# Bapatla Engineering College::BAPATLA
## (Autonomous)
## Academic Regulations
### Regulations for Four Year Bachelor of Technology (B.Tech) Degree programme for the Batches admitted from the academic year 2020-21

## B.Tech Regular Four Year Degree Programme
## (Academic Regulations as amended in November 2021)

**Preliminary Definitions and Nomenclature AICTE:** Means All India Council for Technical Education, New Delhi.

**Autonomous Institute:** Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Acharya Nagarjuna University, Guntur).

**Academic Autonomy:** Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

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

**Academic Year:** It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., one odd and one even.

**Branch:** Means specialization in a program like B.Tech degree program in Civil Engineering, B.Tech degree program in Computer Science and Engineering etc.

**Board of Studies (BOS):** BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

**Backlog Course:** A course is considered to be a backlog course, if the student has obtained a failure grade in that course.

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

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

**Choice Based Credit System:** The credit-based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

**Certificate Course:** It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

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

**Internal Examination:** It is an examination conducted towards sessional assessment.

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

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

**Course Outcomes:** The essential skills that need to be acquired by every student through a course.
**Credit:** A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

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

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

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

**Department:** An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

**Detention in a Course:** Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

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

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

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

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

**Institute:** Means Bapatla Engineering College, Bapatla, unless indicated otherwise by the context.

**Massive Open Online Courses (MOOC):** MOOCs inculcate the habit of self-learning. MOOCs would be additional choices in all the elective group courses.

**Minor:** Minors are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

**Pre-requisite:** A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

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

**Program:** Means, UG degree program: Bachelor of Technology (B.Tech).

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

**Project work:** It is a design or research-based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

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

**Regulations:** The regulations, common to all B.Tech programs offered by Institute, are designated as "BEC Regulations – R20" and are binding on all the stakeholders.

**Semester:** It is a period of study consisting of 16 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

**Semester End Examinations:** It is an examination conducted for all courses offered in a semester at the end of the semester.

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

**University:** Means Acharya Nagarjuna University, Guntur.

## 1. Award of B.Tech. Degree

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

**i.** Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility, this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation. A lateral entry student pursues a course of study for not less than three academic years and in not more than six academic years

**ii.** Registers for 160 credits and secures all 160 credits. However, a lateral entry student registers for 121 credits and secures all the 121 credits from III semester to VIII semester of Regular B. Tech. program.

**iii.** The student will be eligible to get Under graduate degree with honours or additional minor engineering if he/she completes an additional 20 credits

**iv.** A student will be permitted to register either for Honours degree or additional minor engineering but not both.

**2.** Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. A lateral entry student should complete the course within six academic years from the year of their admission, failing which his/her admission in B.Tech course stands cancelled

## 3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. course

| S.No. | Title of the UG Programme | Abbreviation |
|---|---|---|
| 1. | Civil Engineering | CE |
| 2. | Computer Science & Engineering | CS |
| 3. | Electrical & Electronics Engineering | EE |
| 4. | Electronics & Communication Engineering | EC |
| 5. | Electronics & Instrumentation Engineering | EI |
| 6. | Information Technology | IT |
| 7. | Mechanical Engineering | ME |
| 8. | Cyber Security | CB |
| 9. | Data Science | DS |

## 4. Credits:

i. *Credit:* A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture) or two hours of practical work/field work per week.
ii. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.
iii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses.
iv. Each course in a semester is assigned certain number of credits based on following

| Description | Periods/Week | Credits |
|---|---|---|
| Theory | 03 | 03 |
| Tutorial | 01 | 01 |
| Practical | 03 | 1.5 |
| Internship (At the end of IV & VI evaluated in V & VII resp.) | - | 1.5/3.0 |
| Project Work | - | 12 |

## 5. Course Structure

Every course of the B.Tech program will be placed in one of the 8 categories with suggested credits as listed below.

