students. It is also a theoretical subject equivalent to any other professional theory subject but only internal evaluation.

#### **8.1.8: Mandatory Courses:**

**a)** A Mandatory Course is one among the compulsory courses and does not carry any credits and is compulsory with examination (internal evaluation only). List of the mandatory courses will be notified at the beginning of the II B.Tech I Semester for all students and the student has to choose one mandatory course for self study mode/with class work at the beginning of the II B.Tech I Semester. All the students (regular & lateral entry students) shall complete one of the mandatory courses, with acceptable performance. The indicative list of the mandatory courses is given below.

<b>1. Intellectual Property Rights</b>	<b>– 13MA301</b>
<b>2. Sociology &amp; Elements of Indian History for Engineers</b>	<b>– 13MA302</b>
<b>3. Energy Studies</b>	<b>– 13MA303</b>
<b>4. Rural Development</b>	<b>– 13MA304</b>
<b>5. Law for Engineers</b>	<b>– 13MA305</b>
<b>6. Clinical Psychology</b>	<b>– 13MA306</b>
<b>7. Business Communication</b>	<b>– 13MA307</b>

**b)** Mandatory courses will be evaluated by conducting examination for duration of 90 minutes.

**c)** Students will have two chances every academic year to clear the mandatory course beginning from the II B.Tech I Semester. Further, the student has an option to change the mandatory course in case if he / she is unable to clear the mandatory course in the first two chances. However, provisional pass certificate of B.Tech degree will be issued only, when the student clears the mandatory course. Its result shall be declared with “**PASS**” or “**FAIL**” performance and included in the marks memorandum. Each student has to get “**PASS**” in the mandatory course prescribed to qualify for the award of degree.

#### **8.1.9: Audit Courses:**

**a)** A student can register for courses for audit only, when interested to supplement his /her knowledge and / or skills. These courses are optional and there will be no examination. The audit courses shall not be taken into account in determining the student’s academic performance in any semester. They will be notified separately by the department. It is optional for students to register for these courses and seek their inclusion in marks memorandum (but not for earning credits). Courses in this category are technology oriented but not necessarily focused on the discipline under study.

## **8.2 YEAR / SEMESTER END EXAMINATIONS:**

### **8.2.1 Theory Courses: 70 marks each:**

The Year/ Semester end examination in each theory subject shall be conducted for 3 hours duration at the end of the year/semester for 70 marks. The question paper each theory subject for Year/Semester pattern shall be designed as per the following guidelines:

- Contains a total of nine questions.
  - A total of NINE questions.
  - Answer one Question from each Unit
  - The Eight questions are to be designed taking one question from each unit (Unit Wise Either or Type) of the four units.
  - In each question, one, two or more bits can be set, totaling 14 Marks with appropriate distribution of marks.
  - Question No.9 containing of 14 one mark questions. A minimum of three one – mark questions shall be set from each unit of the four units.

A student has to secure not less than a minimum of 35% of marks (25 marks) exclusively at the end year/semester examinations in each of the theory subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 40% of marks (40 marks) in both external and internal components put together to become eligible for passing in the subject.

### **8.2.2 Engineering Drawing:**

The syllabus of Engineering Drawing subject comprises of four units. The end examination in Engineering Drawing shall be conducted for 3 hours duration at the end of the year. The question paper shall be designed in the following pattern:

- Question paper contains a total of nine questions.
  - Answer one Question from each Unit
  - The Eight questions are to be designed taking one question from each unit (Unit Wise Either or Type) of the four units.
  - In each question, one, two or more bits can be set, totaling 14 Marks with appropriate distribution of marks.
  - Question No.9 containing of 7 two mark questions. A minimum of two two – marks questions shall be set from unit-I, II & III of the four units.

A student has to secure not less than a minimum of 35% of marks (25 marks) exclusively at the end year/semester examinations in each of the subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 40% of marks (40 marks) in both external and internal components put together to become eligible for passing in the subject.

### **8.2.3 Lab Courses (Practical / Workshop): 70 marks**

Out of 70 marks **50** marks are allocated for experiment (procedure for conducting the experiment carries 15 marks & readings, calculation and result-35) and **15** marks for viva-voce examination with **5** marks for the record.

Each Year/Semester External Lab Examination shall be evaluated by an Internal Examiner along with an External Examiner appointed by the Principal.

A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (50 marks) (Internal & year/semester External Examination marks put together), subject to a minimum of 40% marks (28 marks) in the year/semester external examination.

#### 8.2.4 Project Work Phase-II:

The semester end examination for project work done during IV B.Tech I semester and IV B.Tech II semester for 150 marks shall be conducted by a Project Review Committee (PRC). The committee comprises of an External Examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor. The evaluation of project work shall be conducted at the end of the II Semester of IV B.Tech. The above committee evaluates the project work report with weightages of 50% of the marks (50 marks) awarded by external examiner, 20% of marks (20 marks) awarded by HOD & 30% of the marks (30 marks) by Project Guide/Supervisor respectively for a total of 100marks. Of the 50 marks for Presentation & Viva-Voce examination, HOD evaluates for 10 marks and external examiner for 40 marks. The evaluation of 150 marks is distributed as given below:

**Table 11: Distribution of Project Work Marks**

Sl. No.	Criterion	Marks
1	Report	100
2	Presentation & Viva – Voce	50

A candidate shall be declared to have passed in project work phase-II if he secures a minimum of 50% aggregate marks (100 marks) (Internal marks + External project marks), subject to a minimum of 40% marks (60 marks) in the project end examination.

#### 9. YEAR/SEMESTER – WISE DISTRIBUTION OF CREDITS:

**Table 12: Year/Semester –wise Credits distribution**

YEAR/SEMESTER	No. of Credits for courses per year/semester Theory+ Lab/Drg/Proj/CVV/Semi	Total credits
I year	30+16	46
II year I semester	18+08	26
II year II semester	18+08	26
III year I semester	18+08	26
III year II semester	18+08	26
IV year I semester	18+08	26
IV year II semester	12+12	24
<b>TOTAL CREDITS</b>	<b>200</b>	<b>200</b>

(i) In first year the course of study consists of 6 theory subjects + Engineering Drawing + 4 laboratories and from second year onwards, each semester the course of study consists of 6 theory subjects + 3 laboratories. However, in the IV year II semester, there shall be only 4 theory subjects in addition to the project work and comprehensive viva – voice examination.

(ii) All the Technical Seminars, Professional Ethics & Human Values and Aptitude, Arithmetic Reasoning & Comprehension are credit based.

#### **10. ATTENDANCE REGULATIONS AND CONDONATION:**

- i) A student shall be eligible to appear for end semester examinations, if he acquires a minimum of 75% attendance in aggregate of all the subjects.
- (ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (65% above and below 75%) in each semester may be granted on the recommendation of the College Academic Committee. However, granting condonation is purely at the discretion of Principal of the college.
- (iii) A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered next.
- (iv) Shortage of Attendance below 65% in aggregate shall in no case be condoned.
- (v) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that particular semester and their registration for examination shall stand cancelled.
- (vi) A stipulated fee shall be payable towards condonation of shortage of attendance if granted.
- (vii) Attendance may also be condoned for those students who participate in prestigious sports and co and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose and recommended by the concerned authority.
- (viii) Attendance in Project Work Phase-II in IV B.Tech II Semester is not included in the calculation of final attendance. However, the student has to acquire 75% of attendance aggregate other than attendance of Project Work Phase-II in IV B.Tech II Semester.

#### **11. MINIMUM ACADEMIC REQUIREMENTS:**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.10.

A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory/drawing subject if he secures not less than a minimum of 35% of marks exclusively at the end year/semester examinations in each of the subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 40% marks in both external and internal components put together to become eligible for passing in the subject.

1. A candidate shall be declared to have passed in individual lab/project course if he secures a minimum of 50% aggregate marks (Internal & year/semester end examination marks put together), subject to a minimum of 40% marks in the year/semester end examination.
2. A student shall be promoted to next semester, if he satisfies the minimum attendance requirement.
3. A Student shall be promoted from II year to III year, if he fulfills the academic requirements of securing a minimum of 36 credits from:
  - a) One regular and one supplementary examination of I Year.
  - b) One regular examination of II Year I Semester.

4. A student shall be promoted from III year to IV year if he fulfills the academic requirements of securing a minimum of 62 credits from:

- a) Two regular and two supplementary examinations of I Year.
- b) Two regular and one supplementary examinations of II Year I Semester.
- c) One regular and one supplementary examinations of II Year II Semester.
- d) One regular examination of III Year I Semester.

Irrespective of whether the candidate takes the end examination or not as per the normal course study. And in case of getting detained for want of credits by points 4&5, the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of III B.Tech I Semester and IV I Semester respectively.

5. There shall be supplementary examinations along with the regular end examinations enabling the students to give a fair chance to clear the subject if failed.

6. However, advance supplementary examinations shall be conducted for all such students who had failed at the IV B.Tech II Semester subjects of their study.

7. A student shall register for all the subjects and earn all the 200 credits as indicated in the course structure within eight academic years (6 consecutive years for LES students) from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.

## **12. AWARD OF CLASS:**

After the student has satisfied the requirements, prescribed for the completion of the programme and is eligible for the award of B.Tech. Degree, he shall be placed in one of the following four classes:

**Table 13: Award of Division**

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%
Pass Class	Below 50% but not less than 40%

## **13. TRANSITORY REGULATIONS:**

A student, who is detained or discontinued in the year/semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently.

**13.1** A student who is following the JNTUA, Ananthapuramu curriculum, detained due to lack of credits/ attendance at the end of the first semester of second year, shall join the autonomous batch of I Semester of II B.Tech. Such students will study all the courses prescribed for that batch, in which the student joins. The first year marks shall not be converted in to course credits. However, the student has to clear all his first year backlog subjects if any by appearing in the supplementary examinations of JNTUA, Ananthapuramu when conducted and courses prescribed in Autonomous stream for the Award of Degree. The class will be awarded based on the academic performance of a student. Such candidates will be considered on par with lateral entry candidates of autonomous stream and will be governed by the regulations applicable to lateral entry candidate's category.

**13.2.** A student who is following the JNTUA, Ananthapuramu curriculum, detained due to lack of credits/ attendance at the end of the second semester of second B.Tech, and also at the subsequent semesters, shall join the autonomous batch at the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by concerned BOS for such batch of students, to be eligible for the award of degree. However, exemption will be given in all those courses of the semester(s) of the batch, which the candidate joins now, which he had passed earlier. The student has to clear all his backlog subjects by appearing in the supplementary examinations, conducted by JNTUA, Ananthapuramu and College (Autonomous Stream) for the Award of Degree. The class will be awarded based on the academic performance of a student in the JNTUA Pattern and academic regulations of JNTUA will be followed.

#### **14. READMISSION CRITERIA:**

A Candidate, who is detained in a year/semester due to lack of attendance/credits, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying the required fee.

#### **15. SUPPLEMENTARY EXAMINATIONS:**

Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day.

#### **16. CONDUCT AND DISCIPLINE:-**

- (a) Students shall conduct themselves within and outside the premises of the Institute in a decent and dignified manner befitting the students of Audisankara College of Engineering & Technology.
- (b) As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with.
- (c) The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.
  - (i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the college campus.
  - (ii) Damage of college property or distribution of alcoholic drinks or any kind of narcotics to fellow students / citizens.
- (d) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- (e) Mutilation or unauthorized possession of library books.
- (f) Noisy and unruly behavior, disturbing studies of fellow students.
- (g) Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber crime etc.
- (h) Usage of camera /cell phones in the campus.
- (i) Plagiarism of any nature.

- (j) Any other act of gross indiscipline as decided by the college academic council from time to time.
- (k) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- (l) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprimand or impose fine.
- (m) Cases of adoption of unfair means and/ or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action.
- (n) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council of the college.
- (o) The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.
- (p) The Principal shall deal with any problem, which is not covered under these rules and regulations.
- (q) **“Grievance and Redressal Committee” (General)** constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.
- (r) All the students must abide by the code and conduct rules prescribed by the college from time to time.

**17.0 RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS**

	<b>Nature of Malpractices/Improper conduct</b>	<b>Punishment</b>
	<i>If the candidate</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he 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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(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 exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Is found copying in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate will be cancelled.
3.	Comes in alcohol drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
4.	Smuggles the Answer book or a part thereof 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also 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.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or	Expulsion from the examination hall and cancellation of performance in that subject and

	any part thereof inside or outside the examination hall.	all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also 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.
6.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate will also be debarred and forfeit the seat.
7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate will also be debarred and forfeit the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate will also be 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 impostor is an outsider, he will be handed over to the police and a case registered against him.
8.	Refuses to obey the orders of the Chief Superintendent/Asst. Superintendent/ 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 causing any injury to him or to any of his relations whether by words, either spoken or written or by signs or by visible representation, 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case registered against them.

	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.	
9.	Is a 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 clauses 6 to 8.	In case of students of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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.	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 subject.
11.	Is detected copying on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	Indulging in any malpractice which is not covered in the above clauses 1 to 11 if detected shall be reported to the College Authorities for further action to award suitable punishment.	Appropriate action will be taken as recommended by the College Authorities.

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

#### **18. AWARD OF RANK:**

The rank shall be awarded based on the following:

- Only such candidates, who pass the Final Semester end examination at the end of the II Semester of IV B.Tech (Final Semester) after admission as regular final year students along with the others in their batch and become eligible for the award of the Degree, shall be eligible for the award of rank. Candidates, who lose one year / one or more Semesters of study for any reason what so ever are not eligible for the award of rank.
- Ranks shall be awarded in each branch of study for the top five students appeared for the Regular Examinations.
- For the purpose of awarding rank in each branch, the aggregate of marks (Internal + External) of all courses (put together) in all the four years, secured at the first attempt only shall be considered.
- Award of prizes, scholarships, or any other Honors shall be based on the rank secured by a candidate, consistent with the guidelines of the Donor, wherever applicable.

**19. GENERAL:**

- (a) Where the words "he" "him" "his" occur in the regulations, they include "she", "her".
- (b) The academic regulation should be read as a whole for the purpose of any interpretation.
- (c) In the case of any dues or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
- (d) The Institute may change or amend the academic regulations or syllabi at any time duly approved by Academic Council and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

**20. CHANGE OF BRANCH:**

There shall be no sliding of branch after the completion of admission process.



**AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY  
(AUTONOMOUS)**  
Gudur, Nellore Dist - 524101, A.P (India)

**(LATERAL ENTRY SCHEME)**

**(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year 2015-2016 onwards)**

**1. Award of B.Tech. Degree**

A student admitted in LES will be declared eligible for the award of the B.Tech Degree if he fulfills the following academic regulations:

- i. Pursue a course of study for not less than three academic years and in not more than six academic years.
- ii. Register for 154 credits from II Year to IV Year of Regular B.Tech. Program

**2. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.**

**3. Minimum Academic Requirements:**

The following academic requirements have to be satisfied in addition to the attendance requirements.

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together. For the seminar he should secure 40% in the internal evaluation.
- ii. A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of 39 credits from the following examinations.
  - a. Two regular and one supplementary examinations of II year I semester.
  - b. One regular and one supplementary examinations of II year II semester.
  - c. One regular examination of III year I semester.

Irrespective of whether the candidate takes the end examination or not as per the normal course of study and in case of getting detained for want of credits the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of Fourth year I semester.

**4. Course Pattern**

- i. The entire course of study is three academic years on semester pattern.

- ii. A student eligible to appear for the end examination in a subject, but absent at it or has failed in the end examination may appear for the subject at the next supplementary examination offered.
- iii. When a student is detained due to lack of credits / shortage of attendance he may be re-admitted when the semester is offered after fulfillment of academic regulations, whereas he continues to be in the academic regulations he was first admitted.

**5. Award of Class:**

After a student has satisfied the requirements prescribed for the completion of the program and are eligible for the award of B.Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%
Pass Class	Below 50% but not less than 40%

- 6. All other regulations as applicable for B.Tech. Four-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme) students.



**AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY  
(AUTONOMOUS)**  
Gudur, Nellore Dist - 524101, A.P (India)

**Course Structure for B.Tech (Mechanical Engineering) Regular Programme**  
**Applicable for students admitted from Academic Year 2014-15**

**B.Tech I Year - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13HS101	Communicative English	2	-	-	-	30	70	100	3
2	13HS102	Engineering Physics	2	-	-	-	30	70	100	3
3	13HS103	Engineering Chemistry	2	-	-	-	30	70	100	3
4	13HS104	Engineering Mathematics-I	3	1	-	-	30	70	100	5
5	13HS106	Environmental Science	2	-	-	-	30	70	100	3
6	13HS107	Computer Programming	3	1	-	-	30	70	100	4
7	13HS108	Engineering Mechanics	3	1	-	-	30	70	100	5
8	13HS109	Engineering Drawing	2	-	4	-	30	70	100	4
9	13HS110	Computer Programming Lab	-	-	-	3	30	70	100	4
10	13HS111	Engineering Workshop and IT Workshop	-	-	-	3	30	70	100	4
11	13HS112	Engineering Physics and Engineering Chemistry Lab	-	-	-	3	30	70	100	4
12	13HS113	English Language and Communication Skills Lab	-	-	-	3	30	70	100	4
Contact Periods / Week				19	3	4	12	360	840	1200
Total Periods / Week				38				Total Credits		46

Note: Th: Theory, Tu: Tutorial, Drg: Drawing, Lab: Laboratory, IM: Internal Marks, EM: External Marks

- The students attend the Engineering Workshop and IT Workshop in alternate Weeks. The end exam shall be conducted separately and average of the two exams will be recorded by the Autonomous exam section.
- The students attend the Engineering Physics Lab and Engineering Chemistry Lab in alternate Weeks. The end exam shall be conducted separately and average of the two exams will be recorded by the Autonomous exam section.