| S.No. | Category | Category Description | Abbreviated Category | Credits |
|---|---|---|---|---|
| 1 | Humanities and social science | Humanities and social science including Management courses | HS | 10.5 |
| 2 | Basic Sciences | Basic Science courses | BS | 21 |
| 3 | Engineering Science courses | Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc. | ES | 24 |
| 4 | Professional core | Professional core Courses | PC | 51 |
| 5 | Open Electives | Open Elective Courses- from other | OE | 12 |

| | | | | |
|---|---|---|---|---|
| | | technical/ emerging and job oriented | | |
| 6 | Professional Courses | Professional Elective Courses relevant to chosen specialization/ branch | PE | 18 |
| 7 | Project Work | Project Work, Seminar, Internship in industry elsewhere | PW | 16.5 |
| 8 | Mandatory courses | Environmental Studies, Induction training, Universal human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge (Non-Credit) | MC | 0 |
| 9 | Skill Oriented Courses | Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry | SC | 10 |
| | | **Total Credits** | | 160 |

## 6. Weightage for course evaluation

### 6.1 Course Pattern

- The entire course of study is for four academic years. Semester pattern shall be followed in all years.
- A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
- When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

### 6.2 Evaluation Process

The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded.

The performance of a student in each course is assessed with alternate assessment methods, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Internships carried out after IV Semester & VI Semester shall be evaluated for 100 marks each and the Internship along with Project Work carried out in VIII Semester shall be evaluated for 150 marks. For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination. For project work, the distribution shall be 50 marks for Internal Evaluation and 100 marks for the End-Examination / Viva-Voce. The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

| **Nature of the Course** | **CIE** | **SEE** |
|---|---|---|

| | | |
|---|---|---|
| Theory subjects | 30 | 70 |
| Drawing | 30 | 70 |
| Practical | 30 | 70 |
| Summer / Industrial / Research Internship | -- | 100 |
| Project work | 50 | 100 |

### 6.3 Continuous Internal Evaluation (CIE) in Theory subjects:

**6.3.1** In each Semester there shall be two Term examinations and some ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tools with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course. It will be reviewed and approved by the Department Committee.

The Term Examination is conducted in the regular mode according to a schedule which will be common for a particular year of study. The maximum weightage for Term Examinations, AATs and the calculation of marks for CIE in a theory course is given in the following table.

| **Particulars** | **Term Exams (Max. 20 marks)** | **AAT (Max. 10 marks)** |
|---|---|---|
| Better Performed exam | 75% of marks obtained | Continuous assessment by teacher as per the predetermined course delivery & assessment plan. (Minimum two & maximum four assessments). AAT marks shall be considered based on average of all tests conducted. |
| Other exam | 25% of marks obtained | |

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that course and eligible to write the SEE of that course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

### 6.3.2 Semester End Examination (SEE) in Theory and Design Course:

a) For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 70 marks, except where stated otherwise in the detailed Scheme of Instruction. Question paper setting shall be set by the teacher or teachers together in a multi section courses and to be verified as described in policy document.

b) A minimum of 25 (Approx. 35%) marks are to be secured exclusively in the Semester End Examination (SEE) of theory, design and/or drawing course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

### 6.3.3 Continuous Internal Evaluation (CIE) in laboratory courses:

The evaluation for Laboratory course is based on CIE and SEE. The CIE for 30 marks comprises of 15 marks for day to day laboratory work, 5 marks for record submission and 10 marks for a laboratory examination at the end of the semester. In any semester, a minimum of 90% of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that lab course and eligible to write the SEE of that lab course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

### 6.3.4 Semester End Examination (SEE) in laboratory courses:

a) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the Principal and the duration of the exam shall be for three hours. The SEE is for 70 marks which include 15 marks for write up, 35 marks for lab experiment/exercise, 15 marks for Viva-voce and 5 marks for general impression.

b) A minimum of 25 (Approx. 35%) marks are to be secured exclusively in the Semester End Examination (SEE) of laboratory course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

### 6.3.5 Evaluation of Summer Internship and Industrial/Research Internship:

a) **Summer Internship at the end of IV semester and Industrial/Research Internship** at the end of VI carried out in industry are to be evaluated in V & VII semesters respectively based report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.

b) A minimum of 40 (40%) marks are to be secured exclusively to be declared as passed and securing the credits in the internships.

### 6.3.6 Evaluation of the Project

a) In case of the Project work, the evaluation shall be based on CIE and SEE. The CIE for 50 marks consists of a minimum of two Seminars / presentations for 20 marks and the Project Report submitted at the end of the semester which is evaluated for 30 marks.

b) A minimum of 25 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as passed in the Project Work and eligible to write the SEE in the Project Work.

c) SEE shall be evaluated in the form of a Viva- voce and the demonstration of the thesis work for 100 marks. Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner to be appointed by the Principal.

d) A minimum of 40 (40%) marks shall be obtained in SEE exclusively in order to be declared as passed in the Project and for the award of the grade.

NOTE : A student who is absent for any Test / Exam / Seminar / Presentation as a part of Continuous Internal Evaluation (CIE), for any reason whatsoever, shall be deemed to have scored zero marks in the respective component and no provision for make-up shall be provided.

**6.4** There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the mandatory course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

**6.5 Course Repetition (Repeater course)**

The students not qualified to write SEE in a course may register for the repeater courses through course repetition and summer semester. The students have to apply to the Principal through the respective HOD by paying prescribed fees.

Course repetition: A student can take up a maximum of two theory courses in a semester immediately after the semester end examinations of that particular semester in accordance with the guidelines recommended by the Academic Council. The students who are not taking regular semester courses may additionally register for one more theory course.

Summer semester: Further the students can register maximum three (theory + lab courses together) courses in the summer semester. Summer semester courses shall be of both even & odd semesters. Summer semester shall be conducted immediately after completion of even semester end examinations.

The HODs concerned have to allot a teacher related to that course to conduct class work. The minimum number of periods to be conducted should not be less than 75% of the total prescribed periods for that course. The classes will be conducted in the vacation period or in the weekends or in the afternoons as decided by the HOD concerned. Teacher has to evaluate the student for his performance in CIE as per the autonomous norms and the qualified students should appear for a semester end examination. The pass criteria in both CIE & SEE should be as per autonomous norms.

The documents for monitoring the candidates registered for course repetition are available with the Heads of the Departments and Exam Section.

**6.6** There shall be five Professional Elective Courses from V Semester to VII and for each elective there shall be choices such that the student shall choose a course from the list of choice courses offered by the department for that particular elective.

**6.7** There shall four be Open Electives / Job Oriented Courses common to all disciplines from V Semester to VII, where in the students shall choose the electives offered by various departments including his/her own department in such a manner that he/she has not studied the same course in any form during the Programme.

The students shall be permitted to pursue up to a maximum of two elective courses (either Professional Elective Courses in clause 6.6 or Open Electives/ Job Oriented Courses in clause 6.7) under MOOCs (Massive Open Online Courses) offered by NPTEL and other reputed organizations as notified by the Department during the semester. Each of the Courses must be of minimum 8/12 weeks in duration. The student has to acquire a certificate for the concerned course from the agency during the semester only in order to earn the credits for that course.

**6.8** There shall be a mandatory **induction program** for three weeks before the commencement of first semester.

**6.9** **Minor in a discipline** (Minor degree/programme) concept is introduced in the curriculum for all conventional B. Tech programmes in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme.

a. i) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

   ii) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

b. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

c. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BOS.

d. There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

e. The concerned BOS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.

f. A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

g. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

h. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BOS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

i. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

j. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

k. A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

l. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in

the transcript.

m. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

n. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

o. Minimum enrollment for a Minor course to be offered is 12

p. Students fulfilling the stipulated criterion can register for a Minor by paying a prescribed registration fee.

**6.10 Honors degree in a discipline:**

**Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.**

a. A student shall be permitted to register for Honors program at the beginning of 4$^{th}$ semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2 semester without any backlogs. In case of the declaration of the 3$^{rd}$ semester results after the commencement of the 4$^{th}$ semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

b. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

c. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

d. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

e. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

f. The concerned BOS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.

g. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2).

h. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the BOS/academic council.

i. The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

j. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

k. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

l. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

m. Minimum enrollment for the Honors to be offered is 12.

n. Students fulfilling the stipulated criterion can register for Honors by paying a prescribed registration fee.