**B.Tech II Year I Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13HS116	Mathematics-II	3	-	-	-	30	70	100	3
2	13HS120	Professional Ethics and Human Values	2	-	-	-	30	70	100	2
3	13ME301	Mechanics of Solids	3	1	-	-	30	70	100	3
4	13ME302	Fluid Mechanics and Hydraulic machinery	3	1	-	-	30	70	100	3
5	13ME303	Thermodynamics	3	1	-	-	30	70	100	3
6	13ME304	Basic Electrical and Electronics Engineering	3	-	-	-	30	70	100	3
7	13ME305	Machine Drawing	3	-	-	-	30	70	100	3
8	13ME306	Mechanics of Solids Lab	-	-	-	3	30	70	100	2
9	13ME307	Fluid Mechanics and Hydraulics Machinery Lab	-	-	-	3	30	70	100	2
10	13ME308	Basic Electrical and Electronics Engg. Lab	-	-	-	3	30	70	100	2
<b>Contact Periods / Week</b>			<b>20</b>	<b>3</b>	<b>-</b>	<b>9</b>	<b>300</b>	<b>700</b>	<b>1000</b>	<b>26</b>
<b>Total Periods / Week</b>			<b>32</b>				<b>Total Credits</b>			

**B.Tech II Year II Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13HS117	Mathematics-III	3	-	-	-	30	70	100	3
2	13HS118	Managerial Economics and Financial Analysis	3	-	-	-	30	70	100	3
3	13ME401	Thermal Engineering-I	3	1	-	-	30	70	100	3
4	13ME402	Kinematics of Machinery	3	1	-	-	30	70	100	3
5	13ME403	Manufacturing Technology	3	1	-	-	30	70	100	3
6	13ME404	Material Science and Metallurgy	3	-	-	-	30	70	100	3
7	13ME406	Thermal Engineering Lab-I	-	-	-	3	30	70	100	2
8	13ME407	Production Technology Lab	-	-	-	3	30	70	100	2
9	13ME408	Metallurgy Lab	-	-	-	3	30	70	100	2
10	13ME409	Technical Seminar-I	-	1	-	-	100	-	100	2
<b>Contact Periods / Week</b>			<b>18</b>	<b>4</b>	<b>-</b>	<b>9</b>	<b>370</b>	<b>630</b>	<b>1000</b>	<b>26</b>
<b>Total Periods / Week</b>			<b>31</b>				<b>Total Credits</b>			

**B.Tech III Year I Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13HS121	Qualitative and Quantitative Analysis	2	-	-	-	30	70	100	2
2	13ME501	Thermal Engineering-II	3	1	-	-	30	70	100	3
3	13ME502	Dynamics of Machinery	3	1	-	-	30	70	100	3
4	13ME503	Machine Tools	3	-	-	-	30	70	100	3
5	13ME504	Design of Machine Elements - I	3	1	-	-	30	70	100	3
6	13ME505	Production Drawing	3	-	-	-	30	70	100	3
7	13ME506	Industrial Engineering and Management	3	-	-	-	30	70	100	3
8	13ME507	Thermal Engineering Lab-II	-	-	-	3	30	70	100	2
9	13ME508	Machine Tools Lab	-	-	-	3	30	70	100	2
10	13HS122	Soft Skills Lab	-	-	3	-	30	70	100	2
<b>Contact Periods / Week</b>			<b>20</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>300</b>	<b>700</b>	<b>1000</b>	<b>26</b>
<b>Total Periods / Week</b>			<b>32</b>				<b>Total Credits</b>			

**B.Tech III Year II Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13ME601	Production and Operations Management	3	1	-	-	30	70	100	3
2	13ME602	Heat Transfer	3	-	-	-	30	70	100	3
3	13ME603	Forming Technology	3	1	-	-	30	70	100	3
4	13ME604	Design of Machine Elements - II	3	1	-	-	30	70	100	3
5	13ME605	Metrology and Measurements	3	-	-	-	30	70	100	3
6	13ME606	CAD/CAM	3	-	-	-	30	70	100	3
7	13ME607	Heat Transfer Lab-I	-	-	-	3	30	70	100	2
8	13ME608	Metrology Lab	-	-	-	3	30	70	100	2
9	13ME609	CAD Lab	-	-	-	3	30	70	100	2
10	13ME610	Technical Seminar-II	-	1	-	-	100	-	100	2
<b>Contact Periods / Week</b>			<b>18</b>	<b>4</b>	<b>-</b>	<b>9</b>	<b>370</b>	<b>630</b>	<b>1000</b>	<b>26</b>
<b>Total Periods / Week</b>			<b>31</b>				<b>Total Credits</b>			

**B.Tech IV Year I Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13ME701	Automobile Engineering	3	1	-	-	30	70	100	3
2	13ME702	Instrumentation and control Systems	3	1	-	-	30	70	100	3
3	13ME703	Robotics	3	-	-	-	30	70	100	3
4	13CE704	Refrigeration and Air Conditioning	3	1	-	-	30	70	100	3
5	13ME705 13ME706 13ME707 13ME708	<u>Elective-I</u> 1. Un Conventional Machining Processes 2.Tool Design 3.Finite Element Methods 4.Rapid Prototyping	3	-	-	-	30	70	100	3
6	13ME709 13ME710 13ME711	<u>Open Elective</u> 1. Geometric Modeling 2.Tribology 3. Entrepreneurship	3	-	-	-	30	70	100	3
7	13ME712	CAM Lab	-	-	-	3	30	70	100	2
8	13ME713	Instrumentation and Control Systems Lab	-	-	-	3	30	70	100	2
9	13ME714	Heat Transfer Lab-II	-	-	-	-	100	-	100	2
10	13ME715	Project Work - Phase-I	-	-	-	2	100	-	100	2
<b>Contact Periods / Week</b>			<b>18</b>	<b>3</b>	<b>-</b>	<b>8</b>	<b>440</b>	<b>560</b>	<b>1000</b>	<b>26</b>
<b>Total Periods / Week</b>			<b>29</b>				<b>Total Credits</b>			

**B.Tech IV Year II Semester - Mechanical Engineering**

Sl.No	Course Code	Subject	Scheme of instruction (Periods per week)				Scheme of Examination			No. of Credits
			Th	Tu	Drg	Lab	IM	EM	Total Marks	
1	13ME801	Operations Research	3	1	-	-	30	70	100	3
2	13ME802	Energy Systems	3	-	-	-	30	70	100	3
3	13ME803	<b><u>Elective-II</u></b> 1.Total Quality Management 2.Computational Fluid Dynamics 3.Mechanical Vibrations 4.Gas Turbines and Jet Propulsion	3	1	-	-	30	70	100	3
	13ME804									
	13ME805									
	13ME806									
4	13ME807	<b><u>Elective-III</u></b> 1.Power Plant Engineering 2.Nano Technology 3.Adavnces in Casting and Welding Processes 4.Mechatronics	3	0	-	-	30	70	100	3
	13ME808									
	13ME809									
	13ME810									
5	13ME811	Comprehensive Viva - Voce	-	-	-	-	-	100	100	2
6	13ME812	Project Work – Phase-II	-	-	-	-	50	150	200	10
<b>Contact Periods / Week</b>			<b>12</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>180</b>	<b>520</b>	<b>700</b>	<b>24</b>
<b>Total Periods / Week</b>			<b>14</b>				<b>Total Credits</b>			

**AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR  
(AUTONOMOUS)**

**Detailed Syllabus**

<b>I B.Tech (ME)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>[C]</b>
	<b>2</b>	<b>0</b>	<b>0</b>	<b>[3]</b>

**(13HS101) COMMUNICATIVE ENGLISH**

**Objectives:**

- To improve the language proficiency of the students in English with an emphasis on LSRW skills.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication skills in formal and informal situations.

**1. SYLLABUS :**

**Listening Skills:**

**Objectives**

1. To enable students to develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and dialects.

*Students should be given practice in listening and identifying the sounds of English language and to mark stress , right intonation in connected speech.*

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

**2. TEXTBOOKS PRESCRIBED:**

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content are prescribed and divided into Four Units:

**For Detailed study:** ENJOYING EVERYDAY ENGLISH, Sangam Books (India) Pvt Ltd  
Hyderabad, 2009

**For Non-detailed study:** INSPIRING LIVES, Maruti Publications, Guntur, 2009

**UNIT –I:**

**Heaven's Gate:** Introduction of the Author and Lesson, Paragraphs and Description, Introduction of Leh,... Greeting and Leave Taking and Introducing, Naming Words, Homonyms, Homophones, Homographs, Synonyms and Antonyms.

**Mokshagundam Visvesvaraya:** Introduction of Visvesvaraya, Childhood, Education, Projects he Undertook, Social Reforming Activities..... Synonyms and Antonyms.

**UNIT –II:**

**Cuddalore Experience:** Introduction of the Author and Lesson, Paragraphs and Description, Description of Tsunami, Damage Caused, Immediate Rescue Operations Implemented..... Official Reports, Congratulating, Offering Sympathy and Condolences and Making Complaints, Tenses, Phrasal Verbs.

**Mother Teresa:** Introduction of Teresa, Childhood, Humanity Work, Honours and Awards.... One Word Substitutes.

**UNIT –III:**

**Odds against us:** Introduction of the Author and Lesson, Paragraphs and Description, Differences between Foreign Movies and Indian Movies, Three Factors that Guide a Director..... Information Transfer, Conjunctions and Prepositions, Technical Vocabulary.

**Charlie Chaplin:** Introduction of Chaplin, His Films, His married Life..... One Word Substitutes

**UNIT –IV:****Exercises on:**

Remedial Grammar covering Common errors in English, Use of Articles and Prepositions, Active/Passive Voice, Reported speech, Tenses, Degrees of Comparison, conditional Clauses (If/Weather/Unless), One Word Substitutions, Idiomatic Expressions, Synonyms & Antonyms, Words often confused, Question Tags.

**Exercises on:**

Letter Writing

Report Writing

**Reference Books:**

1. Meenakshi Raman and Sangita Sharma, Technical Communication , Principle and Practice, OUP, 2009
2. Essential Grammar in Use, (with CD) 3/e, Cambridge University Press, 2009
3. M.Ashraf Rizvi, Resumes and Interviews, Tata – McGraw Hill, 2009
4. Robert J. Dixson , Everyday Dialogues in English, Prentice-Hall of India Ltd., 2006.
5. Farhathullah, Communication Skills for Technical Students, T.M., Orient Blackswan, 2008

**AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY: GUDUR**  
**(AUTONOMOUS)**

**I B.Tech (ME)**

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

**(13HS102) ENGINEERING PHYSICS**

**Objectives:** To Impart the awareness among the Engineering Students about the present day technologies in Physics to reach the heights of technical globe with latest technologies in Fiber Optics, Nanotechnology, Super Conductivity and Lasers.

**UNIT – I:**

**Optics, Fiber Optics and Lasers**

**Interference:** Introduction, Interference in thin film by reflection, Newton's rings.

**Diffraction:** Introduction, Fraunhofer diffraction due to single slit, Diffraction Grating.

**Fiber Optics:** Construction of Optical Fiber, Principle of Optical Fiber, Acceptance angle and Acceptance cone, Numerical aperture, Types of Optical Fibers, Fiber optic communication system and its advantages, Attenuation in Optical Fibers, Applications of Optical Fibers.

**Lasers:** Introduction, Characteristics of Lasers, Spontaneous & Stimulated emission of radiation, Population Inversion, Pumping Methods, Components of Lasers, Ruby Laser, Helium Neon Laser, Semiconductor laser, Applications of Lasers.

**UNIT – II:**

**Crystal Structures, X-Ray Diffraction and Semiconductors**

**Crystal Structures, X-Ray Diffraction:** Introduction, Space Lattice, Basis, Unit Cell, Lattice Parameters, Bravais Lattices, Crystal systems, Expression for Lattice constant, Structure and Packing factor of SC, BCC & FCC crystals, Structure of NaCl and Diamond, Crystal Planes, Crystal directions and Miller Indices, Important features of Miller Indices, Expression for Interplanar spacing in rectangular coordinate systems, X-ray Diffraction by crystal planes, Bragg's law, Laue Method, Powder Method.

**Semiconductors:** Introduction, Intrinsic semiconductor and carrier concentration, Extrinsic semiconductor and carrier concentration, Law of mass action, Electrical conductivity in semiconductors, Drift and Diffusion, Einstein relation, Hall Effect, Direct and Indirect Band gap semiconductors, LED, Photodiodes.

**UNIT-III:**

**Principles of Quantum Mechanics, Band Theory of Solids and Magnetic Properties:**

**Principles of Quantum Mechanics :**Waves and particles, de-Broglie Hypothesis, Matter waves, Heisenberg Uncertainty principle, Applications of Heisenberg uncertainty principle, Schrodinger time independent wave equation, Physical significance of wave function, Particle in one dimensional potential box, Fermi Dirac Distribution function, Electron Scattering and Sources of electrical resistance.

**Band Theory of Solids:** Electron in a periodic potential, Kronig-Penny Model (qualitative treatment only), Origin of Energy Bands formation in Solids, Effective mass of electron, Classification of solids into Conductors, Semiconductors & Insulators based on Band theory.

**Magnetic Properties:** Magnetic susceptibility, Origin of Magnetic moment-Bohr magneton, Classification of magnetic materials, Domain theory of ferromagnetism, Hysteresis curve, Ferrites and its applications, Soft and hard magnetic materials.

**UNIT – IV****Superconductivity & Nanotechnology**

**Superconductivity:** Introduction, Properties of superconductors, Meissner Effect, Type – I and Type – II Superconductors, Flux Quantization, Penetration Depth. Josephson Effect, BCS theory, Applications of superconductors, High Temperature Superconductors.

**Nanotechnology:** Origin of Nanotechnology, Nanoscale, Surface area to volume ratio, Quantum Confinement effect, Properties of nanomaterials, Electrical properties, Optical properties, Magnetic Properties, Mechanical properties, Fabrication of nanomaterials by Ball Milling, Plasma Arcing, Chemical vapour deposition, Sol-Gel method, Electrode position methods and Applications of Nanomaterials.

CNT-Introduction, Types, Properties, Production, Applications of CNTS, Graphene and Graphene based FET.

**Text Books:**

1. V. Rajendran, K.Thyagarajan Engineering Physics , III Edition, 2012.Tata MacGraw Hill Publishers
2. P.K.Palanisamy , Engineering Physics, II Edition 2010 Scitech Publishers.

**Reference Books:**

1. S. ManiNaidu ,Engineering Physics, I Edition, 2012. Pearson Education
2. M. Arumugam , Engineering Physics II Edition, 1997 , Anuradha Publications.
3. A.J. Dekkar , Solid State Physics , Latest edition, 2012. McMillan Publishers
4. Gaur and Gupta Dhanapati , Engineering Physics, 7th Edition, 1992 Rai Publishers ,.
5. B S Murthy, P.Shankar, Baldev Raj B BRath, James Murday , I Edition, 2012.
- Text book of Nanoscience and Nanotechnology:, University Press,
6. H.S. Philip Wong, Deji Akinwande , Carbon Nanotubes and Graphene Device Physics –, Cambridge University Press, 2011.

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**(13HS103) ENGINEERING CHEMISTRY**

**Objectives:**

- The Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.

**UNIT – I:**

**Water Technology & Fuel Technology:**

**Water Technology:** Sources of water, Hardness of water, units of hardness, Estimation of hardness by EDTA method, Analysis of water – Dissolved oxygen, Estimation of Chloride, Alkalinity, Acidity.

**Sterilization of water:** Chlorination, Ozonisation, Addition of Bleaching powder.

**Water for Industrial Purpose:** Water for steam generation, Boiler troubles – priming and foaming, Boiler corrosion, sludges and scales, caustic embrittlement.

**Water treatment:** Internal treatment – colloidal, phosphate, calgon, carbonate and sodium aluminate conditioning. Softening methods of water – Ion exchange process. Determination of brakish water – Reverse Osmosis.

**Fuel Technology:** Definition, classification, characteristics of good fuel.

**Solid fuels:** Coal, classification, Metallurgical coke – characteristics and Manufacturing (Otto-Halfman's by product oven method)

**Liquid fuels:** Petroleum, origin, refining, and fractional distillation, synthetic petrol.

**Gaseous fuels:** Composition and preparation of producer gas, water gas, bio gas, coal gas, natural gas.

Calorific Value and its Units, flue gas analysis by Orsat's apparatus.

**Lubricants:** Functions, Classification and Properties – viscosity, viscosity index, flash and fire point, pour and cloud point, aniline point, mechanical strength, neutralization number.

**UNIT – II:**

**Electrochemistry and Science of corrosion:**

**Electrochemistry :** Conductance, Equivalent conductance, Molecular conductance, conduct metric titrations, Applications of conductivity measurement., numerical calculations, review of electro chemical cells-Galvanic cells.

**Batteries:** Ni-Cd cell, Lithium ion cells, fuel cells – Hydrogen Oxygen Fuel cell, Methanol fuel cell.

**Science of corrosion:** Definition and Types of corrosion – Dry corrosion and wet corrosion. Galvanic series, Galvanic corrosion and concentration cell corrosion.

Factors influencing corrosion,

**Control of corrosion:** Use of inhibitors, Sacrificial Anode, Impressed current, Electroplating and Electro less plating (Cu and Ni).

**UNIT – III:**

**Polymers and advanced Engineering Materials**

**Polymers:** Basic concepts, Types of polymerization – Addition, condensation, co-polymerization.

**Plastics:** Thermoplastics and Thermosetting plastics, preparation, properties and Engineering uses of Teflon, PVC, Bakelite, Nylon.

**Natural Rubber (Elastomers):** Processing, Compounding, Vulcanization of Natural Rubber.

**Synthetic Rubber:** Buna – S, Buna – N, Poly urethane, poly sulphide and silicone Rubber.

**Advanced Engineering Materials:**

**Conducting Polymers:** Synthesis and Applications of poly acetylene, poly aniline.

**Liquid Crystals:** Definition, properties, and classification and Engineering applications.

**Inorganic Polymers:** Basic Introduction, Silicones, Polyphospazins  $(-R)_2-P=N-$  and applications.

#### UNIT – IV:

##### **Building Materials and Photo Chemistry**

**Cement:** Definition, Composition and Manufacture of Portland cement, Analysis, setting and hardening of cement.

**Refractories:** Definition, classification, criteria of good Refractory- Refractoriness, Refractoriness under load, Chemical inertness, Dimensional stability, Thermal spalling, porosity, Thermal expansion, Thermal conductivity, Abrasion Resistance, Electrical conductivity. Causes for failure of refractories.

##### **Photo Chemistry:**

Photochemical Reactions, Difference between Photochemical reactions and thermochemical reactions. Absorption of light: Beer-Lambert's law.

Photo-physical Processes: (a) Fluorescence. (b) Phosphorescence and (c) Chemi-luminiscence applications.

#### **Text Books:**

1. Prof. K.N.Jayaveera, Dr.G.V.Subba Reddy and Dr.C. Ramachandraiah, , Engineering Chemistry Fourth Edition, 2012 McGraw Hill Higher Education, New Delhi.
2. Jain & Jain, Text book of Engineering Chemistry , 15th Edition 2009, Dhanpat Rai Publishing Company, New Delhi.

#### **Reference Books:**

1. S.S Dhara, S.S.Umare, A Text book of Engineering Chemistry ,12th Edition, 2010. S. Chand Publications, New Delhi,
2. K.B.Chandra Sekhar, UN.Das and Sujatha Mishra Engineering Chemistry , 2nd Edition, 2012 SCITECH, Publications India Pvt Limited, Chennai
3. K. Sesha Maheswaramma and Mrudula Chugh , Engineering Chemistry, First Edition, 2013 PearsonEducation
4. C.V. Agarwal, Chemistry of Engineering Materials Varanasi,2008. Tara Publication.

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**(13HS104) ENGINEERING MATHEMATICS-I**

**Objectives:** The Subject is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.

**UNIT – I:**

**Differential & Integral Calculus**

**Mean Value Theorems** – Rolle's, Lagrange's, Cauchy's, Taylor's, and Maclaurin's theorem (without proofs) with simple related problems.

Functions of several variables - Jacobian, functional dependence, Taylor's and Maclaurin's series (without proof) with two variables, maxima & minima of function of two and three variables. - Lagrange's method of multipliers with three variables only

**Radius of Curvature** – Cartesian, Polar, Parametric forms and Radius of Curvature at Origin (Newton's Method).

**Curve Tracing** – Cartesian, Polar, Parametric forms.

**Multiple Integrals** - Evaluation of Double Integrals – Change of Order of Integration- Change of Variables- Evaluation of Triple Integrals.

**UNIT-II:**

**Ordinary Differential Equations:**

**Differential Equations of First Order and First Degree:** Exact Differential Equations, Integrating factors, Linear Differential Equations, Bernoulli's Differential Equations, Orthogonal Trajectories of curves, Newton's Law of cooling, Law of Natural Decay & Growth.