**6.11** National Service Scheme (NSS)/Yoga is compulsory for all the Undergraduate students. The student participation shall be for a minimum period of 45 hours during the first year. Grades will be awarded as Very Good, Good, Satisfactory in the mark sheet on the basis of participation, attendance, performance and behaviour. If a student gets Un-satisfactory grade, he/she has to repeat the above activity in the subsequent years along with the next year students.

**6.12** Students shall undergo two summer internships each for a minimum of six weeks duration at the end of second and third years of the programme for 1.5 credits & 3 credits respectively. The organization in which the student wishes to carry out Internship need to be approved by Internal Department Committee comprising Head of Department and two senior faculty members. The student shall submit a detailed technical report along with internship certificate from the Internship organization in order to obtain the prescribed credits. The student shall submit the Internship Project Report along with Certificate of Internship. The

evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively.

There shall be internal evaluation for 100 marks and there shall not be external evaluation. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty of the department) on the basis of the project report submitted by the student.

Completion of the internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship in the subsequent summer provided that the student doesn't pursue two summer internships in the same summer.

Community Service Project focussing on specific local issues shall be an alternative to the six weeks of summer Internship, whenever there is any emergency and when students cannot pursue their summer internships. The Community Service Project shall be for 6 weeks in duration which includes preliminary survey for 1 week, community awareness programs for one week, community immersion program in consonance with Government agencies for 3 weeks and a community exit report (a detailed report) for one week. The community service project shall be evaluated for 100 marks by the internal departmental committee comprising Head of the Department and two senior faculty of the department. **However, the first priority shall be given to the internship.**

**6.13** There shall also be a mandatory full internship in the final semester (VIII Semester) of the Programme along with the project work. The organization in which the student wishes to carry out the Internship need to be approved by Internal Department Committee comprising Head of the Department and two senior faculty. The faculty of the respective department monitors the student internship program along with project work. At the end of the semester, the candidate shall submit a certificate of internship and a project report. The project report and presentation shall be internally evaluated for 50 marks by the departmental committee consisting of Head of the Department, Project supervisor and a senior faculty member. The Viva-Voce shall be conducted for 100 marks by a committee consisting of HOD, Project Supervisor and an External Examiner.

Completion of internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship along with project work for next six months.

**6.14** There shall be five skill-oriented courses offered during III semester to VII semester. Out of the five skill courses, two shall be skill-oriented programs related to the domain and these two shall be completed in second year. Of the remaining three skill courses, one shall necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

The student can choose between a skill advanced course being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies which are duly approved by the Internal Department Committee. The credits assigned to the skill advanced course shall be awarded to the student upon producing the Course Completion Certificate from the agencies / professional bodies.

The Internal Department Committee comprising Head of Department and two senior faculty shall evaluate the grades / marks awarded for a course by external agencies and convert to the equivalent marks / grades.

**7. Attendance Requirements:**

- A student shall be eligible to appear for semester end examinations (SEE), if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
- Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical ground duly approved by the Principal.
- Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- Further the student must obtain a minimum of 50% attendance in each subject failing which; the student shall not be permitted to write the SEE of that subject. Student has to register this subject through course repetition and satisfy the CIE qualification criteria of attendance and marks in the subsequent semesters.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
- A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

**8. Minimum Academic Requirements:**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7

8.1 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/she secures not less than 15 marks in CIE and 25 marks in SEE. In case of, internships, project work viva – voce, he/she should secure 40% of the total marks. For mandatory courses minimum 15 marks in CIE are to be secured.

8.2 B.Tech students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

One regular and two supplementary examinations of I Semester.
One regular and one supplementary examination of II Semester.
One regular examination of III semester.

Lateral Entry students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

One regular examination of III semester.

8.3 B.Tech students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and four supplementary examinations of I Semester.
One regular and three supplementary examinations of II Semester.
One regular and two supplementary examinations of III Semester.
One regular and one supplementary examinations of IV Semester.
One regular examination of V Semester.

Lateral entry students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and two supplementary examinations of III Semester.
One regular and one supplementary examinations of IV Semester.
One regular examination of V Semester.

And if a student is detained for want of credits for particular academic year by sections 8.2 and 8.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester as the case may be.

8.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained. In case of lateral entry students, the number of credits is 121.