**Linear Differential Equations of Second or Higher Order:** Homogeneous, Non-Homogeneous, Differential Equations of second and higher order with constant coefficients with RHS terms of the type  $e^{ax}$ ,  $\sin ax/\cos ax$ , Polynomial in  $x$ ,  $e^{ax}V$  [ $V$  is  $\sin ax$  or  $\cos ax$  or polynomial in  $x$ ],  $x^m V$  [ $V$  is  $\sin ax/\cos ax$ ], method of Variation of parameters.

**UNIT III:**

**Laplace Transforms**

Laplace transforms of standard functions – Inverse Laplace - First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of Laplace transforms – Application of Laplace transforms to ordinary differential equations of first and second order.

**UNIT IV:**

**Vector Calculus:**

**Vector Differentiation:** Scalar and Vector point functions, Gradient of scalar point function, Directional derivatives – Divergence of a vector point function – Curl of a vector point function and their related properties.

**Vector integration:** Line integral - Work done – Vector potential function – Area, Surface and volume integrals. Green's theorem, Stoke's Theorem, and Gauss's Divergence Theorem (without proof), Applications of Green's, Stoke's and Gauss's Theorems.

**Text Books:**

1. T.K.V. Iyengar , Engineering Mathematics Volume-I , 12<sup>th</sup> Edition(2013) , S.Chand publication
2. E. Rukmangadachari & E. Keshava Reddy, Engineering Mathematics, Volume – I , 1<sup>st</sup> Edition (2010). Pearson Publisher

**Reference Books:**

1. Erwin Kreyszig , Advanced Engineering Mathematics, 10th Edition(2012), Wiley India.
2. B.S.Grewal ,Higher Engineering Mathematics, 42 Edition(2012), Khanna publishers .
3. Debachish Dutta ,Text Book of Engineering Mathematics, New Age International Publishers.
4. B.V.Ramana ,Higher Engineering Mathematics, Mc Graw Hill publishers(2008)

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**(13HS106) ENVIRONMENTAL SCIENCE**

**Objectives:** The student should be conversant with the evolution and the importance of environmental studies, various natural resources and the current threats to their sustainability, significance and protection of bio diversity and various forms of environmental degradation causes, effects and control measures of various pollutants and international conventions and protocols for the protection of environment.

**UNIT-I:**

**Introduction to Environmental Science and Natural Resources:**

Environment: Definition, scope, importance – need for public awareness. Renewable and non-Renewable resources. Natural resources and associated problems. Forest resources: Use –over exploitation- deforestation - case studies. Mining, dams - effects on forests and tribal people. Water resources: Use – over utilization of surface and ground water. Floods, drought, conflicts over water. Mineral resources: Use – exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture- fertilizer-pesticide problems. Water logging, salinity. Energy resources: Growing energy needs - renewable and non renewable energy sources. Use of alternate Energy sources, Impact of Energy use on Environment.

**UNIT-II:**

**Ecosystems and Biodiversity:**

Concept of an ecosystem: Structure and function of an ecosystem – producers, consumers, decomposers. Energy flow in the ecosystem. Ecological succession – food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Introduction- definition, genetic - species –ecosystem diversity. Value of biodiversity: Consumptive use - productive use – social values – ethical values - aesthetic values. Biodiversity level: Global - national - local levels- India as a mega diversity nation- Hotspots of biodiversity. Threats to biodiversity: Habitat loss - poaching of wildlife – man wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: *In-situ* and *ex-situ* conservation of biodiversity.

**UNIT-III**

**Environmental Pollution :**

Pollution: Definition Cause, effects and control measures of –air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution - nuclear hazards. Solid waste management: Causes - effects - control measures of Rural/Urban/Industrial waste management [with case study of any one type, e.g., power, fertilizer, tannin, leather, chemical, sugar]. Role of an individual in prevention of pollution. Population growth and Environment, Environment and human health. Effects of human activities (Urbanization, Transportation, Industrialization, Green revolution) on the Quality of Environment.

**UNIT-IV****Social issues and the Environment:**

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. Environment Protection Act. – Air (Prevention and Control of Pollution) Act.- Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**Field Work:**

Visit to a local area to document environment assets River/ forest grassland/ hill/mountain – Visit to a local polluted site-Urban/Rural / Industrial/ Agricultural Study of common plants, insects, birds – river, hill slopes, etc

**Text Books:**

1. Text book of Environmental Studies for Undergraduate Courses by Erach. Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.
3. Environmental Studies by Benny Joseph, Mc. Graw Hill Publications.

**Reference Books:**

1. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
2. Comprehensive Environmental studies by J.P. Sharma, Laxmi publications.
3. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
4. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela – Printce hall of India Private limited.
5. Environmental Studies by Anindita Basak – Pearson education.

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**(13HS107) COMPUTER PROGRAMMING**

**Objectives:** The primary objective is to develop the under – graduate students of Engineering a level of competence in IT required for independent and effective skills for academics and industry needs.

**UNIT – I:**

**Introduction to Computers and Programming:**

Introduction computers- What is a computer?, block diagram of computer, Computer characteristics, hardware, software, types of programming languages.

**Introduction to computer problem solving:** introduction, the problem solving aspects , top-down design, implementation of algorithms, program verification, Flow charts.

**Introduction to C Language** - C Language Elements, General form of a C Program, Variable declarations, Data types, Executable statements, Expressions, Precedence and Associativity, Expression Evaluation, Operators and Expressions, Type Conversions, Data Input and Output, Preparing and running a complete C program.

**UNIT – II:**

**Control Statements:**

**Decision Statements:** If, if-else, nested if and switch Statements, Loop Control Statements - while, for, do-while Statements, Nested Loops, Other Related Statements - break, continue, goto.

**Functions:** Function prototype, definition and accessing, passing arguments to a function, Library Functions, Scope of a function, Storage Classes - Auto, Register, Static, Extern, Scope rules, Type qualifiers, Recursion - Recursive functions, C Preprocessor, header files.

**UNIT – III:**

**Arrays and Pointers:**

**Arrays:** Declaring and Referencing arrays, Array subscripts, Using for Loops for Sequential access, Using array elements as function arguments, operations on Multidimensional Arrays.

**Sorting and Searching:** Bubble Sort, Selection Sort, Quick sort, Merge Sort, Linear and Binary Search Methods

**Pointers:** Introduction, Features of Pointers, Pointer Declaration, Arithmetic Operations with Pointers, Pointers and Arrays, Pointers and Two-Dimensional Arrays, Array of Pointers, Pointers to Pointers, Void Pointers, Memory Allocation Functions, Pointer to Functions, Command- Line Arguments.

**Strings:** String Basics, String Handling Functions, String Comparison, Searching and sorting of strings.

**UNIT – IV:**

**Structure and Union**

**Structure and Union:** Introduction, Features of structure, Declaration and Initialization of Structure, Structure within Structure, Array of Structures, Pointer to Structure, self referential Structures, Structures and Functions, type def and Enumerated data types, Unions, Bit fields

**Files:** Introduction, Streams and file types, Steps for file operations, File I/O structures, Read and Write,\_register variables and bitwise operations, File Status functions (error handling).

**Text Books:**

1. Byron S Gottfried, Jitender Kumar Chabra, Programming with C, , Third Edition, McGraHill Pvt. Ltd.
2. Jeri R Hanly, Elliot B. Koffman, Ashok Kamthane, A. Ananda Rao, Programming in C and data structures, Pearson Education

**Reference Books:**

1. R. G. Dromey, How to Solve it by Computer, Person Education,2008.
2. B.A.Forouzan and R.F. Gilberg, C Programming & Data Structures, Third Edition, Cengage Learning,2000.
3. Stephen G. Kochan,Programming in C –III Edition, Pearson Educataion,2004.
4. J.A. Jones & K. Harrow ,C Programming with problem solving, Dreamtech Press
5. Harry H. Cheng,C for engineers and scientists an interpretive approach, , McGraHill International Pvt. Ltd
6. E.Balagurusamy, C Programming & Data Structures, TMH,2009.

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**(13HS108) ENGINEERING MECHANICS**

**Objectives:** The course is aimed at developing the basic skills of Civil Engineering students that are imperative for effective understanding of Civil Engineering subjects. The topics introduced will serve as basic tools for specialized studies in civil engineering.

**UNIT – I:**

**Basics of Engineering Mechanics:** Basic Concepts of Engineering Mechanics: Introduction to Engineering Mechanics – Scalar and Vector – Forces – Characteristics of a force – Definitions and examples of various types of force systems – Definition of resultant – Composition and resolution of forces – Moment of a force – Principles of moments of force – Couples – characteristics of a couple – on Transformations of a couple – Resolution of a force into a force and couple.

**Resultants of Force System:** Possible resultants of different types of force systems – Resultant of a concurrent, coplanar force system – Resultant of a non-concurrent coplanar force system – Resultant of a concurrent non-coplanar force system – Resultant of a parallel, non-coplanar force system – Resultant of a system of couples in space – Resultant of non-concurrent, non-coplanar, non-parallel force system – screw of Wrench.

**Equilibrium of Forces:** Free body diagrams – Equations of equilibrium for a concurrent coplanar force system – Equilibrium of Bodies acted on by two or three forces – Equilibrium of bodies acted on by non-concurrent coplanar force system – Equilibrium of bodies acted on by parallel, non-coplanar force system – Equilibrium of non-concurrent, non-coplanar non-parallel force system

**UNIT – II:**

**Frictional Resistance & Applications of Friction:**

**Frictional Resistance:** Classification of friction- laws of friction – coefficient of friction-angle of friction – angle of repose – cone of friction – free body diagram-advantages-equilibrium of a body on a rough horizontal and inclined plane

**Applications of Friction:** Ladder friction – rope friction – wedge friction. Simple machines-concept of lifting machines-law of lifting machine – efficiency-mechanical advantages – velocity ratio and their relationship.

**UNIT – III:**

**Centroids and Centers of Gravity & Moments of Inertia:**

**Centroid and Centers of Gravity:** Definition – Centroid and centers of gravity simple and composite bodies – Theorems of Pappus

**Moments of Inertia:** Definition – Parallel axis theorem for areas – Second moments of areas by integration – Radius of gyration of areas – Moments of inertia of composite areas – Parallel axis and parallel plane theorems for masses – Moments of inertia of masses by integration – Radius of gyration of mass – Moments of inertia of composite masses(Simple problems only)

**UNIT – IV:**

**Kinematics:** Introduction, Rectilinear kinematics: Continuous motion, General curvilinear motion, Curvilinear motion: Rectangular components, Motion of a projectile, curvilinear motion: Normal and tangential components, Absolute dependent motion analysis of two particles

**Kinetics:** Newton's law of motion, The equation of motion, Equation of motion for a system of particles, Equation of motion: Rectangular coordinates, Equation of motion: Normal and tangential Coordinates.

**Text Books:**

1. B. Bhattacharya, Engineering Mechanics- Oxford University Publications, 2009
2. S.S. Bhavikatti, Engineering Mechanics, New Age Internationals, 2<sup>nd</sup> edition, 2010

**References Books:**

1. A. K. Tayal, "Engineering Mechanics", Umesh Publications, 2005.
2. Ferdinand.L.Singer, Engineering Mechanics (Statics and Dynamics), Harper Row Publishers.2007.
3. Shames.I.H, Engineering Mechanics (Statics and Dynamics), Prentice – Hall of India- New Delhi, 2004.
4. Timoshenko.S.P and Young.D.H, Engineering Mechanics, McGraw Hill Book Co. Ltd.2003.
5. S.Temoshenko,D.H.Young and J.V.Rao,Engineering Mechanics,Revised 4th Edition,Tata-McGraw-Hill Publishing Company Limited,New Delhi,2007.

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**(13HS109) ENGINEERING DRAWING**

**Objectives:** Increase ability to communicate with people, Learn to take data and transform it into graphic drawings and Learn basic engineering drawing formats

**UNIT – I:**

**Introduction to Engineering Drawing:** Introduction to Drawing Instruments and their uses, Lettering, Types of Dimensioning, Division of a Line, Construction of Polygons, Inscribing of polygons, Describing of polygons.

**Conic Sections**

**Ellipse:** Eccentricity method, Oblong method, Parallelogram method, Arc's of Circles method and Concentric Circles method.

**Parabola:** Eccentricity method, Rectangle method, Tangent method, Parallelogram method.

**Hyperbola:** Eccentricity method, Rectangular hyperbola, Asymptotes method, Two branches of Hyperbola (Arc's of Circles method), Abscissa- Ordinate- method.

**Cycloids:** General Cycloid, Epi-Cycloid, Hypo-Cycloid.

**UNIT – II:**

**Projections of Points, Straight Lines, Planes:**

**Points:** Introduction to Orthographic Projections, Describing of quadrants , First and Third angle projection – Position of points in 4 quadrants.

**Straight Lines:** Lines parallel to both the principal planes, perpendicular to one plane and parallel to another plane, lines inclined to one plane, lines inclined to both the planes, finding true lengths, true inclinations.

**Planes:** Projection of regular plane surfaces, planes parallel to one plane, planes inclined to one plane and inclined to both the planes.

**UNIT – III:**

**Projection of Solids, Sections and Development of Solids:**

**Solids:** Positions of regular solids( prism, cylinder, pyramid and cone) – Projection of Solids – Axis perpendicular to one plane and parallel to another plane, inclined to one plane and inclined to both the planes, Axis parallel to both the Principal planes.

**Section of Solids:** Section Planes and Sectional views of Right Regular Solids–Prism, Cylinder, Pyramid and Cone. True shapes of the sections.

**Development of Solids:** Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid, Cone and their Sectional parts.

**UNIT – IV:**

**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS**

**Isometric Projections:** Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

**Orthographic Projections** – Conversion of pictorial views into orthographic views

**Text Books:**

1. N.D. Bhat, Engineering Drawing, Charotar Publishers, 52nd Revised and Enlarged : 2013
2. K.L. Narayana, P. Khanniah, Engineering Drawing, Publisher, Scitech

**Reference Books:**

1. Venugopal, K., A Textbook of Engineering Graphics , New age Publishers,2009
2. Venkata Reddy, Engineering Drawing, B.S.Publisher ,2009
3. Basant Agrawal, C M Agrawal ,Engineering Drawing ,2013
3. V.Ramesh Babu, Engineering Drawing .2009
4. Shah and Rana, 2/e, Engineering Drawing, Pearson education.2013

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**(13HS110) COMPUTER PROGRAMMING LAB**

**Objectives:**

- To make the student learn a programming language.
- To teach the student to write programs in C to solve the problems.
- To introduce the student to simple linear data structures such as lists, stacks, queues.

**Recommended Systems/Software Requirements:**

Intel based desktop PC with ANSI C Compiler and Supporting Editors

**EXERCISE-1:**

- a) Write a C program to evaluate area of triangle ( $\sqrt{s(s-a)(s-b)(s-c)}$ ).
- b) Write a C program to swap 2 numbers without using temporary variable.
- c) Write a C program to print Sum of n natural numbers.
- d) Programs on Expressions

**EXERCISE-2:**

- a) Write a C program to calculate the following Sum:  

$$\text{Sum} = 1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$$
- b) Write a C program to find the roots of a quadratic equation.
- c) Write a C program to print prime Numbers up to n numbers

**EXERCISE-3:**

- a) Write a C program to find factorial of a number using while, do-while, for loops
- b) Write a C program to determine if the given Number is a palindrome or not
- c) Write a C program to determine if the given Number is an Armstrong or not

**EXERCISE-4:**

- a) Write a program on matrices
  - i) Addition
  - ii) Subtraction
  - iii) Multiplication
  - iv) Transpose
  - v) Sum of diagonal elements
  - vi) Summing row wise and column wise

**EXERCISE-5:**

Programs on sorting and searching

**EXERCISE-6:**

- a) Write a program to implement call by value and call by reference
- b) Write a C program to print Fibonacci series using recursion and iteratively
- c) Write a C program to find factorial of a number using recursion and iteratively

**EXERCISE-7:**

- a) Write a C program to sort 5 city names in alphabetical order
- b) Write a C program to determine if the given string is a palindrome or not.
- c) Write a C program to implement string handling functions

**EXERCISE-8:**

- a) Write a C program to print address of variable
- b) Write a C program print the element of array using pointers

**EXERCISE-9:**

- a) write a c program to find the total salary of employee and salary of employee details
- b) write a C program to pass structure as an arguments to function and calculate total marks of 5 subjects

**EXERCISE-10:**

- a) Write a C program to write and read data to and from files
- b) Write a C program which copies one file to another.
- c) Write a C program to reverse the first n characters in a file.

**EXERCISE-11:**

Programs on command line arguments

**EXERCISE-12:**

Programs on self referencing

**Reference Books:**

1. M.Cooper, The Spirit of C, an introduction to modern programming, Jaico Publishing House.
2. K.R. Venugopal and S.R. Prasad, Mastering C, TMH Publications,2006.
3. V. Rajaraman, Computer Basics and C Programming, PHI Publications.

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**(13HS111) ENGINEERING WORKSHOP AND I.T. WORKSHOP**

**ENGINEERING WORKSHOP**

**Objectives:** The Engineering Workshop for engineers is a training lab course. It imparts the required knowledge about producing the Products particular joining methods, manufacturing methods among the students through which they will get an idea about shop floor level, a manufacturing section in industry.

**1: Trades for Exercises:**

**(a) Carpentry Shop**

1. Cross Lap Joint
2. Mortise and Tenon Joint

**(b) Fitting Shop**

1. Square Fitting
2. V Fitting

**(c) Sheet Metal Shop**

- 1.3-Sided Tray (Trapezoidal Tray)
2. Cylinder (Circular Tin)

**(d) House Wiring**

1. Wiring for two lamps (bulbs) with independent switch controls with or without looping
2. Wiring for stair case lamp.

**(e) Foundry**

1. Single Piece Pattern
2. Double Piece Pattern.

**(f) Welding**

1. Lap Joint
2. T - Joint

**2: Trades for Demonstration**

- i. Machine Shop (Lathe Machine, Grinding Machine and Drilling Machine)
- ii. Metal Cutting
- iii. Plumbing

In addition to the above, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, plastics, steels, meters, gauges, equipment, first-aid and shop safety shall be demonstrated through charts, layouts, figures, circuits, CD or DVD.

**Reference Books:**

1. Engineering Work shop practice, V. Ramesh Babu, VRB Publishers Private Limited, 2009
2. Work shop Manual, P.Kannaiah and K.L.Narayana, SciTech Publishers, 2009
3. Workshop Practice Manual, K. Venkata Reddy, BS Publications,

## I.T. WORKSHOP

**Objectives:** The IT Workshop for engineers is a training lab course. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, Power Point and Publisher.

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. The students should work on a working PC (PIV or higher) to disassemble and assemble back to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.

### **CHAPTER – I: PC Hardware**

#### **Task – 1:**

Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor

#### **Task – 2:**

Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video shall be given as part of the course content

#### **Task – 3:**

Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva

#### **Task – 4:**

Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

#### **Task – 5:**

Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

### **CHAPTER - II: Word Processor**

#### **Task – 1:**

Introduction to Ms Word, importance of Word as Word Processor, overview of toolbars, saving, accessing files, using help and resources.

#### **Task – 2:**

To create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

### **CHAPTER –III: Spread Sheets**

#### **Task –1:**

The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

#### **Task –2:**

Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

#### **Task –3:**

Create student marks list for 10 students using for the formulas

**CHAPTER –IV: Presentation****Task –1:**

Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Powerpoint. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

**Task –2:**

Second Exercise helps students in making their presentations interactive. Topic covered during this Exercise includes : Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts

**CHAPTER – V: Internet & World Wide Web****Task –1:**

Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task –2:**

Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers.

**Task –3:**

Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated by the student to the satisfaction of instructors.

**Task – 4:**

Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install an antivirus software, configure their personal firewall and windows update on their computer.

**Text Books:**

1. ITL Education Solutions limited, Introduction to Information Technology, Pearson Education,2005.
2. Peter Norton, Introduction to Computers, 6/e Mc Graw Hill

**Reference Books:**

1. Leslie Lamport, LaTeX Companion –PHI/Pearson.
2. Scott Muller QUE, Upgrading and Repairing, PC's 18<sup>th</sup> e, Pearson Education,2007.
3. Vikas Gupta, Comdex Information Technology course tool kit, WILEY Dreamtech
4. David Anfinson and Ken Quamme. IT Essentials PC Hardware and Software Companion Guide, Third Edition by– CISCO Press, Pearson Education,2008.

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**(13HS112) ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LAB**

**Objectives:** Educate the theoretical concepts experimentally.

**ENGINEERING PHYSICS LAB**

1. Dispersive power of the prism – Spectrometer.
2. Determination of wavelength of given source- Spectrometer-Normal Incidence Method.
3. Determination of wavelength of a laser source - Diffraction Grating.
4. Determination of particle size by using a laser source.
5. Newton's Rings.
6. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
7. Numerical aperture of an optical fiber.
8. B – H Curve.
9. Energy gap of a material of p-n junction
10. Determination of rigidity modulus of a wire material – Torsional pendulum
11. Melde's experiment – Transverse & Longitudinal modes.
12. Hall Effect

**ENGINEERING CHEMISTRY LAB**

1. Preparation of Standard Potassium Dichromate and Estimation of Ferrous Iron.
2. Preparation of Standard Potassium Dichromate and Estimation of Copper, by Iodometry.
3. Preparation of Standard EDTA solution and Estimation of Hardness of Water.
4. Determination of Alkalinity of water.
5. Preparation of Standard EDTA and Estimation of Copper
6. Determination of strength of the given Strong acid and weak acid against standard strong base solution by Conductometric titration
7. Determination of viscosity of the oils through Redwood viscometer (i) and (ii)
8. Flash point and Fire point apparatus.
9. Estimation of dissolved oxygen through Winklers method.
10. Preparation of phenol-formaldehyde resin (Bakelite)
11. Determination of Chlorine in Bleaching powder and Iodine in Iodised salt.
12. Estimation of Chloride ion using potassium chromate indicator by mhor's method.

**Reference Books:**

1. J. Mendham et al ,Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition, 2012, Pearson Education,.
2. K.B.Chandra Sekhar, G.V. Subba Reddy and K.N.Jayaveera, Chemistry Practical – Lab Manual ,SM Publications, 3rd Edition, 2012Hyderabad.
3. Vogel's Book of Quantitative Inorganic Analysis, ELBS Edition.

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**(13HS113) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB**

**Objectives:** To equip students with effective speaking and listening skills in English, help them develop the soft skills and people skills which will make them to excel in their jobs and enhance to students' performs at placement interviews

**UNIT – I:**

**Activity– 1:** Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.

**Activity– 2:** Situational Dialogues (Giving Directions etc.)

**UNIT – II:**

**Activity– 3:** Speaking on the mobiles and telephone conversation

**Activity– 4:** Role Play

**Activity– 5:** 'Just A Minute' Sessions (JAM).

**UNIT – III:**

**Activity– 6:** Describing Objects / Situations / People in spoken and written formats.

**Activity– 7:** Information Transfer

**UNIT – IV:**

**Activity– 8:** Debate & Group Discussion.

**Activity– 9:** Reading Comprehension

**Reference:**

1. Daniel Jones, English Pronouncing Dictionary, Current Edition with CD.
2. R. K. Bansal and J. B. Harrison, Spoken English, Orient Longman 2006 Edn.
3. Krishna Mohan & NP Singh, Speaking English Effectively, (Macmillan)
4. J. Sethi, Kamlesh Sadanand & D.V. Jindal, A Practical Course in English Pronunciation, (with two Audio cassettes), Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Dr Shalini Verma , Body Language- Your Success Mantra , S.Chand & Co, 2008
6. English Dictionary for Advanced Learners, (with CD) International edn. Macmillan 2009

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**(13HS116) MATHEMATICS-II**

**Objectives:** The course is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.

**UNIT – I:**

**Matrix Algebra:**

Rank of a matrix – Normal form, Echelon form – Inverse of a matrix using elementary operations – Consistency of system of Linear equations (Homogenous and Non-homogeneous) Hermitian & Skew Hermitian- unitary matrices and their properties. Eigen Values and Eigen Vectors (Real and Complex Matrices) Cayley- Hamilton theorem and its applications. Diagonalization of a matrix – Reduction of a quadratic form to canonical form by orthogonal transformation. Norm of a matrix – Euclidian and Infinite norms.

**UNIT – II:**

**Numerical Analysis:**

Numerical solutions of algebraic and transcendental equations by Bisection – Iteration and Newton – Raphson methods,. Forward, backward differences, Interpolation - Newton's forward and backward interpolation formulae, Lagrange interpolation, Numerical differentiation at the tabulated points with forward and backward differences. Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule.

**UNIT – III:**

**Numerical Solutions of Ordinary Differential Equations:**

Numerical Solutions of ODEs – solution by Taylor series method, Euler's method, Picard's Method, Modified Euler's method, Runge-Kutta method of 2<sup>nd</sup> & 4<sup>th</sup> orders

**UNIT IV – Fourier Series:**

Expansion of a function in Fourier series for a given range – Half range sine and cosine expansions. Complex form of Fourier series – Fourier transformation – sine and cosine transformations – simple illustrations.

**Z-Transforms:** Inverse Z-transforms-Damping Rule and shifting Rule, initial and final value theorems – Convolution theorem.

**Text Books:**

1. T.K.V. Iyengar ,Mathematical Methods , 8th Edition(2013) ,S. Chand publication.
2. E. Rukmangadachari & E. Keshava Reddy, Engineering Mathematics, Volume - II, 1st Edition (2010),Pearson Publisher.

**Reference Books:**

1. B.S.Grewal ,Higher Engineering Mathematics, 42 Edition(2012),Khanna publishers.
2. B.V.Ramana , Higher Engineering Mathematics, Mc Graw Hill publishers(2008).
3. S.S. Sastry ,Introductory Methods of Numerical Analysis, 5th Edition(2012), PHI publisher .
4. Erwin Kreyszig,Advanced Engineering Mathematics, 10th Edition(2013),Wiley India.

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### **(13HS120) PROFESSIONAL ETHICS AND HUMAN VALUES**

**Objectives:** To create awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty, to appreciate the rights of others.

#### **UNIT-I:**

**Human Values:** Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

#### **UNIT-II:**

**Engineering Ethics:** Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

#### **UNIT-III:**

**Engineering as Social Experimentation:** Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

#### **UNIT-IV:**

**Safety, Responsibilities and Rights:** Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

#### **Text Books:**

1. Mike Martin and Roland Schinzingher, "Ethics in Engineering", McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

#### **Reference Books:**

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, NeJersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available).
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

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**(13ME301) MECHANICS OF SOLIDS**

**Objectives:** The objective of the subject is to learn the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationships. To accesses stresses and deformations through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & Theory of machines courses.

**UNIT-I:**

**Simple Stresses and Strains:** Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress & strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes-theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

**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.

**Flexural Stresses:** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections

**UNIT- III:**

**Shear Stresses:** Introduction, Shear stress at a section (derivation of equation), Shear stress distribution for different sections (rectangular, circular, solid and hollow, I, T, angle sections).

**Torsion of Circular Shafts-** Theory of pure torsion- Derivation of torsion equations;  $T/J = q/r = N\theta/L$  – Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus.

**Deflection Of Beams:** 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

**UNIT- IV:**

**Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

**Thick Cylinders:** Lame's equation – cylinders subjected to inside & outside pressure -Compound cylinders.

**Text Books:**

1. R. K. Bansal, Strength of materials ,Lakshmi Publications, 5th Edition, 2012.
2. R. K. Rajput, Strength of Materials ,S. Chand and Co., New delhi.1999
3. S. S. Bhavikatti, Strength of Materials I & II ,New Age Publications,2012

**Reference Books:**

1. Strength of Materials and mechanics of solids Vol-1 & 2 by B.C. Punmia, Laxmi Publications, New Delhi,2013
2. Introduction to Engg mechanics of solids by Egor Popov.
3. Theory of structures by Ramamratnam,jain book depot , New Delhi
4. James M. Gere, Stephen Timoshenko, Mechanics of materials, CBS Publisher ,2004.

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**(13ME302) FLUID MECHANICS AND HYDRAULIC MACHINERY**

**Objectives:** This course gives an introduction to the fundamentals of fluid flow and its behavior so as to equip the students to learn related subjects and its application in the day to day life in a very effective manner

**UNIT- I:**

**Introduction:** Dimensions and units – physical properties of fluids, specific gravity, viscosity, surface tension and capillarity, vapor pressure and their influences on fluid motion. Newtonian and non Newtonian fluids. Fluid Pressure at a Point; Pascal's law, Hydrostatic law, Atmospheric, Absolute and gauge pressure; Hydrostatic paradox, Pressure measurement manometers; Simple, differential and Micro Manometers

**Kinematics of Fluid Motion:** Methods of describing fluid motion; Classification of flow; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; Three, two and one dimensional flows; Irrotational and rotational flows; Streamline; Pathline; Streakline; Equation for acceleration; Convective acceleration; Local acceleration; Continuity equation; Velocity potential and stream function.

**UNIT – II:**

**Dynamics of Fluid Flow:** Forces acting on a Fluid in Motion; Euler's equation of motion; Bernoulli's equation ; Energy correction factor; Momentum principle; Force exerted on a pipe bend. Discharge through Venturi Meter; Discharge through Orifice Meter; Discharge through flow nozzle; Measurement of velocity by Pitot tube,pitot-static tube.

**Closed Conduct Flow:** Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length; Hydraulic power transmission through a pipe; Siphon; Pipes in series, parallel & branched pipes.

**UNIT – III:**

**Basics of Turbo Machinery:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle, Torque and head transferred in roto dynamic machines.

**Hydraulic Turbines-I:** Introduction, head and efficiencies of hydraulic turbines, Classification of turbines; pelton wheel: parts, Velocity triangles, work done and efficiency, working proportions, design of pelton wheel. Radial flow reaction turbines: velocity triangles and work done for inward radial flow turbine, degree of reaction, discharge, speed ratio, flow ratio.

**UNIT – IV:**

**Hydraulic Turbines-II:** Francis turbine: main components and working, work done and efficiencies, design proportions; design of francis turbine runner. Kaplan turbine: main components and working, working proportions. Draft tube: theory and efficiency; specific speed, unit quantities, characteristic curves of hydraulic turbines. Cavitation: causes, effects.

**Centrifugal Pumps:** Introduction, component parts and working of a centrifugal pump, work done by the impeller; heads, losses and efficiencies; minimum starting speed; Priming ;specific speed; limitation of suction lift, net positive suction head(NPSH);Performance and characteristic curves; Cavitation effects ;Multistage centrifugal pumps; troubles and remedies.

**Text Books:**

1. Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi
2. Fluid Mechanics & Hydraulic Machines by Dr. R. K. Bansal; Laxmi Publications, New Delhi.

**Reference Books:**

1. Hydraulic Machines by Jagdish Lal, Metropolitan.
2. A. K. Jain; Fluid Mechanics, Khanna Publishers, Delhi
3. Rajput, Fluid mechanics and fluid machines, S.Chand &Co.
4. D.S. Kumar Kataria, Fluid Mechanics & Fluid Power Engineering ,Publishers: D.S. Kumar Kataria&Sons.
5. K R Arora, Fluid Mechanics, Hydraulics and Hydraulic Machines ,Standard Publishers
6. Kumar K.L., Engineering Fluid Mechanics , Eurasia Publishing House (P) Ltd., New Delhi

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**(13ME303) THERMODYNAMICS**

**Objectives:** By this subject students will get the awareness on basic thermodynamic principles, skills to perform the analysis and design of thermodynamic systems, First law and second law of thermodynamics and its applications to a wide variety of systems, principles of psychrometry and properties of pure substances. And also understand the concept of various air standard cycles with the help of P-V and T-S Diagrams.

**UNIT – I:**

**Basic Concepts:** Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

**Work & Heat Transfer:** Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

**First Law of Thermodynamics:** First Law applied to a process and a cycle, Energy - a Property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

**UNIT-II:**

**Flow Systems:** Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

**Second Law of Thermodynamics:** Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II

**Entropy:** Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of dead state, Availability.

**UNIT-III:**

**Pure Substances:** P-V, P-T, T-S diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties

**Thermodynamic Relations:** Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius-clapeyron equation.

**UNIT-IV:**

**Properties of Gases and Gas Mixtures:** Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases-Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

**Gas Power Cycles:** Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

**Text Books:**

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition, 2013.

**Reference Books:**

1. Engineering Thermodynamics by P. Chattopadhyam, Oxford,1st Revised ,2011.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wlyen, John Wiley & sons (ASIA) Pte Ltd, 7th Edition, 2009.
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH,7th Edition 2011.
4. Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.
5. An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,
6. Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.

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**(13ME304) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

**Objectives:** Because of dependency on electricity in day to day life, a reasonable understanding of the basics of applied electricity is important for every Engineer. The course content enables students to understand the fundamentals of electricity and magnetism, and get a comprehensive idea about circuit analysis and working principles of electrical machines.

**UNIT-I:**

**DC Machines:**

**DC Generator:**

Principle of operation of dc generator, Types of DC generators, EMF equation of a dc generator ,OCC of a DC Shunt Generator(Simple problems ).

**DC Motor:**

Principle of operation of DC motor, Types of DC Motors, back emf, Torque equation, losses & efficiency calculation, Swinburne's test

**UNIT-II:**

**A.C Machines:**

**Transformers** : Principles of operation, Constructional Details, Ideal Transformer and Practical Transformer, EMF equation, Losses, Transformer tests (OC and SC), efficiency and regulation calculations (simple problems)

**Three phase induction motor:**

Construction and principle of operation, slip and rotor frequency, Slip-torque Characteristics(Simple Problems).

**UNIT-III:**

**Semiconductor Devices:** Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction – Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

**UNIT-IV:**

**BJT And FET:** Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between IC, IB and IE. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. Junction Field Effect Transistor (JFET)- Theory and Operation of JFET.

**Digital Electronics:** Number Systems-Decimal System, Binary System, Octal System, Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates- NAND, NOR Gates. Boolean algebra and De Morgan's Theorems, Combinational Circuits-Adders and Subtractors

Semiconductor Memories: Introduction, Memory Organization and Operation, Classification and Characteristics Of Memories.

**Text Books:**

1. T K Nagasarkar, and M.S. Sukhija, Basic Electrical Engineering, Oxford University Press. Second Edition 2007
2. M.S.Naidu and S. Kamakshiah, Basic Electrical Engineering. TMH.3<sup>rd</sup> Edition 2009
3. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.
4. Modern Digital Electronics, RP Jain, Tata MC Graw-Hill, 2010

**Reference Books:**

1. D P Kothari and I.J. Nagrath, Theory and solutions of Basic Electrical Engineering. PHI.2010
2. B.L Theraja&A.K.Theraja, "A Text Book of Electrical Technology", 23rd Revised Edition, S.Chand & Company Ltd., New Delhi, 2005.
3. H Cotton, "Advanced Electrical Technology", AH Wheeler & Co., 1990. Eugene C Lister, "Electric Circuits and Machines", New York, McGraw-Hill, 1975.
4. V N Mittle & I Arvind Mittal, "Basic Electrical Technology", TMH 2nd edition, 2006. JB Gupta, "A Course in Electrical Technology", S K Kataria& Sons, 2003

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**II B.Tech I Semester (ME)**

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**(13ME305) MACHINE DRAWING**

**Objectives:** To make the students to understand the concepts of I.S. conventions, methods of dimensioning, 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

**UNIT – I:**

**Machine Drawing Conventions:** Need for drawing conventions- introduction to IS conventions. Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, Centers curved and tapered features. Title boxes, their size, location and details-common abbreviations & their liberal usage

**UNIT – II:**

**Drawing of Machine Elements and simple parts:** Selection of Views, additional views for the Following machine elements and parts with drawing proportions: Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint.

**UNIT – III:**

Riveted joints for plates flanged &protected flanged joint. Shaft coupling, spigot and socket pipe joint. Journal and foot step bearings.

**UNIT – IV:**

**Assembly Drawings:** Drawings of assembled views for the part drawings of the following. Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly. Other machine parts- Screw jack, Machine Vice, single tool post.

**Valves:** Steam stop valve, feed check valve. Non return valve.

**Text Books:**

1. Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.
2. Machine Drawing- Dhawan, S.Chand Publications, 1<sup>st</sup> Revised Edition, 1998.

**Reference Books:**

1. *Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012.*
2. *Machine Drawing- Luzzader, PHI Publishers, 11th Edition.*
3. *Machine Drawing – Raj put, S. Chand Pub.*
4. *Textbook of Machine Drawing-K.C.Johns, 2009, PHI learning, 1st Edition.*

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**II B.Tech I Semester (ME)**

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**(13ME306) MECHANICS OF SOLIDS LAB**

**Objectives:** The experimental work involved in this laboratory should make the student understand the fundamental modes of loading of the structures and also make measurements of loads, displacements and strains. Relating these quantities, the student should be able to obtain the strength of material and stiffness properties of structural elements.

**List of Exercises / Tests:**

1. Tension test.
2. Bending test on simple support beam.
3. Bending test on continuous beam.
4. Torsion test.
5. Hardness test.
6. Spring test.
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges.
12. Continuous beam – deflection test.

**List of Major Equipment:**

1. UTM for conducting tension test on rods
2. Steel beam for flexure test.
3. Wooden beam for flexure test.
4. Torsion testing machine
5. Brinnel's/ Rocks hardness testing machine.
7. Compression testing machine
8. Izod Impact machine
9. Shear testing machine
10. Beam setup for Maxwell's theorem verification.
11. Continuous beam setup.
12. Electrical Resistance gauges.

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**(13ME307) FLUID MECHANICS AND HYDRAULIC MACHINERY LAB**

**Objective:** The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices, turbines and pumps.

**List of Experiments:**

1. Venturimeter : Determination of Coefficient of discharge.
2. Orificemeter : Determination of Coefficient of discharge.
3. Determination of friction factor of Pipes.
4. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion.
5. Verification of Bernoulli's equation.
6. Impact of jet on vanes.
7. Performance test on Pelton wheel turbine.
8. Performance test on Francis turbine.
9. Performance test on kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

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**(13ME308) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

**Objectives:** To understand the concepts of electric circuits and the performance characteristics of machines. This laboratory course will give a thorough knowledge about the basics of circuit analysis, DC machines and transformers.