8.5 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

Lateral entry students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

**9. Course Pattern:**

(i) A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

(ii) **With–holding of Results**

If any case of indiscipline or malpractice is pending against candidate, the result of the candidate shall be with held and he/she will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

(iii) **Grading**

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

**Table – Conversion into Grades and Grade Points assigned**

| Range in which the marks in the subject fall | Grade | Grade Points Assigned |
|---|---|---|
| ≥ 90 | S (Superior) | 10 |
| 80-89 | A (Excellent) | 9 |
| 70-79 | B (Very Good) | 8 |
| 60-69 | C (Good) | 7 |
| 50-59 | D (Average) | 6 |
| 40-49 | E (Below Average) | 4 |
| < 40 | F (Fail) | 0 |
| Absent | Ab (Absent) | 0 |

A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains 'Ab' in end examination.

For **mandatory** courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

**10. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)**

(i) The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i \times GP_i}{\sum_{i=1}^{n} C_i}$$

where, $C_i$ is the number of credits of the $i^{th}$ subject and $GP_i$ is the grade point scored by the student in the $i^{th}$ course.

(ii) The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$\text{CGPA} = \frac{\sum_{j=1}^{m} SGPA_j \times TC_j}{\sum_{j=1}^{m} TC_j}$$

where "$SGPA_j$" is the SGPA of the $j^{th}$ semester and $TC_j$ is the total number of credits in that semester.

(iii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

(iv) While computing the SGPA, the subjects in which the student is awarded Zero grade points will also be included.

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

(vi) *Letter Grade:* It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

## 11. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree, he/she shall be placed in one of the following four classes.

| Class Awarded | CGPA Secured |
|---|---|
| First Class with Distinction | ≥ 7.5 |
| First Class | ≥ 6.5 < 7.5 |
| Second Class | ≥ 5.5 < 6.5 |
| Pass Class | ≥ 4.0 < 5.5 |

## 12. Gap Year

Gap year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted by the College to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

## 13. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, and they will be in the academic regulations into which the candidate is presently re-joining.

**14. Minimum Instruction Days**

The minimum instruction days including exams for each semester shall be 90 days.

**15. Medium of Instruction**

The Medium of Instruction is **English** for all courses, laboratories, internal and external examinations and project reports.

**16. Rules of Discipline**

(i) Use of mobile phones with camera, in the campus is strictly prohibited.
(ii) Students shall behave and conduct themselves in a dignified and courteous manner in the campus/Hostels.
(iii) Students shall not bring outsiders to the institution or hostels.
(iv) Students shall not steal, deface, damage or cause any loss to the institution property.
(v) Students shall not collect money either by request or coercion from others within the campus or hostels.
(vi) Students shall not resort to plagiarism of any nature/extent. Use of material, ideas, figures, code or data without appropriate acknowledgement or permission of the original source shall be treated as cases of plagiarism. Submission of material, verbatim or paraphrased, that is authored by another person or published earlier by oneself shall also be considered as cases of plagiarism.
(vii) Use of vehicles by the students inside the campus is prohibited.
(viii) Any conduct which leads to lowering of the esteem of the organization is prohibited.
(ix) Any material to be uploaded to social media sites need to be approved by Head of the Department concerned/Dean/Principal.
(x) Any student exhibiting prohibited behaviour shall be suspended from the institute. The period of suspension and punishment shall be clearly communicated to the student. The student shall lose the attendance for the suspended period
(xi) Dress Code
Boys : All the boy students should wear formal dresses. Wearing T-shirts and other informal dresses in the campus is strictly prohibited.
Girls : All the girls students shall wear saree / chudidhar with dupatta

**17. Punishments for Malpractice cases – Guidelines**

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad

members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

| S.No. | Nature of Malpractice/Improper conduct | Punishment |
|---|---|---|
| 1 | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cellphones, pager, palm computers or any other form of material concerned with or related to the course 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 student which can be used as an aid in the course of the examination). | Expulsion from the examination hall and cancellation of the performance in that course only. |
| 2 | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that course. |
| 3 | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 4 | Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student 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 course only of all the students involved. In case of an outsider, he will be handed over to the police and a case shall be registered against him. |
| 5 | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the student is appearing. | Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. |
| 6 | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. |
| 7 | Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination | Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The student is also debarred |

| | | |
|---|---|---|
| | | for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeit of seat. |
| 8 | Refuses to obey the orders of the Chief 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 of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case shall be registered against them. |
| 9 | Leaves the exam hall taking away answer script or intentionally tears up the script or any part there of inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 10 | Possesses any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat. |
| 11 | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in | For Student of the college: Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and |

| | | |
|---|---|---|
| | any malpractice or improper conduct mentioned in S.No7 to S.No 9. | project work 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 shall be registered against them. |
| 12 | Impersonates any other student in connection with the examination | The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college for one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case shall be registered against him.<br>The performance of the original student who has been impersonated, shall be cancelled in all the courses of the examination including practicals and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. |
| 13 | If any malpractice is detected which is not covered in the above S.No 1 to S.No 12 items, it shall be reported to the college academic council for further action and award suitable punishment. | |
| 14 | Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment. | |

**18.0 ADDITIONAL ACADEMIC REGULATIONS:**

18.1 Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

18.2 When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

19.0 **AMENDMENTS TO REGULATIONS:**

The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations and / or Syllabi, Academic schedules, Examination schedules, Examination pattern, Moderation to students, Special opportunity to complete degree beyond stipulated time and any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

**BAPATLA ENGINEERING COLLEGE: BAPATLA**
***(Autonomous)***
**SCHEME OF INSTRUCTION & EXAMINATION (Semester System)**

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

**For**

## *Mechanical Engineering*

**Effective from the Academic Year 2020-2021 (R20 Regulations)**

**First Year B.Tech (SEMESTER – I)**

| Code No. | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME101/MA01 | Mathematics-I (Linear Algebra and Ordinary Differential Equations) | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME102/PH01 | Physics (Advanced Optics and Material Testing) | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME103/EE01 | Basic Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME104 | Engineering Mechanics-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME105/CS01 | Problem Solving using Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20MEL101/PHL01 | Physics Laboratory | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL102/EEL01 | Basic Electrical and Electronics Engineering Lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL103/CPL01 | Problem Solving Using Programming lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| Induction Program | First Three Weeks (Physical activity, Creative Arts,Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations) | | | | | | | | |
| | **TOTAL** | **15** | **0** | **9** | **24** | **240** | **400** | **800** | **19.5** |

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical

1 Hr. Lecture (L) per week - 1 credit

1 Hr. Tutorial (T) per week - 1 credit

1 Hr. Practical (P) per week - 0.5 credits

2 Hours Practical (Lab)/week - 1 credit

**BAPATLA ENGINEERING COLLEGE: BAPATLA**

***(Autonomous)***

**SCHEME OF INSTRUCTION & EXAMINATION (Semester System)**

**For**

## *Mechanical Engineering*

**Effective from the Academic Year2020-2021 (R20 Regulations)**

**First Year B.Tech (SEMESTER – II)**

| Code No. | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME201/MA02 | Mathematics-II (Numerical Methods and Advanced Calculus) | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME202/CY01 | Engineering Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME203/EL01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME204 | Engineering Mechanics- II | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME205/CE01 | Environmental Studies | 2 | 0 | 0 | 2 | 30 | -- | 30 | 0 |
| 20MEL201/MEL01 | Engineering Graphics | 1 | 0 | 4 | 5 | 30 | 70 | 100 | 3 |
| 20MEL202/CYL01 | Engineering Chemistry Laboratory | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL203/ELL01 | English Communication Skills Laboratory | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL204/MEL02 | Workshop Practice Lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| | NCC/NSS | 0 | 0 | 2 | 2 | -- | -- | -- | 0 |
| | TOTAL | 15 | 0 | 15 | 30 | 450 | 450 | 830 | 19.5 |

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical
MC: Mandatory course

1 Hr. Lecture (L) per week - 1 credit
1 Hr. Tutorial (T) per week - 1 credit
1 Hr. Practical (P) per week - 0.5 credits
2 Hours Practical (Lab)/week - 1 credit