**List of Experiments:**

**PART -A: ELECTRICAL LAB**

1. Verification of Superposition theorem
2. Verification of Thevenin's and Norton's Equivalent circuits and Verification by direct Test
3. Magnetization characteristics of DC Shunt Generator. Determination of critical Resistance.
4. Swinburne's Test on DC Shunt machine(Predetermination of efficiency of a given DC shunt machine working as motor and generator)
5. Brake Test on DC Shunt Motor. Determination of performance characteristics
6. OC and SC Test on single phase Transformer(Predetermination of efficiency and regulation at given power factors and determination of Equivalent circuit)

**PART -B: ELECTRONICS LAB**

1. Identification, Specifications and Testing of R, L, C components (colour codes), Potentiometers, Switches (SPDT, DPDT and DIP), Coils, Gang Condensers, Relays, Bread Boards, Identification and Specifications of active devices, Diodes, BJTs, Lowpower JFETs, MOSFETs, LEDs, LCDs, SCR, UJT, Linear and Digital Ics.
2. PN Junction Diode Characteristics (Forward bias, Reverse bias).
3. Zener Diode Characteristics and Zener as regulator.
4. Transistor CE Characteristics (Input and Output).
5. Rectifier with and without Filters (Full wave )
6. Characteristics of SCR

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**(13HS117) MATHEMATICS-III**

**Objectives:** The Subject is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.

**UNIT – I:**

**Probability:**

Sample space and events – The axioms of Probability – Some elementary theorems - Conditional probability – Baye's theorem

**UNIT – II:**

**Random Variables and Probability Distributions:**

Discrete and Continuous distributions – Distribution functions – Binomial, Poisson, and Normal distributions.

Population and samples - Sampling distribution of mean (with known and unknown variance), proportion, variances – Special Distributions: Student t - Distribution

**Unit – III**

**Statistics:**

Mean , Median , Mode and other measures of Central tendency – Dispersion or variation – The Range – The Mean Deviation – The Semi – interquartile Range - The 10 – 90 Percentile Range – The Standard Deviation – The Variance – Short Methods for computing the Standard Deviation – Properties of Standard Deviation – Moments – Skewness and Kurtosis

**UNIT- IV:**

**Partial Differential Equations:**

Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions - Method of Separation of variables, Solutions of Wave equation, Heat equation and two dimensional Laplace equation under initial and boundary conditions (both Cartesian and Polar forms)

**Text Books:**

1. B.S.Grewal, Higher Engineering Mathematics, 42 Edition (2012), Khanna publishers.

**Reference Books:**

1. TKV Iyengar et al, Probability and Statistics, S.Chand Publications.
2. E. Rukmangadachari & E. Keshava Reddy, Engineering Mathematics, Volume - II, 1st Edition (2010) Pearson Publisher.
3. Erwin Kreyszig, Advanced Engineering, Mathematics, 10th Edition (2013), Wiley India.

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**II B.Tech II Semester (ME)**

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**(13HS118) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**Objectives:** To explain the basic principles of managerial economics, accounting and current business Environment underlying business decision making

**UNIT- I:**

**Introduction to Managerial Economics:** Definition, Nature and Scope of Managerial Economics– Demand Analysis: Determinants, Law of Demand and its exceptions.

**Elasticity of Demand:** Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, methods, (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

**UNIT- II:**

**Theory of Production:** Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

**Cost Analysis:** Cost concepts, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs.

**Break-Even Analysis:** (BEA)-Determination of Break-Even Point (simple problems)

**Market:** Types of competition, Price-Output Determination in case of Perfect Competition and Monopoly, Monopolistic competition.

**Methods of Pricing:** Cost, competition, strategy based pricing

**UNIT -III:**

**Business Types:** Business, features, Sole Proprietorships, Partnerships, Joint Stock Companies, Public Enterprises and their types.

**Capital and Capital Budgeting:** Capital and its significance, Types and sources of raising finance. Nature and scope of Capital Budgeting, Features, Methods: Payback Method, Accounting Rate of Return Method (ARR) and Net Present Value Method (simple problems)

**UNIT- IV:**

**Financial Accounting:** Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts. (Simple Problems)

**Financial Analysis through Ratios:** Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS), (Simple Problems).

**Text Books:**

1. Aryasri: “**Managerial Economics and Financial Analysis**”, TMH, 2<sup>nd</sup> edition, 2005.
2. SA Siddiqui and AS Siddiqui “**Managerial Economics and Financial Analysis**”, New age international publishers.
3. Varshney & Maheswari: “**Managerial Economics**”, Sultan Chand, 2003.

**Reference Books:**

1. Raghunatha Reddy & Narasimhachary: **“Managerial Economics& Financial Analysis”**, Scitech,2009
2. V. Rajasekaran & R. Lalitha, **” Financial Accounting”**, Pearson Education, New Delhi,2010.
3. Suma Damodaran, **“Managerial Economics”**, Oxford University Press.
4. Domnick Salvatore: **“Managerial Economics In a Global Economy”**, Thomson, 4th Edition.
5. Subash Sharma & M.P. Vittal, **“Financial Accounting for management”, Text & Cases**, Machmillan 2008
6. S.N.Maheswari & S.K. Maheswari, **” Financial Accounting”**, Vikas,2008
7. Truet and Truet: **“Managerial Economics:Analysis”, Problems and Cases**, Wiley,2009
8. Dwivedi:**”Managerial Economics”**, Vikas, 6th Edition,2009

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**(13ME401) THERMAL ENGINEERING-I**

**Objectives:** The objective of this subject is to impart the knowledge of engine components, working principles of IC engines, auxiliary systems, and the combustion aspects of SI and CI engines in addition to the methods of improving performance. The students shall become aware on the latest developments in the field of IC engines like MPFI, CRDI etc. and also shall become familiar about the working of Reciprocating and Rotary Compressors. The student also shall apply the thermodynamic concepts in IC engines and compressors.

**UNIT- I**

**I.C. Engines:** Definition of Engine and Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

**Fuel System:** Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Fuel Injection Systems. Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication.

**UNIT- II**

**Ignition System:** Function of an Ignition System, Types of Ignition Systems, Battery coil Ignition System, Magneto Coil Ignition System

**Combustion in IC Engines (SI and CI Engines):** Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

**UNIT- III**

**Testing and Performance:** Parameters of Performance - 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- Sankey diagram and pie diagram.

**UNIT- IV**

**Air Compressors:** Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors – Principle of rotary compressors.

**Text Books:**

1. Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012
2. Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013

**Reference Books:**

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010
2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009
3. Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010
4. Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002
5. I.C. Engines fundamentals, Heywood, McGrawHILL, 1st Edition,2011
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012

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<b>3</b>	<b>1</b>	<b>0</b>	<b>[3]</b>

**(13ME402) KINEMATICS OF MACHINERY**

**Objectives:** The objective of this subject is to cover the kinematics and dynamics of planar single degree of freedom mechanisms. 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 fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain. Mobility of mechanisms. Straight Line Motion. Mechanisms- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

**UNIT – II:**

**Belt, Rope and Chain Drives :** Introduction, Belt and rope drives, selection of belt drive- types of belt drives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains-length, angular speed ratio, classification of chains.

**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 involutes. 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.

**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 velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, and determination of Coriolis component of acceleration.Kleins construction. Analysis of 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 centers in-line theorem.

**UNIT – IV:**

**Gear Trains:** Introduction –Types of gears – Simple, compound, reverted and Epicycle gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicycle gear trains. Torque in epicycle gear trains. Differential gear of an automobile.

**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.

**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.

**Reference Books:**

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.*

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**(13ME403) MANUFACTURING TECHNOLOGY**

**Objectives:** By this subject the students will understand how manufacturers use technology to change raw materials into finished products, the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications.

**UNIT-I:**

**Casting:** Definition, elements, Steps involved in making a casting— Types of patterns – Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Design of core prints, buoyancy principle. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

**UNIT-II:**

**Special Casting Processes:** Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting. Risers – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks

**Methods of Melting:** Crucible melting and cupola operation, steel making processes. Casting inspection and defects.

**UNIT-III:**

**Introduction to Welding:** Classification of welding processes, types of welds and welded joints and their Characteristics, Heat affected zones in welding, Design of welded joints, Arc Welding- (Shielded metal arc welding, submerged arc welding, TIG welding, MIG welding, Stud welding, Electro slag welding), Simple problems related to Arc Welding

**UNIT-IV:**

**Gas Welding:** Induction Welding, Explosive Welding, Forge welding, Résistance Welding, Ultra sonic welding, Friction Welding, Thermit welding and Plasma (Air and water) welding, Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, nonferrous metals, Electron Beam Welding, Laser Beam Welding, Soldering & Brazing and adhesive bonding.

**Mechanics:** Process parameters, Simple problems related to Gas Welding and Resistance Welding. Welding defects – causes and remedies – destructive and nondestructive testing of welds.

**Text Books:**

1. Manufacturing Technology, Vol. I P.N. Rao, Tata Mc Graw Hill, 4th Edition, 2013
2. Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition, 2002

**Reference books:**

1. *Production Technology*, K.L Narayana, I.K. International Pub, 3rd Edition , 2013
2. *Manufacturing Process Vol. I*, H.S.Shah Pearson, 2013,
3. *Principles of Metal Castings*, Rosenthal, Tata Mc Graw Hill, 2nd Edition,2001
4. *Welding Process*, Par mar.
5. *Manufacturing Technology*, R.K. Rajput, Laxmi Pub, 1st Edition, 2007
6. Workshop Technology – B.S.RaghuVamshi – Vol I.

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<b>3</b>	<b>0</b>	<b>0</b>	<b>[3]</b>

**(13ME404) MATERIAL SCIENCE AND METALLURGY**

**Objectives:** To make the student to understand the basic fundamental of material science and physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

**UNIT-I:**

**Structure of Metals:** Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

**Constitution of Alloys:** Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

**Equilibrium of Diagrams :** Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe<sub>3</sub>C.

**UNIT-II:**

**Cast Irons and Steels:** Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

**Non-ferrous Metals and Alloys:** Structure and properties of copper and its alloys, Aluminum and its Alloys, Titanium and its alloys.

**UNIT-III:**

**Heat treatment of Alloys:** Effect of alloying elements on Fe-Fe<sub>3</sub>C system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Harden ability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

**UNIT-IV:**

**Ceramic Materials:** Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials – definition, properties and applications of the above.

**Composite Materials:** Classification of composites, various types of metal matrix composites. Particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites. Polymer Composites.

**Text Books:**

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.

**Reference Books:**

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and engineering / William and collister.
4. Elements of Material science / V. Rahghavan
5. An introduction to material science / W.g.vinas & HL Mancini
6. Material science & material / C.D.Yesudian & Harris Samuel
7. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
8. Engineering materials and metallurgy/R.K.Rajput/ S.Chand.

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**(13ME406) THERMAL ENGINEERING LAB-I**

**Objectives:** To impart practical exposure to the students on the performance evaluation methods of various types of internal combustion engines and compressors.

**List of Experiments:**

1. Determination of Viscosity – Saybolt Viscometer
2. Calorific value determination by Bomb Calorimeter
3. Calorific value determination by Junker's gas calorimeter.
4. Cloud point and Pour point Apparatus
5. Valve Timing Diagram of Four Stroke CI Engine
6. Port Timing Diagram of Two Stroke SI Engine
7. I.C. Engines Performance Test (4 -Stroke Diesel Engines)
8. To find the Engine Performance Characteristics by applying different loads on 2-Stroke SI Engine
9. Study of Boilers
10. I.C. Engines Air/Fuel Ratio and Volumetric Efficiency

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**(13ME407) PRODUCTION TECHNOLOGY LAB**

**Objectives:** The Engineering Workshop for engineers is a training lab course. It imparts the required knowledge about producing the Products particular joining methods, manufacturing methods among the students through which they will get an idea about shop floor level, a manufacturing section in industry.

**1: Trades for Exercises:**

**(a) Pattern Design and Making**

1. Single Piece Pattern
2. Split Piece Pattern

**(b) Sand Properties Testing**

1. Sieve Analysis
2. Permeability and strength tests

**(c) Gas Welding**

1. TIG Welding
2. Spot Welding

**(d) Plastic Moulding:**

1. Injection Moulding
2. Blow Moulding

**(e) Press Working Operations**

1. Blanking
2. Cup drawing

**Reference Books:**

1. Engineering Work shop practice, V. Ramesh Babu, VRB Publishers Private Limited, 2009
2. Work shop Manual, P.Kannaiah and K.L.Narayana, SciTech Publishers, 2009
3. Workshop Practice Manual, K. Venkata Reddy, BS Publications,

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**(13ME408) METALLURGY LAB**

**Objectives:** The experimental work involved in this laboratory will make the student to understand the fundamental concepts and possess knowledge on the evaluation of material properties.

**List of Exercises:**

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. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

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**(13ME409) TECHNICAL SEMINAR-I**

**Objectives:** To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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**(13HS121) QUALITATIVE AND QUANTITATIVE ANALYSIS**

**Objectives:** To determine and measure the one's ability thorough advanced training, some specific set of skills (intellectual, motor and so on), the subject assumes that professional potential and special abilities developed.

**UNIT – I:**

**Simple Arithmetic** -Number - H.C.F. & L.C.M. of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root – Average – Problems on Numbers – Problems on Ages – Percentage – Profit & Loss – Ratio & Proportion-Partnership – Chain Rule – Time & Work – Pipes & Cisterns – Time & Distance – Problems on Trains – Boats & Streams – Allegation or Mixture – Simple Interest – Compound Interest – Area Volume & Surface Areas – Volume & Surface Areas – Calendar – Clocks – Races & Games of Skill – Number Series – Tabulation – Pi –Chart – Bar Diagram – Line Graphs.

**UNIT– II:**

**Reasoning (Verbal and Non-Verbal)** -Series Completion – Analogy – Coding-Decoding – Classification – Blood Relations – Puzzle test – Sequential output tracing - Direction Sense test – Logical Venn diagrams – Alphabet test – Alpha-Numeric Sequence puzzle – Number, Ranking and time sequence test – Mathematical operations – Logical sequence of words – Arithmetical reasoning – Insert the missing character – Data sufficiency – Eligibility test – Assertion and reason – Situation reaction test – Verification of Truth of the Statement - –Cubes and dice.

**UNIT – III:**

**Logical deductions, Non verbal reasoning**

Logic – Statement-Arguments – Statement-Assumptions – Statement-Course of action – Statement- Conclusions – Deriving conclusion from passages – Theme deduction – Cause and effect reasoning

**UNIT – IV:**

**Reading Comprehension-** Purpose of reading, reading rates, improving comprehension skills, techniques for good comprehension, skimming, scanning, determining the meaning of words, different styles of worked out problems.

**Text Books:**

1. RS Agarwal , A textbook on Quantitative Aptitude.
2. RS Agarwal, A textbook on verbal and nonverbal reasoning .
3. Meenakshi Raman and Sangeeth Sarma, Technical Communication.

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**(13ME501) THERMAL ENGINEERING -II**

**Objectives:** The objective of this subject is to impart the knowledge of engine components, working principles of boilers, steam nozzles. The students shall become aware on the latest developments in the field of steam turbines; gas turbines etc. and also shall become familiar about the working of jet propulsions and rocket.

**UNIT-I**

**Basic Concepts:** Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating. Combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, and Flue gas analysis.

**Boilers :** Classification – Working principles – with sketches including H.P.Boilers – Mountings and accessories – Working principles, Boiler horse power, equivalent evaporation, efficiency and heat balance – Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

**UNIT-II**

**Steam Nozzles :** Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

**Condensers:** Classifications, air leakage, vacuum efficiency, condenser efficiency and problems.

**UNIT-III**

**Impulse Turbine:** Mechanical Details – Velocity Diagram – Effect of friction – Power developed Axial Thrust blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine- its features. Methods to reduce Rotor Speed – Velocity Compounding and Pressure Compounding, Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded Impulse Turbine

**Reaction Turbine** Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.

**UNIT-IV**

**Gas Turbines :** Simple gas turbine plant – Ideal cycle, essential components – parameters of performance- actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

**Jet Propulsion:** Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

**Text Books:**

1. Thermal Engineering / R.K. Rajput / Lakshmi Publications
2. Gas Turbines – V.Ganesan /TMH

**Reference Books:**

1. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot
2. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
4. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
5. Thermal Engineering-P.L.Ballaney/ Khanna publishers.
6. Thermal Engineering-M.L.Marthur & Mehta/Jain bros.

**Web References:** NPTEL

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**(13ME502) DYNAMICS OF MACHINERY**

**Objectives:** The objective of this subject is to cover the dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the dynamics analysis of machine elements including clutches, brakes and governors and also becomes familiar with balancing of reciprocating masses and vibrations.

**UNIT-I**

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

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

**UNIT-II**

**Clutches:** Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

**Brakes and Dynamometers:** Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of Operation.

**Turning Moment Diagram and Fly Wheels:** Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design.

**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.

**Balancing:** Balancing of rotating masses - single and multiple – single and different planes.

**UNIT-IV**

**Balancing of Reciprocating Masses:** Primary, Secondary and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V, multi cylinder, in -line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow, Swaying couple, variation of tractive force.

**Vibrations:** Free Vibration of mass attached to vertical spring – oscillation of pendulums, centers of oscillation and suspension. Transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Whirling of shafts, critical speeds, and torsional vibrations, two and three rotor systems. Simple problems on forced, damped vibration, Vibration Isolation & Transmissibility.

**Text Books:**

1. Theory of Machines / S.S Ratan/ Mc. Graw Hill Publ.
2. Theory of machines / Khurmi/S.Chand.

**Reference Books:**

1. Mechanism and Machine Theory / JS Rao and RVDukkipati / New Age
2. Dynamics of Machinery/Balleney/Dhanpat Rai
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of Machines / Jagadish Lal & J.M.Shah /Metropolitan.

**Web References:** NPTEL

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**(13ME503) MACHINE TOOLS**

**Objectives:** The objective of this subject is to make the student to understand the elementary treatment of metal cutting theory, principle and working of engine lathe, shaping, slotting and drilling, boring machines. Further the student shall be able to understand the principles of working of milling, grinding, honing machines and the design of jigs and fixtures.

**UNIT- I**

**Introduction to Metal Cutting Theory:** Elements of cutting process – Geometry of single point tool and angles chip formation and types of chips, its effects, chip breakers. Mechanics of Orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, economics- machinability, Tool materials, coolants.

Engine lathe – Principle of working, specification of lathe – types of lathes – work holders, tool holders – Box Tools, Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

**UNIT- II**

**Shaping, Slotting and planning machines** – their Principles of working – Principal parts – specification, classification, Operations performed. Kinematic scheme of the shaping slotting and planning machines, machining time calculations.

**Drilling and Boring Machines** – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

**UNIT-III**

**Milling machine** – Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

**Grinding machine** –Theory of grinding – classification of grinding machine – cylindrical and Surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel

**UNIT-IV**

**Lapping, Honing and Broaching Machines:** Constructional features, Machining time calculations and Applications.

**Design of Jigs and fixtures:** Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and Fixtures.

**Text Books:**

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.Raghu Vamshi – Vol II

**Reference Books:**

1. Machine Tools – C.Elanchezhian and M. Vijayan / Anuradha Agencies Publishers.
2. Manufacturing Technology-Kalpakzian- Pearson.
3. Production Technology by H.M.T. (Hindustan Machine Tools).

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**(13ME504) DESIGN OF MACHINE ELEMENTS-I**

**Objectives:** To make the students to understand the design consideration and stresses in machine members and the strength of machine elements. To understand the design of bolted joints, cotter joints and knuckle joints, shafts, keys and couplings.

**UNIT - I**

**Introduction:** General considerations of design, design process. Selection of Engineering Materials - properties – Manufacturing considerations in the design. BIS codes of materials. Preferred numbers.

**Stresses in Machine Members:** Simple stresses – Combined stresses – Torsional and bending Stresses – Impact stresses – stress -strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity. Concept of stiffness in tension, bending, torsion and Combined cases.

**UNIT - II**

**Strength of Machine Elements:** Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line.

**Riveted Joints:** Types of riveted joints, design of riveted joints. Boiler shell riveting, eccentric loading.

**UNIT -III**

**Bolted Joints** – Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses – Design of joints under eccentric loading– Bolts of uniform strength.

**Cotter and Knuckle Joints:** Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

**UNIT - IV**

**Shafts:** Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.

**Keys and Couplings:** Design of Rigid couplings: Muff, Split muff and Flange couplings Flexible couplings.

**Text Books:**

1. Machine design / Schaum's Series.
2. Machine design – Pandya & shah.

**Reference Books:**

1. Machine design- J.E.Shigley
2. Machine design- R S Khurmi and J K Gupta
3. Design of Machine Elements - M.F.Spotts-PHI
4. Machine Design - Kannaiah/ SciTech.

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**(13ME505) PRODUCTION DRAWING**

**Objectives:** To make the students to understand the conventional representation of parts, limits and fits tolerances to draw the machine elements and simple parts. To make the students to understand and draw part drawing of machine parts and to draw their sectional views.

**UNIT -I**

**Conventional representation of Materials** – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

**Limits and Fits:** Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

**UNIT-II**

**Form and Positional Tolerances:** Introduction and indication of the tolerances of form and position on drawings, deformation of run out and total run out and their indication.

**Surface roughness and its indication:** Definitions – finishes obtainable from various manufacturing Processes, recommended surface roughness on mechanical components.

**UNIT -III**

Heat treatment and surface treatment symbols used on drawings

**UNIT - IV**

**Detailed and Part drawings:** Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

Part drawing using computer aided drafting by CAD software

**Text Books:**

1. Production and Drawing – K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD- Pohit and Gosh, PE

**Reference Books:**

1. Geometric dimensioning and tolerancing- James D. Meadows/ B.S Publications
2. Engineering Metrology, R.K. Jain, Khanna Publications

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**(13ME506) INDUSTRIAL ENGINEERING AND MANAGEMENT**

**Objectives:** To make students learn the basic concepts of management and organisation and designing organizational structures. To provide understanding of plant location and work study, material management. To introduce the materials management, PERT/CPM .To impart the knowledge of inspection and quality control techniques.

**UNIT - I**

**Introduction to Management:** Definition, Levels of Management, Functions of Management, Role and Importance of Management, Types of Management, Social responsibility of Management – Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy Of Human Needs – Systems Approach to Management.

**UNIT - II**

**Organizational Structures:** Basic concepts related to Organisation - Departmentation and Decentralization, Types of mechanistic and organic structures of organisation (Line organization, Line and staff Organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat Organization structure) and their merits, demerits and suitability.

**UNIT- III**

**Plant Location and Plant Layout::** Types of production, Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for Selection of plant. Plant Layout – definition, objectives, types of plant Layout – Principles of material handling.

Function of Production Planning and Control: Phases, Forecasting, Planning, Scheduling, Controlling, Follow up and expediting.

**Project Management:** Introduction to PERT / CPM, GANTT charts, Uses of Network analysis, Rules for Network Construction, Difference between PERT and CPM, Determination of Critical Path-probability of completing the Project, critical path calculation, Types of floats, introduction to crashing.

**UNIT- IV**

**Introduction to Human Resource Management:** Functions of HRM, Job Evaluation, different types of evaluation Methods. Job description, Merit Rating, Performance Appraisal, Wage and Salary Administration, Introduction to Factory Act and Workman Compensation Act.

**Marketing Management:** Selling, Marketing, Marketing Functions, Centralization and Decentralization, marketing strategies, distribution channels.

**Text Books:**

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.
3. Management Science – A.R.Aryasri, TMH.

**Reference Books:**

1. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2005.
2. Panner Selvam, *Production and Operations Management*, PHI, 2004.
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, *Reliability Engineering & Quality Engineering*, Galgotia Publications, Pvt., Limited.
4. Ralph M Barnes, *Motion and Time Studies*, John Wiley and Sons, 2004.
5. Chase, Jacobs, Aquilano, *Operations Management*, TMH 10th Edition, 2003.
6. L.S.Srinath, *PERT / CPM* affiliate East-West Press, New Delhi, 2000.
7. Gary Dessler, *Human Resource Management*, Pearson Education Asia, 2002.
8. Phillip Kotler, *Marketing Management*, Pearson, 2004.
9. A.R.Aryasri, *Management Science for JNTU (B.Tech)*, Tata McGraw-Hill, 2002.

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**(13ME507) THERMAL ENGINEERING LAB-II**

**Objectives:** To impart practical exposure to the students on the performance evaluation of reciprocating air compressor and determination of COP of a refrigeration system.

**List of Experiments:**

1. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol Engine
2. Conduct retardation test on 4- stroke diesel engine
3. Conduct Heat Balance sheet on 4-stroke diesel engine
4. Performance Test on Variable Compression Ratio Engines, economical speed test.
5. Dis-assembly / Assembly of Engines.
6. Performance Test on Reciprocating Air – Compressor Unit.
7. Performance test on single/two stage reciprocating air compressor.
8. Study of Steam Generators and Turbines.
9. Conduct motoring test on 4-stroke diesel Engine.
10. Measurement of exhaust gas emissions by using gas analyzer.

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**(13ME508) MACHINE TOOLS LAB**

**Objectives:** To impart knowledge of different machine tools used in machine shop such as Lathe, Drilling Machine, Milling Machine, Shaper, Planing Machine, Slotting Machine, Cylindrical Grinder, Surface Grinder

**List of Experiments:**

1. Introduction of General Purpose Machines -Lathe, Drilling Machine, Milling Machine, Shaper, Planing Machine, Slotting Machine, Cylindrical Grinder, Surface Grinder and Tool and Cutter Grinder.
2. Step Turning on Lathe Machine
3. Taper Turning on Lathe Machine
4. Thread Cutting and Knurling on -Lathe Machine.
5. Drilling and Tapping
6. Shaping
7. Planing
8. Slotting
9. Boring
10. Milling
- 11 Cylindrical Surface Grinding
12. Grinding of Tool Angles.

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**(13HS122) SOFT SKILLS LAB**

**Objectives:** Keeping in mind the previous exposure of the student to English, this lab focuses on improving the student's efficiency in English at all levels. The lab intends to train students to use language effectively, to participate in group discussions, to help them face interviews, and sharpen public speaking skills and enhance the confidence of the student by exposing him/ her to various situations and contexts which he/ she would face in his/ her career.

- Activity– 1:** Reading Comprehension
- Activity– 2:** Listening Comprehension
- Activity– 3:** Technical Report Writing
- Activity– 4:** Resume Writing
- Activity– 5:** Group Discussion
- Activity– 6:** Situation Dialogues
- Activity– 7:** Interview Skills
- Activity– 8:** Technical Presentation

**Reference Books:**

1. Dr.Alex, "Soft Skills" – Know yourself & Know the world.
2. Huckin and Olsen, Technical Writing and professional communication, Tata Mc Graw-Hill 2009.
3. Scott Morgan and Barrett Whitener, Speaking about Science, A Manual for Creating Clear Presentations ,Cambridge University press, 2006
4. Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press 2009.
5. M. Ashraf Rizvi, Resume's and Interviews, Tata Mc Graw-Hill, 2008
6. KK Ramachandran and KK Karthick, Form Campus To corporate, Macmillan Publishers, India Ltd, 2010
7. Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, English Language Communication: A Reader cum Lab Manual, Anuradha Publications, Chennai 2008.
8. K R Lakshminarayan and T. Muruguvel , Managing Soft Skills, Sci-Tech Publication, 2010
9. John X Wang, Business Communication, CRC Press, Special Indian Edition, 2008.

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**(13ME601) PRODUCTION AND OPERATIONS MANAGEMENT**

**Objective:** The Objective of the course is to enable students to understand the production Planning and Controlling aspects of a typical production and operations organization. To understand the concepts of work study and Quality management.

**UNIT -I:**

**Introduction to Production Management:** Production, Productivity, Methods of production, Production process, Types of Process charts, Productivity Engineering and Management, Total productivity model, Product & Process Development.

**UNIT-II**

**Strategic Management:** Corporate Planning process, Principles of Planning, Types of Plans, Environmental Scanning, Environmental analysis, SWOT Analysis.

**Materials Management**-Objectives, Inventory – functions, types, associated costs, inventory classification Techniques-ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review System. Stores Management and Stores Records. Purchase management.

**UNIT - III**

**Inspection and Quality control:** Types of inspections - Statistical Quality Control-techniques-variables and attributes-assignable and non assignable causes- variable control charts, and R charts, attributes control Charts, p charts and c charts. Acceptance sampling plan- single sampling and double sampling plans.

**UNIT-IV**

**Work study** - Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts-difference between micro motion and macro motion studies. Work measurement- definition, Time study, steps involved-equipment, different methods of performance rating- allowances, standard time Calculation. Work Sampling – definition, steps involved and standard time calculations.

**Text Books:**

1. R.Panneerselvam, "Production and Operations Management" - PHI Learning private Ltd
2. Aswathappa.K - "Production and Operation Management"- Himalaya publishing house, Mumbai

**Reference Books:**

1. Upendra-Kachru, "Production and operations management" –Excel books, New Delhi
2. S N Chary, "Production and Operations Management" - Tata McGraw Hill, New delhi,2008
3. Chase, Aquilano, Jacobs – "Operations management for competitive advantage" - Tata McGraw Hill
4. Elwood S.Buffa and Rakesh k.Sarin, "Modern production/operations management"- Wiley India
5. Mahadevan, "Operations Management" - Pearson, New Delhi.

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**(13ME602) HEAT TRANSFER**

**Objectives:** To make the student to employ the basic knowledge of mechanisms of heat transfer in steady and unsteady flow in thermal system. To analyze the components in a thermal equipment and identify various heat transfer phenomena and develop mathematical models. To provide solutions for altering heat flow in desired manner.

**UNIT- I**

**Introduction:** Modes and mechanisms of heat transfer – Basic laws of heat transfer –General applications of heat transfer.

**Conduction Heat Transfer:** Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – boundary and Initial conditions

**UNIT-II**

**One Dimensional Steady State Heat Conduction:** in Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation-with Variable Thermal conductivity –with internal heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to errors in Temperature measurement.

**One Dimensional Transient Heat Conduction:** in Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Problems on semi-infinite body.

**UNIT-III**

**Convective Heat Transfer:** Dimensional analysis–Buckingham  $\pi$  Theorem and its application for developing semi – empirical non- dimensional correlations for convective heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

**Forced convection: External Flows:** Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer for flow over-Flat plates, Cylinders and spheres.

**Internal Flows:** Division of internal flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of empirical relations for convective heat transfer in Horizontal Pipe Flow, annular flow.

**Free Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation.

**UNIT-IV**

**Heat Transfer with Phase Change: Boiling:** Pool boiling – Regimes, determination of heat transfer coefficient in Nucleate boiling, Critical Heat flux and Film boiling.

**Condensation:** Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders

**Heat Exchangers:** Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

**Radiation Heat Transfer:** Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between gray bodies – radiation shields – electrical analogy for radiation networks.

**Text Books:**

1. Fundamentals of Engg. Heat and Mass Transfer / R.C. Sachdeva / New Age International
2. Fundamentals of Heat and Mass Transfer/M.Thirumaleswar/Pearson Edu.

**Reference Books:**

1. Heat Transfer – P.K.Nag/ TMH
2. Heat Transfer / Holman .J.P/TMH
3. Heat and Mass Transfer –Cengel- McGraw Hill.
4. Heat and Mass Transfer – R.K. Rajput – S.Chand & Company Ltd.
5. Heat and Mass Transfer-Kondandaraman
6. Fundamentals of Heat Transfer - Incropera & Dewitt / John Wiley Pub.
7. Thermal Engineering Data Book /B.S.Reddy and K.H.Reddy Rev.Edition/I.K.International

**Web References:** NPTEL

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**(13ME603) FORMING TECHNOLOGY**

**Objectives:** This subject will enable the students to acquire a fundamental knowledge on metal forming technology which is necessary for an understanding of industrial processes. To introduce students to the wide range of materials and processes, which are currently used in manufacturing industry. This will also provide methods of analysis allowing a mathematical/physical description of forming processes. To enable the students to identify the processes characteristics, select the main operator parameters, the tool geometry and materials, and determine forces and power required to select the main and auxiliary equipment.

**UNIT-I**

**Theory of Metal Forming:** Introduction to cold/hot forming processes: Metallurgical aspects of metal forming –slip-twining mechanics of plastic deformation- effects of temperature, strain rate, microstructure and friction in metal forming, yield criteria and their significance, classification of metal forming processes: slip line field theory.

**UNIT-II**

**Forging and rolling processes:** Forging principle, classification, equipment, tooling-processes, parameters and calculation of forces and power requirements during forging post forging heat treatment - defects (cause and remedy) & application; Principles of rolling processes, classification, types of rolling mills, ring comparison tests calculation of forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, effects of friction. Form rolling, rolling defects, causes and remedies, problems related forging and rolling.

**UNIT-III**

**Extrusion and Drawing Processes:** Classification of extrusion processes-tool, equipment, and principle of these processes, influence on friction-Extrusion force calculation-defects and analysis-rod/wire drawing-tool, equipment and principle of processes defects-Tube drawing and sinking processes-Mannesmann processes of seamless pipe manufacturing, problems related to extrusion and wire drawing operation

**Plastics and Glasses Processing Techniques:** Injection, blow, extrusion, calendaring, thermo forming, roto moulding and drawing.

**UNIT-IV**

**Sheet metal forming processes: Classification** - conventional and HERF processes-presses-types and selection of presses formability of sheet metals- principle, process parameters, equipment and application of the following processes: deep drawing, spinning, stretch forming. Plate bending, spring back, press brake forming, Introduction to forming, electro hydraulic forming, magnetic pulse forming. Introduction to press work – coining, embossing etc., Design of sheet metal dies.

**Powder Metallurgy** :Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, green compaction, sintering process and its effect on the product, application of powder metallurgy products, advantages of powder metallurgy products. Sintering equipment.

**Surface Engineering**: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces.

**Text Books:**

- 1 Serope Kalpakjian, Steven R. Schmid "Manufacturing Engineering and Technology" (4th 19 Editions) Prentice Hall 2000-06-15 ISBN: 0201361310.
- 2 P.N.Rao "Manufacturing Technology", TMH Ltd 1998(Revised edition) .
- 3 Dieter "Mechanical Metallurgy", revised edition 1992, McGraw.

**Reference Books:**

- 1 E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, "Materials and Processes in Manufacturing", Wiley; 9 editions (December 6, 2002) ISBN: 0471033065.
- 2 Lindberg, "Processes and Materials of Manufacture ", Prentice Hall of India (p) Ltd.
- 3 George.E. Dieter, "Engineering design (A materials and processing approach)", McGraw Hill – EditionII 1991.
- 4 William F.Hosford & Robert M.Caddel "Metal forming".
- 5 Amitabha Ghosh and Mallik, "Manufacturing Science", East west press pvt Ltd.
- 6 Narayanaswamy. R, "Metal Working Technology", PHI (1997).
- 7 Nagpal. G.R., "Metal Forming Processes" Khanna publishers, Delhi 1998.
- 8 Sinha and Prasad, "Theory of Metal Forming and Metal Cutting", Dhanpat Rai Publication 1999

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**(13ME604) DESIGN OF MACHINE ELEMENTS-II**

**Objectives:** To impart knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications. To analyze the mechanical properties; and understand, identify and quantify failure modes for mechanical parts. To approach a design problem successfully, taking decisions when there is no unique answer/solution. To provide innovative solutions/improvisation to improve trial designs of complex systems.

**UNIT-I**

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

**Engine Parts:** Pistons, Forces acting on piston – Construction Design and proportions of piston. Cylinder, Cylinder liners,

**UNIT-II**

**Connecting Rod:** Thrust in connecting rod – stress due to whipping action on Connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung cranks.

Design of crane Hooks, C-clamps.

**UNIT-III**

**Power Transmissions Systems:** Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

**Spur & Helical Gears:** Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

**UNIT-IV**

**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-Coaxial springs.

**Design Of Power Screws:** Design of screw, Square ACME, Buttress screws- Efficiency of the screw. Design of nut, compound screw, differential screw, ball screw- possible failures.

**Text Books:**

1. Machine Design /V.B.Bhandari/TMH
2. Machine Design – R.S. Khurmi & J.S.Gupta / S.Chand Pub.

**Reference Books:**

1. Mech. Engg. Design - JE Shigley
2. Data Books: (I) P.S.G. College of Technology (ii) Balaveer Swamy and Mahadevan
3. Machine Design by T.V.Sundaramoorthy & N.Shanmugam
4. Machine Design by Kanniah/ SciTech

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**(13ME605) METROLOGY AND MEASUREMENTS**

**Objective:** To make the students to identify the uncertainties in dimensional Metrology by defining measurement standards and use electronic Instrumentation. To analyze the measurement requirement and choose effective methods of measuring straightness, flatness, roundness and profiles of screw threads and gear teeth and such other metrology practices. To employ knowledge in selecting a suitable instrument/ measurement method for a given application. To recognize the importance of accuracy and precision as a mechanical engineer through self motivation for a defect-free Product by using modern tools

**UNIT- I**

**Systems Of Limits And Fits:** Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – International Standard system for plain and screwed work.

**Linear Measurement:** Length standard, line, ends & 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 -II**

**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.

**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.

**UNIT- III**

**Comparators:** Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

**Screw Thread Measurement:** Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

**Machine Tool Alignment Tests:** Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools. Preparation of acceptance charts.

**UNIT -IV**

**Gear Measurement:** Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

**Coordinate Measuring Machines:** Types of CMM and Applications of CMM.

**Text Books:**

1. Engineering Metrology, Mahajan, Dhanpat Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

**Reference Books:**

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology, Connie Dotson, 4e, Thomson
3. Handbook of Tribology: Materials, Coating, and Surface Treatments, Bharat Bhushan and B.K.Gupta.
4. Surface Engineering with Lasers, Dehossion J.T.
5. Surface engineering for corrosion and wear resistance, JR Davis, Wood head Publishers.

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**(13ME606) CAD/CAM**

**Objectives:** To make the students to know the concepts of CAD/CAM to generate a suitable geometric model of an object. To analyze the features on an object and develop process planning chart/ part program. To use popular drafting packages to develop geometric models of parts and their assemblies. To use computer aided quality control methods to detect manufacturing errors during inspections.

**UNIT- I**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

**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.

**UNIT -II**

**Geometric modeling:** Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

**Numerical control:** NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC PartProgramming: fundamentals, manual part programming methods, Computer Aided Part Programming.

**UNIT - III**

**Group Tech:** Part family, coding and classification, production flow analysis, advantages and limitations, Retrieval type and Generative type, Computer Aided Processes Planning.

**Types of manufacturing systems:** FMS, Material handling systems, computer control systems, JIT, Human labor in manufacturing systems.

**UNIT- IV**

**Computer integrated production planning:** Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits.

**Computer Aided Quality Control:** Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical non-contact inspection methods-non-optical computer aided testing, integration of CAQC with CAD/CAM.

**Text Books:**

1. CAD / CAM, A Zimmer's & P.Groover/PE/PHI
2. CAD / CAM – Principles and applications / P.N. Rao/TMH

**Reference Books:**

1. Automation, Production systems & Computer integrated Manufacturing, Groover,P.E
2. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
3. Principles of Computer Aided Design and Manufacturing, Farid Amrouche, Pearson
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH

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**(13ME607) HEAT TRANSFER LAB –I**

**Objectives:** To devise experimentation schemes for estimating heat transfer rates in conduction, convection, radiation heat transfer and to estimate the approximate imbalance in machines and Approximate heat transfer requirements. To provide probable solution for heat transfer. To provide experimentation schemes for sub-systems of a complex machine or thermal equipment to predict the characteristics of a complex system.

**List of Experiments:**

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection.

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**(13ME608) METROLOGY LAB**

**Objectives:** To make the student to choose correct measurement tools and /or measurement systems in a practical situation. To identify sources of measurement errors and eliminate them. To use common and advanced Metrology and measurement appliances which are commonly used in industrial inspection process and specify a dimension validation process. To measure surface roughness by precision measuring instruments such as SJ 210 roughness tester, Autocollimator and Calibrate instruments and/or measurement systems using known standards.

**List of Experiments:**

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool maker's microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars.
8. Internal Taper measurements by using spheres, cylinders & Spheres..
9. Use of spirit level in finding the flatness of surface plate.
10. Thread measurement by two wire/ three wire method.
11. Surface roughness measurement by Talysurf instrument.
12. Profile measurement by using Profile Projector.

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**(13ME609) CAD LAB**

**Objectives:** To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines. To train them to use the various sensors

**List of Experiments:**

- 1. Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.
- 2. Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.
3. a). Determination of deflection and stresses in 2D and 3D trusses and beams.  
 b). Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.  
 c). Determination of stresses in 3D and shell structures (at least one example in each case)  
 d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.  
 e). Steady state heat transfer Analysis of plane and Axisymmetric components.

**Any Six Software Packages from the following:**

Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM.

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**(13ME610) TECHNICAL SEMINAR-II**

**Objectives:** To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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**(13ME701) AUTOMOBILE ENGINEERING**

**Objectives:** The objective of Automobile Engineering is to develop and understand the principles of conversion in design, construction and working of mechanical systems and electronic systems in automobiles.

**UNIT - I**

**Introduction :** Components of a four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile Engines, engine construction, turbo charging and super charging – oil filters, oil pumps crank case ventilation.

**Ignition System:** Principle of Electronic Ignition System using contact breaker points, Electronic Ignition using Contact Triggers – Spark Advance and retard mechanism.

**UNIT - II**

**Emissions from Automobiles** – Pollution standards National and international – Pollution Control– Techniques – Multipoint fuel injection for SI Engines- Common rail diesel injection Emissions from alternative energy sources– hydrogen, Biomass, alcohols,LPG, CNG - their merits and demerits.

**Electrical System :** Charging circuit, generator, current – voltage regulator – starting system, Bendix drive, mechanism of Solenoid switch, Lighting systems, Horn, wiper, Fuel gauge – oil pressure gauge, Engine temperature indicator.

**UNIT-III**

**Transmission System:** Clutches- Principle- types: cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear box- types: sliding mesh, constant mesh, synchromesh, epi-cyclic, over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential, rear axles.

**UNIT-IV**

**Steering System:** Steering geometry – camber, castor, king pin rake, combined angle toe-in, Center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis Steering mechanism, steering gears – types, steering linkages.

**Suspension System:** Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

**Breaking System:** Mechanical brake system, Hydraulic brake system, Pneumatic and vacuum brake systems.

**Text Books:**

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh.
2. Automobile Engineering, William Crouse

**Reference Books:**

1. Automobile Engineering, R.K.RAJPUT, Laxmi Pub
2. Automobile Engineering, K.K.Ramalingam/SciTech Pub.
3. Automotive engines, Newton, Steeds & Garret.

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**(13ME702) INSTRUMENTATION AND CONTROL SYSTEMS**

**Objectives:** To make the students to learn the basic principles of measurement of temperature pressure, speed, acceleration, vibration, acceleration, humidity. To impart the knowledge of elements of control systems.

**UNIT - I**

Definition - Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of error.

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

**Measurement of Temperature:** Classification – Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers -Temperature Indicators.

**UNIT - II**

**Measurement of Pressure:** Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. Conductivity gauges - ionization pressure gauges, McLeod pressure gauge.

**Measurement of Level:** Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubbler level indicators.

**Flow Measurement:** Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

**UNIT - III**

**Measurement Of Speed:** Mechanical Tachometers -Electrical tachometers - Stroboscope, Noncontact type of tachometer.

**Measurement of Acceleration and Vibration:** Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

**Stress & Strain Measurements:** Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

**UNIT - IV**

**Measurement of Humidity:** - Moisture content in the gases, sling psychrometry, Absorption psychrometry, Dew point meter.

**Measurement Of Force, Torque And Power:** Elastic force meters, load cells, Torsion meters, Dynamometers.

**Elements of Control Systems:** Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems

**Text Books:**

1. Measurement systems: Application and design, Doeblin Ernest. O. Adaptation by Manik and Dhanesh, TMH
2. Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE

3. Instrumentation and Control Systems by K.Narayana Reddy & P.S.Rama Krishna SciTech Publishers

**Reference Books:**

1. Instrumentation, measurement & analysis, B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design, D.S Kumar.
3. Instrumentation and Control systems, S.Bhaskar, Anuradha Agencies.
4. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers.
5. Instrumentation & mech. Measurements, AK. Tayal, Galgotia Publications
6. Mechanical Measurements, Sawhni

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**(13ME703) ROBOTICS**

**Objectives:** To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors to expose the students to build a robot for any type of application

**UNIT - I**

**Introduction to Industrial Robots:** Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

**UNIT - II**

**Manipulator Kinematics:** Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.

**Manipulator Dynamics:** Differential transformation, Jacobians. Lagrange – Euler and Newton – Euler formations.

**UNIT - III**

**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.

**Robot actuators and Feedback components:** Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, Encoders – Velocity sensors, tactile sensors, Proximity sensors.

**UNIT - IV**

**Robot Application in Manufacturing:** Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

**Text books:**

1. Automation, Production systems and CIM, M.P. Grover/Pearson Edu.
2. Industrial Robotics - M.P. Grover, TMH.

**Reference Books:**

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 – AshitaveGhosal, Oxford Press
5. Robotics and Control, Mittal R K & Nagrath I J, TMH.
6. Introduction to Robotics – John J. Craig, Pearson Edu

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**(13ME704) REFRIGERATION AND AIR CONDITIONING**

**Objectives:** To employ the knowledge of RAC systems to build mathematical models of physical systems to predict their performance. To analyze refrigeration requirements to arrive at an outline configuration of the refrigeration system. To propose probable designs of systems. To assess the safety issues in RAC systems and propose viable solutions

**UNIT- I**

**Introduction to Refrigeration:** Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration: Ideal and Actual cycles, Open and Dense air systems -- problems

**Vapour compression refrigeration** – Basic cycle – working principle and essential components of the plant – COP – Representation of cycle on T-S and p-h charts – Expander vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle- Influence of various parameters on system performance – Construction and Use of P-h charts – numerical Problems.

**UNIT -II**

**Refrigerants** – Desirable properties – classification of refrigerants used – Nomenclature- secondary refrigerants lubricants – Ozone Depletion – Global Warming- newer refrigerants.

**Vapor Absorption Refrigeration System** – description and working of NH<sub>3</sub> – water system and Li Br – water (Two shell & four shell) System -Calculation of max COP. Principle of operation of three Fluid absorption systems.

**UNIT- III**

**Steam Jet Refrigeration System:** Working Principle and Basic Components-estimation of motive steam required. Principle and operation of: (i) Thermo-electric refrigerator (ii) Vortex tube or Hilsch tube.

**Introduction to Air Conditioning:** Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: RSHF, GSHF- Cooling load calculations.

**UNIT –IV**

**Air Conditioning equipment** - humidifiers – dehumidifiers – air filters, fans and blowers.

**Heat Pump** – Heat sources – different heat pump circuits.

Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning- Summer, winter & year round air conditioning simple problems.

**Text Books:**

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai

**Reference Books:**

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration - Dossat / Pearson Education.
3. Refrigeration and Air Conditioning-P.L.Ballaney
4. Basic Refrigeration and Air-Conditioning – Ananthanarayanan / TMH.

**Tables/Codes:** Thermal Engineering Data Book containing Refrigerant and Psychometric property Tables and charts

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### **(13ME705)UNCONVENTIONAL MACHINING PROCESSES (Elective-I)**

**Objectives:** To make the student to learn Non-Traditional machining techniques or nontraditional Machining processes to fabricate a part or perform material removal with a given accuracy. To estimate the effects of mechanical and thermal loading when machining metal and Non-metal cutting using a nontraditional machining process. To estimate the material removal rate and cutting force and the surface finish attainable using a non-traditional machining process and suggest a suitable process for a given application. To propose, where possible, environment- friendly and sustainable solutions to suit non-traditional machining processes

#### **UNIT-I**

**Introduction:** Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection materials, applications.

**Ultrasonic Machining:** Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

#### **UNIT-II**

**Abrasive jet machining, Water jet machining and abrasive water jet machine:** Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

**Electro – Chemical Processes:** Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tools, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

#### **UNIT- III**

**Thermal Metal Removal Processes:** General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, and selection of tool electrode and dielectric fluids, characteristics of spark eroded surface and machine tool selection. Parameters controlling surface finish and machining accuracy, Wire EDM, principle, applications.

**Electron Beam Machining:** Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes.

**Laser Beam Machining:** General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

#### **UNIT -IV**

**Plasma Machining:** Principle, metal removal mechanism, process parameters, accuracy and surface finish, applications.

**Chemical Machining:** Fundamentals of chemical machining- Principle maskants –etchants advantages and applications. Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining.

**Rapid Prototyping:** Classification – Stereo lithography, Selective Laser Sintering, applications.

**Text Books:**

1. VK Jain advanced machining processes. Allied publishers.

**Reference Books:**

1. Pandey, P.C. and Shah H.S., Modern Machining Process. TMH.
2. Bhattacharya A, New Technology. The Institution of Engineers, India 1984.
3. Kalpakzian, Manufacturing Technology. Pearson.

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**(13ME706) TOOL DESIGN**  
**(Elective-I)**

**Objectives:** To impart the knowledge of the basic cutting tool angles. To analyze the cutting tool requirement and specify the material and geometry required for a given tool in a given machining Situation. To design multipoint cutting tools and jigs/fixtures in selected applications. To identify the tooling and other requirements for machining an object with complex geometry.

**UNIT-I**

**Gauge Design:** Gauges and gauge design coated tools, ceramic tools.

**Design of Single Point Cutting Tools:** Single point, cutting tools-various systems of specifications, geometry and their inter, relation, theories of formation of chip and their effect, design of broach.

**Design of multipoint Cutting Tools:** Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

**UNIT-II**

**Design of Sheet Metal Blanking And Piercing:** Fundamentals of die cutting operating, power press types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, stripper and pressure pads presswork material, strip layout, short run tooling for piercing.

**Design of Sheet Metal Bending, Forming and Drawings Die:** Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

**UNIT-III**

**Design of Jigs And Fixtures:** Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

**UNIT-IV**

**Design of Moulds:** Design of single cavity, multi cavity moulds for injection and blowing.

**Using plastics as tooling materials:** introduction, plastics commonly used as tooling material application of epoxy plastic tools construction methods of plastic tooling metal forming operations with Urethane dies. Calculating forces for urethane pressure pads, and economics of tooling.

**Text Books:**

1. Donaldson, Lecain and Goold, Tool Design. TMH.
2. A Bhattacharya, Principles of Metal cutting. New Central Book Agency, Calcutta.

**Reference Books:**

1. Surendra Kenav and Umesh Chandra, Production Engineering Design (Tool Design). Satyaprakashan, New Delhi 1994.
2. Amitabh Bhattacharya and Inyong Ham, Design of Cutting Tools. Use of Metal Cutting Theory. ASTME publication Michigan USA, 1969.
3. RK Singal and Others, Fundamentals of Machining and Machine Tools. I.K. International, 2008.
4. Shaw, Metal Cutting Principles. Oxford Univ. Press.

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**IV B.Tech I Semester (ME)**

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### **(13ME707) FINITE ELEMENT METHODS (Elective-I)**

**Objectives:** To apprise the students about the basics of Finite Element theory, computer implementation of this theory and its practical applications.

#### **UNIT- I**

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain - Displacement relations. Stress - strain relations.

**One-Dimensional Finite Element Methods:** Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element.

#### **UNIT- II**

**Trusses:** Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, and temperature effects.

**Beams:** Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

#### **UNIT -III**

**Two Dimensional Problems:** Basic concepts of plane stress and plane strain, stiffness matrix of CST element, finite element solution of plane stress problems.

**Iso-Parametric Formulation:** Concepts, sub parametric, super parametric elements, 2 dimensional 4 noded iso-parametric elements, and numerical integration.

#### **UNIT -IV**

**Axi-Symmetric Model:** Finite element modeling of axisymmetric solids subjected to axi-symmetric loading with triangular elements.

**Heat transfer problems:** Heat transfer with conduction, convection, Heat transfer through fins

**Dynamic Analysis:** Dynamic equations, Eigen value problems and their solution methods, simple problems

#### **Text Books:**

1. Tirupathi.R. Chandrapatla and Ashok D. Belagondu, Introduction to Finite elements in Engineering.
2. S Senthil, Introduction of Finite Element Analysis. Laxmi Publications.
3. SMD Jalaluddin, Introduction of Finite Element Analysis. Anuradha Publications.

#### **Reference books:**

1. K. J. Bathe, Finite element procedures. PHI.
2. SS Rao, The finite element method in engineering. Butterworth Heinemann.
3. J.N. Reddy, An introduction to the Finite element method. TMH.
4. Chennakesava, R Alavala, Finite element methods: Basic concepts and applications. PHI.

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**(13ME708) RAPID PROTOTYPING**  
**(Elective-I)**

**Objectives:** To make the students to gain the knowledge on how to identify the tools needed to produce a prototype of the product using RPT techniques. To analyze the simulation/prototyping need and select an RPT system in a given situation for economy and rapid results. To use both hardware and software tools to enhance the productivity in an RPT Process.

**UNIT – I**

**Introduction:** Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry and classification of RP systems,

**Stereo Lithography Systems:** Principle, Process parameters, Process details, Data preparation, Data files and machine details, Applications.

**Selective Laser Sintering:** Type of machine, Principle of operation, Process parameters, Data Preparation for SLS, Applications, Fused Deposition Modeling: Principle, Process parameter, Path generation, Applications.

**UNIT – II**

**Solid Ground Curing:** Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials, Process details, applications.

**Concepts Modelers:** Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

**UNIT – III**

**Rapid Tooling:** Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, Direct Rapid Tooling.

**Tooling:** Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

**UNIT – IV**

**Software for Rp:** STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools, RAPID.

**Manufacturing Process Optimization:** Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

**Allied Processes:** Vacuum, Casting, Surface digitizing, and Surface generation from point cloud, Surface modification - data transfer to solid models.

**Text Books:**

1. Paul F. Jacobs, Stereo Lithography and Other RP & M Technologies, SME, NY.
2. Fulham D.T & Dinjoy S.S Verlog, Rapid Manufacturing, London.

**Reference Books:**

1. Terry Wohlers Wohler's Report 2000, *Rapid Prototyping*, Wohler's Association 2000.
2. Gurumurthy, *Rapid Prototyping Materials*, IISc Bangalore.

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**(13ME709) GEOMETRIC MODELING**  
**(Open Elective)**

**Objectives:** To make the student understand the role of computer graphics in the context of the object representation. To represent and generate points, lines and circles using algorithms. To work with multiple 2-D and 3-D geometrical transformations to represent and solve real engineering problems. To gain experience in design projects involving animation systems

**UNIT – I**

**Introduction:** Application area of Computer graphics, overview of graphic system, video- display devices, raster- scan systems, random scan systems, graphics monitors and work stations and input devices.

**Output primitives:** Points and lines, line drawing algorithms, midpoint circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood –fill algorithm.

**UNIT-II**

**2-D geometrical transformations:** Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates.

**2-D viewing:** The viewing pipe0line, viewing coordinat4reference frame, window to view –port-co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus –Beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm.

**UNIT-III**

**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B- spline curve, Bezier and B- spline surfaces, Basic illumination models, shading algorithms.

**3-D geometric transformations:** Translation, rotation, scaling, reflection and shear transformation and composite transformations.

**UNIT – IV**

**Visible surface detection methods:** Classification, back-face detection, depth- buffer, scan- line, depth sorting.

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation. Computer animation language, key frame system, motion specification.

**Text Books:**

1. Mathematical Elements for computer graphics, David 1 Rodgers, TMH
2. Computer Graphics and Automation, M.C. Trivedi, Jaico Pub. Pearson Education

**Reference Books:**

1. CAD/CAM Theory, Ibrahim Zeid, TMH
2. Computer Graphics second edition, Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw Hill edition.
3. Computer Graphics, Steven Harrington, TMH
4. Principles of computer Graphics, Shalini Govil, PHI, 2005, Springer.
5. Computer Graphics Principles & Practice, C.Foley, Vandom, Fesner, Hughes, Pearson Pub. 2/e
6. Computer Graphics C version, Donald Hearn and M.Pauline Baker, Pearson, PHI

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**(13ME710) TRIBOLOGY  
(Open Elective)**

**Objectives:** The objective of the subject is to apply the basic theories of friction, wear and lubrication to predictions about the frictional behavior of commonly encountered sliding interfaces. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding. Interpret the latest research on new topics in tribology including its application to nanoscale devices and biological systems.

**UNIT – I**

**Study of Various Parameters:** Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

**Hydrostatic Lubrication:** Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

**UNIT – II**

**Hydrodynamic Theory Of Lubrication:** Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti - friction bearing

**Friction And Power Losses In Journal Bearings:** Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

**UNIT – III**

**Air Lubricated Bearing:** Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction. Columb's laws of friction, theories of friction

**UNIT – IV**

**Types of Bearing Oil Pads:** Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings – externally pressurized bearings.

**Bearing Materials:** General requirements of bearing materials, types of bearing materials, Selection of Bearing materials for various applications, Applications of Bearing materials.

**Text Books:**

1. Suhas V. Patankar, Numerical heat transfer and fluid flow. Butter-Worth Publ.
2. John. D. Anderson, Computational fluid dynamics, Basics with applications. Mc Graw Hill.

**Reference Books:**

1. Niyogi, Computational Fluid Flow and Heat Transfer. Pearson Publ.
2. Tapan K. Sengupta, Fundamentals of Computational Fluid Dynamics. Universities Press.
3. Jiyuan and Others, Computational Fluid Dynamics. Elsevier, 2008.

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**IV B.Tech I Semester (ME)**

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**(13ME711)ENTREPRENEURSHIP  
(Open Elective)**

**Objectives:** To make the student to assess the risk and reward involved with a business idea. To develop a business plan for expansion and market segmentation. To identify socially relevant mechanical engineering business ideas. To develop a financial plan for a business venture to be submitted to a financing agency.

**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. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, and product planning and development process.

**UNIT-II**

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. Financing and managing the new venture, Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, and financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

**UNIT-III**

New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Choosing location and layout, Issues related to Selection of layout.

**UNIT-IV**

Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, designing the work place, Inventory control, material handling and qualitycontrol. Marketing functions, market segmentation, marketresearch and channels of distribution, Sales promotion and product pricing. Global aspects of Entrepreneurships.

**Text Books:**

- 1 Entrepreneurship, Robert His rich, & Michael Peters, TMH, 5<sup>th</sup> Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

**Reference Books:**

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.
4. The Entrepreneurial Connection, Gurmeet Naroola TMH, 2001.
5. Indian Economy. Dutt & Sundaram S. Chand, 2005.
6. Essential of Entrepreneurship and small business management, Thomas W. Zimmerer & Norman M. Scarborough, PHI, 4/e, 2005.
7. Industrial Relations & Labor Laws, Srivastava, Vikas, 2005.
8. Industrial Law, ND Kapoor, Sultan Chand & Sons, 2005

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<b>0</b>	<b>0</b>	<b>3</b>	<b>[2]</b>

**(13ME712) CAM LAB**

**Objectives:** To impart hands on practical exposure on and equipment.

**List of Experiments:**

1. Study of “ G” codes and “M” codes.
2. CNC – Milling rectangular pocketing.
3. CNC – Milling circular pocketing.
4. CNC – Simple turning
5. CNC – Step turning.
6. CNC Lathe – Simple Facing.
7. CNC Lathe – Right Hand Taper Turning.
8. CNC Lathe – Left Hand Taper Turning.
9. CNC Lathe – Thread Cutting Operation.

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

**(13ME713) INSTRUMENTATION AND CONTROL SYSTEMS LAB**

**Objectives:** To make the students to study and calibrate the pressure gauges transducer, thermocouple, rotometer, and anemometer.

**List of experiments:**

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.
12. Study of anemometer

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<b>L</b>	<b>T</b>	<b>P</b>	<b>[C]</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>[2]</b>

**(13ME714) HEAT TRANSFER LAB-II**

**Objectives:** To devise experimentation schemes for estimating heat transfer rates in conduction, convection, radiation heat transfer and to estimate the approximate imbalance in machines and approximate heat transfer requirements. To provide probable solution for heat transfer. To provide experimentation schemes for sub-systems of a complex machine or thermal equipment to predict the characteristics of a complex system.

**List of Experiments:**

1. Experiment on Parallel and counter flow heat exchanger.
2. Emissivity of a gray body through Emissivity apparatus.
3. Experiment on Stefan Boltzman Apparatus.
4. Heat transfer in drop and film wise condensation.
5. Experiment on Critical Heat flux apparatus.
6. Study of heat pipe and its demonstration.
7. Study of Two – Phase flow.

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**IV B.Tech I Semester (ME)**

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**(13ME715) PROJECT WORK PHASE-I**

The object of Project Work Phase-I is to enable the student to take up investigative study in the broad field of his branch of Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the department on an individual basis or three/four students in a group under the guidance of a supervisor/ guide. This is expected to provide a good initiation for the student(s) in R&D work.

*The assignment normally includes:*

- Survey and Study of published literature of on the assigned topic.
- Working out a preliminary approach to the problem relating to the assigned topic.
- Conducting preliminary analysis/ modeling/simulation/experiment/ design/ feasibility.
- Preparing a written report on the study conducted for presentation to the department.
- Final seminar presentation before Project Review Committee.

The supervisor/ guide will evaluate the execution of the project periodically.

Project Work Phase-I is allocated 100 marks with 2 credits. Out of 100, 25 marks are allocated for the supervisor/guide to be awarded based on periodical project reviews and submission of the report on the work done. 25 marks are allocated for the supervisor/guide and head of the department to be awarded based on seminar given by each student on the topic of the project. The other 50 marks shall be awarded on the basis of his presentation on the work done on his project by the Departmental committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

The candidate is declared to have passed in Project work Phase-I when he gets 40% marks given by the Departmental Committee and 50% marks overall.

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<b>3</b>	<b>1</b>	<b>0</b>	<b>[3]</b>

### **(13ME801) OPERATIONS RESEARCH**

**Objectives:** To make use of the below techniques while modeling and solving the engineering problems of different fields.

#### **UNIT-I**

**Development** – Definition– Characteristics and Phases – Types of models – operation Research models– applications.

**Allocation:** Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two-phase method, Big-M method – Duality Principle-Economic interpretation of duality.

**Transportation Problem:** Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution – Variants of Assignment Problem-Travelling Salesman problem.

**Sequencing** – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines.

#### **UNIT -II**

**Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not considered and considered – Replacement of items that fail completely, group replacement.

**Theory of Games:** Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 & 2 X n games -graphical method.

#### **UNIT-III**

**Queuing Theory:** Introduction – Terminology, Service channel, Arrival Pattern, Population, Departure Pattern (Service Pattern), Queuing Disciplines, Birth and Death Process, Balking, Reneging, Jockeying, Single Channel Models with Poisson arrivals, Exponential Service Times, with finite Queue length and infinite Queue length, Multi channel models with Poisson arrivals, exponential service times with finite Queue length.

**Inventory :** Introduction – Single item – Deterministic models –Inventory models with price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable– Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

#### **UNIT-IV**

**Dynamic Programming:** Introduction – Bellman’s Principle of optimality – Applications of dynamic programming capital budgeting problem – shortest path problem – linear programming problem.

**Simulation:** Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages.

#### **Text Books:**

1. Introduction to operations Research, Taha, PHI
2. Introduction to O.R, Hiller & Liebermann (TMH).
3. Operations Research by p.srinivasulu and B.Durgaprasad SciTech publications.

**Reference Books:**

1. Operations Research, A.M.Natarajan, P.Balasubramani, A.Tamilarasi, Pearson Education.
2. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman
3. Operations Research, R.Pannerselvam, PHI Publications.
4. Operations Research, Wagner, PHI Publications.
5. Operation Research, J.K.Sharma, MacMilan.
6. O.R, Wayne L.Winston, Thomson Brooks, Cole.
7. Operations Research, R.Veerachari and V. RaviKumar, I.K International

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**(13ME802) ENERGY SYSTEMS**  
**(Elective-II)**

**Objectives:** To impart the students the knowledge of non-conventional energy resources and build mathematical models to predict their performance. To analyze requirements for various non conventional energy conversion systems and propose probable designs for improvement of performance. To present the feasible non-conventional energy conversion systems for the different parts of the society.

**UNIT I**

**Principles Of Solar Radiation:** Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

**Solar Energy Collection:** Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

**UNIT II**

**Solar Energy Storage And Applications:** Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

**Wind Energy:** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

**UNIT III**

**Bio-Mass:** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engines Operation and economic aspects.

**Geothermal Energy:** Resources, types of wells, methods of harnessing the energy, potential in India.

**UNIT IV**

**Ocean Energy:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

**Direct Energy Conversion:** Need for DEC, Carnot cycle, limitations, and principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

**Text Books:**

1. Renewable energy resources, Tiwari and Ghosal, Narosa.
2. Non-Conventional Energy Sources, G.D. Rai

**Reference Books:**

1. Renewable Energy Sources, Twidell & Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering, B.S. Magal Frank Kreith & BJ.F.Kreith.
4. Principles of Solar Energy, Frank Kreith & John FB Kreider.
5. Non-Conventional Energy, Ashok V Desai, Wiley Eastern
6. Non-Conventional Energy Systems, K Mittal, Wheeler.

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**IV B.Tech II Semester (ME)**

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**(13ME803) TOTAL QUALITY MANAGEMENT**  
**(Elective-II)**

**Objectives:** The objectives of this subject is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

**UNIT - I**

TQM – overview, concepts, elements – History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – Objectives – internal and external customers. Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards – ISO certification process-Third party audit.

**UNIT - II**

Process management- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools. Problem solving techniques - Problem Solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis.

**UNIT - III**

Quality circles – organization – focus team approach – statistical process control process chart – Ishikawa diagram – preparing and using control charts. Quality Function Development (QFD) – elements of QFD – benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

**UNIT - IV**

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management. Six sigma approach – application of six sigma approach to various industrial situations.

**Text Books:**

1. Total Quality Management, Joseph & Susan Berg
2. Total Quality Management, Bester field, Pearson.

**Reference Books:**

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.

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**(13ME804) COMPUTATIONAL FLUID DYNAMICS**  
**(Elective-II)**

**Objectives:** To give the student a working knowledge of a variety of computational techniques that can be used for solving engineering problems.

**UNIT – I**

**Elementary details in numerical Techniques:** Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

**Applied Numerical Methods:** Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes. Of Matrix Inversion, Direct Methods for Matrix Inversion, Direct Methods for banded matrices.

**UNIT – II**

Finite Difference Applications in Heat conduction and Convection - Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, and finite difference application in convective heat transfer. Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite difference equations, consistency, explicit and implicit methods.

**UNIT – III**

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling. Conservative property, the upwind scheme. Review of Equations Governing **Fluid Flow and Heat Transfer:** Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, and special forms of the Navier-stokes equations.

**UNIT-IV**

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

**Finite Volume Method:** Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and Quadratic Interpolation.

**Text Books:**

1. Numerical heat transfer and fluid flow, Suhas V. Patankar, Butter-worth Publishers
2. Computational fluid dynamics, Basics with applications, John. D. Anderson! Mc Graw Hill.

**Reference Books:**

1. Computational Fluid Flow and Heat Transfer, Niyogi, Pearson Publications
2. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, Universities Press.

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**(13ME805) MECHANICAL VIBRATIONS**  
**(Elective-II)**

**Objectives:** The objective for this subject is for students to learn terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis. Topics included Undamped free vibration and damped vibration, Free and forced vibrations of mechanical systems with lumped inertia, springs, and dampers are the primary emphasis.

**UNIT - I**

**Introduction:** Importance and scope ,definition and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

**Single Degree Freedom Systems-I:** Undamped free vibration: Classical method, Energy method, phase plane method, equivalent systems, and torsional systems.

**UNIT - II**

**Single Degree Freedom Systems-II:** Damped free vibration: Viscous damping, under damping, critical damping, coulomb damping, equivalent damping coefficient

**Single Degree Freedom Systems With Forced Vibrations:** Steady state forced vibration, sources of excitation, impressed harmonic force, impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and Vibrometer, methods of vibration control, excitation reduction at source, System modification.

**UNIT - III**

**Two Degree Freedom Systems:** Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, dynamic vibration absorber

**Multi Degree Freedom Systems:** Influence co-efficient method, damped mass and distributed mass systems, stodola method, Holzer's method, newtons iteration method, Orthogonality of mode shapes.

**UNIT - IV**

**Vibration In Continuous Systems:** Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts. Whirling of shafts critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

**Text Books:**

1. Mechanical Vibrations, G.K.Grover
2. Theory and practice of mechanical Vibrations, J.S.Rao and K.Gupta

**Reference Books:**

1. Vibration Theory and Applications, W.T.Thomson
2. Vibration problems in Engineering, Timoshenko and Young

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**(13ME806) GAS TURBINES AND JET PROPULSION**  
**(Elective-II)**

**Objectives:** To understand the basic fundamentals of compressible flow concepts, non-dimensional numbers in compressible flow and to solve the simple compressible flow problems and also to understand the effect of compressibility in nozzles and diffusers, design criteria of nozzles and diffusers and solve isentropic compressible flow problems. Propulsive methods, concept of air-craft propulsion system. Performance of ram jet, turbojet, turbofan and turbo prop engines. Concept of rocket propulsion system, ignition and combustion.

**UNIT- I**

**Gas Turbine Operating Cycles:** Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or Maximum cycle thermal efficiency, means of improving the efficiency and the specific output of simple cycle. Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, intercooling & reheating, turbojet engine, turbofan engine, turboprop engine.

**UNIT-II**

**Jet propulsion:** Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency need for thermal jet engines and applications. Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

**UNIT-III**

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serqujet and Pulse jet, elementary treatment.

**Rocket Engines:** Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

**UNIT-IV**

**Rocket Technology:** Flight mechanics, application thrust profiles, acceleration- staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling. Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

**Text Books:**

1. Gas Turbines, V. Ganesan TMGH
2. Gas Dynamics & Jet Propulsion, Dr. S.L. Somasundaram.

**Reference Books:**

1. Gas turbines, Cohen, Rogers & Sarvana Muttoo, AddisonWiley & Longman
2. Thermodynamics of propulsion, Hill & Paterson.
3. Rocket Propulsion, Sutton.
4. Element of Gas Turbines Propulsion, Jack D Matingly, MGH.

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**(13ME807) POWERPLANT ENGINEERING**  
**(Elective-III)**

**Objectives:** To understand the basic working principles of stream, hydel, Diesel, as turbine power plant and boilers, various ash and fuel handling equipments, equipments for burning the fuel, mechanical stokers, draught, and condenser types, geothermal and other power plant ,also comparison of all power plants and economics of various power plants.

**UNIT-I**

Introduction to the Sources of Energy – Resources and Development of Power in India.

**Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, and choice of handling equipment, coal storage, and Ash Handling systems.

**Steam Power Plant:** Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, and pulverized fuel Burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

**UNIT-II**

**Internal Combustion Engine Plant:** Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

**Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

**UNIT-III**

**Hydro Electric Power Plant:** Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – Classification of dams and spill ways.

**Hydro Projects and Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

**Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

**Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

**UNIT-IV**

**Nuclear Power Station:** Nuclear fuel – breeding and ertile materials – Nuclear reactor – reactor operation.

**Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

**Power Plant Economics and Environmental Considerations:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor,

diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards –Methods of Pollution control.

**Text Books:**

1. A Text Book of Power Plant Engineering, Rajput, Laxmi Publications
2. Power Plant Engineering, P.C.Sharma, S.K.Kataria Pub.

**Reference Books:**

1. Power Plant Engineering, P.K.Nag, II Edition, TMH.
2. Power plant Engineering, Ramalingam, SciTech Publishers
3. A Course in Power Plant Engineering, Arora and S.Domkundwar.

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**(13ME808) NANO TECHNOLOGY**  
**(Elective-III)**

**Objectives:** To expose the students to the evolution of Nano systems, to the various fabrication techniques. Also to impart knowledge to the students about nano materials and various nano measurements techniques.

**UNIT - I**

**General Introduction:** Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

**Silicon Carbide:** Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,

**Nano particles of Alumina and Zirconia:** Nano materials preparation, Characterization, Wear materials and nano composites,

**UNIT- II**

**Mechanical properties:** Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

**Electrical properties:** Switching glasses with nanoparticles, Electronic conduction with nano particles

**Optical properties:** Optical properties, special properties and the coloured glasses

**UNIT - III**

Process of synthesis of nano powders, Electro deposition, important nano materials

**Investigating and manipulating materials in the nanoscale:** Electron microscopic, scanning probe Microscopic, optical microscopic for nano science and technology, X-ray diffraction.

**UNIT - IV**

**Nanobiology:** Interaction between bimolecules and nanoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, nanoprobes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nanobiology, Nanosensors.

**NanoMedicens:** Developing of NanoMedicens Nanosystems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

**Text Books:**

1. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
2. Nano Essentials- T.Pradeep/TMH

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**(13ME809) ADVANCES IN CASTING AND WELDING PROCESSES**  
**(Elective-III)**

**Objectives:** To study the metallurgical concepts and applications of casting and welding process. To acquire knowledge in CAD of casting and automation of welding process.

**UNIT-I**

**CASTING DESIGN:** Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering.

**CASTING METALLURGY:** Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbitt alloy and Cu alloy.

**UNIT-II**

**RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT:** Shell moulding, precision investment casting, CO<sub>2</sub> moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

**UNIT-III**

**WELDING METALLURGY AND DESIGN :**Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

**UNIT-IV**

**RECENT TRENDS IN WELDING:** Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapor phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

**Text Books:**

1. ASM Handbook, Vol 15, Casting, 2004
2. ASM Handbook vol.6, welding Brazing & Soldering, 2003

**Reference Books:**

1. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
2. Parmer R.S., Welding Engineering and Technology, Khanna Publishers, 2002
3. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002
4. Heineloper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000
5. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
6. Cornu.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.
7. Iotrowski – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
8. Schwariz, M.M. – Source book on innovative welding processes – American Society of Metals (OHIO), 1981
9. Lancaster.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980

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**IV B.Tech II Semester (ME)**

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**(13ME810) MECHATRONICS**  
**(Elective-III)**

**Objectives:** To create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

**UNIT-I**

**Introduction:** Definition – Trends – Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

**Signal Conditioning :** Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

**UNIT-II**

**Precision Mechanical Systems:** Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission -Bearings- Motor / Drive Selection.

**Electronic Interface Subsystems:** TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isoation schemes- opto coupling, Buffer IC's - Protection schemes – circuit breakers , over current sensing, resettable fuses , thermal dissipation - Power Supply - Bipolar transistors/ mosfets

**UNIT-III**

**Electromechanical Drives:** Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

**Microcontrollers Overview:** 8051Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

**UNIT-IV**

**Programmable Logic Controllers:** Basic Structure - Programming: Ladder Diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection -Applications.

**Programmable Motion Controllers:** Introduction - System Transfer Function - Laplace transform and its application in analyzing differential equation of a control system - Feedback Devices :Position , Velocity Sensors - Optical Incremental encoders – Proximity Sensors : Inductive , Capacitive ,Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers- P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear ,Circular – Core functionalities – Home, Record position , Go to Position -Applications : SPM, Robotics.

**Text Books:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

**Reference Books:**

1. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publishers.
3. Mechatronics System Design, Devdas shetty, Richard, Thomson.

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**(13ME811) COMPREHENSIVE VIVA-VOCE**

There shall be a Comprehensive Viva-Voce in IV B.Tech II Semester. The comprehensive Viva-Voce shall be evaluated in the topics covering the core aspects of the concerned discipline in which the candidate is likely to get graduated. The marks can be awarded based on the performance in viva-voce examination conducted by a committee consisting of **i) Head of the Department ii) Two Senior Faculty members of the department iii) External Examiner appointed by the Principal.** The comprehensive Viva-Voce shall be conducted for 100 marks. Of the 100 marks, 25 marks are allocated to each member of the committee.

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**(13ME812) PROJECT WORK PHASE-II**

The Project work Phase-II will be an extension of Phase-I project work. The object of Project work phase-II is to enable the student to extend further the investigative study taken up as the project in Phase-I under the guidance of the supervisor/ guide from the department.

*The assignment normally includes:*

- Preparing an action plan for conducting the investigation including the team work.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).

**Internal:** Project Work Phase-II is allocated 50 internal marks. Out of 50, 25 marks are allocated for the supervisor/guide and head of the department to be evaluated based on two seminars given by each student on the topic of the project. The other 25 marks shall be evaluated on the basis of his presentation on the work done on his project by the Departmental Committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

**External:** The semester end examination for project work done during IV B.Tech I semester and IV B.Tech II semester for 150 marks shall be conducted by a Project Review Committee (PRC). The committee comprises of an External Examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor. The evaluation of project work shall be conducted at the end of the II Semester of IV B.Tech. The above committee evaluates the project work report with weightages of 50% of the marks (50 marks) awarded by external examiner, 20% of marks (20 marks) awarded by HOD & 30% of the marks (30 marks) by Project Guide/Supervisor respectively for a total of 100marks. Of the 50 marks for Presentation & Viva-Voce examination, HOD evaluates for 10 marks and external examiner for 40 marks. The evaluation of 150 marks is distributed as given below:

A candidate shall be declared to have passed in project work phase-II if he secures a minimum of 50% aggregate marks (100 marks) (Internal marks + External project marks), subject to a minimum of 40% marks (60 marks) in the project end examination.