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

## PROPOSED SCHEME OF INSTRUCTION
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech (SEMESTER – III)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME301/MA03 | BS | Mathematics- III | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME302 | PC | Basic manufacturing processes | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME303 | PC | Strength of Materials | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME304/ES | ES | Engineering Thermodynamics | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME305 | PC | Fluid Mechanics &Hydraulic Machines | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20MEL301 | PC | Machine Drawing lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL302 | PC | SM&FM lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL303 | PC | Basic Manufacturing Processes lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20ME306/SO | SO | Pneumatic & Hydraulic drives Lab | 0 | 1 | 2 | 3 | 30 | 70 | 100 | 2 |
| 20ME307/MC | MC | Professional Ethics and Human Values | 2 | 0 | 0 | 2 | 30 | 0 | 30 | 0 |
| | | TOTAL | 17 | 1 | 11 | 29 | 300 | 630 | 930 | 21.5 |

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical
ES- Engineering Science SO- Skill Oriented MC: Mandatory course

1 Hr. Lecture (L) per week - 1 credit
1 Hr. Tutorial (T) per week - 1 credit
1 Hr. Practical (P) per week - 0.5 credits
2 Hours Practical (Lab)/week - 1 credit

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

## PROPOSED SCHEME OF INSTRUCTION
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech (SEMESTER – IV)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME401/BS | BS | Materials Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME402 | PC | Metal Cutting & Machine Tools | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME403 | PC | Kinematics of Machines | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME404 | PC | Applied Thermodynamics | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME405/HS | HS | Industrial Engineering & Management | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20MEL401 | PC | Modeling lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL402 | PC | Fuels & Oil testing lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL403 | PC | Machine shop Practice | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20ME406/SO | SO | Sensorics & Automation | 0 | 1 | 2 | 3 | 30 | 70 | 100 | 2 |
| TOTAL | | | 15 | 1 | 11 | 27 | 270 | 630 | 900 | 21.5 |
| **Honors/Minors course (pool-I)** | | | **3** | **1** | **0** | **4** | **30** | **70** | **100** | **4** |
| **Grand Total** | | | **18** | **2** | **11** | **31** | **300** | **700** | **1000** | **25.5** |

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical

ES- Engineering Science SO- Skill Oriented HS- Humanities and Social Sciences

1 Hr. Lecture (L) per week - 1 credit
1 Hr. Tutorial (T) per week - 1 credit
1 Hr. Practical (P) per week - 0.5 credits
2 Hours Practical (Lab)/week - 1 credit

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

## PROPOSED SCHEME OF INSTRUCTION
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech (SEMESTER – V)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME501 | C | Dynamics of Machines | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME502 | PC | Design of Machine Elements | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME503 | PC | Manufacturing Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME504-PE | PE- I | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME505-OE | OE | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20MEL501 | PC | IC Engines lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL502 | PC | Design and Metrology lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20ME506/ SO | SO | Python Programming | 0 | 1 | 2 | 3 | 30 | 70 | 100 | 2 |
| 20ME507/ MC | MC | Essence of Indian Traditional Knowledge | 2 | 0 | 0 | 2 | 30 | 0 | 30 | 0 |
| 20MEL503/ INT | INT | Summer Internship | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.5 |
| | | TOTAL | 17 | 1 | 8 | 26 | 270 | 560 | 830 | 21.5 |
| **Honors/Minors course (pool-II)** | | | **3** | **1** | **0** | **4** | **30** | **70** | **100** | **4** |
| **Grand Total** | | | **20** | **2** | **8** | **30** | **300** | **630** | **930** | **25.5** |

**Professional Elective-I**

1. Advanced Strength of Materials
2. I.C. Engines & Gas Turbines
3. Nano Technology
4. Non-Destructive Evaluation

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

## PROPOSED SCHEME OF INSTRUCTION
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech (SEMESTER – VI)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME601 | PC | Automation in Manufacturing | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME602 | PC | Design of Transmission Elements | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME603 | PC | Heat Transfer | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME604-PE | PE -II | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME605-OE | OE | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20MEL601 | PC | Heat Transfer lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL602 | PC | CAE lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20MEL603 | PC | CAM lab | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 1.5 |
| 20ME606/SS | SS | English Department | 0 | 0 | 3 | 3 | 30 | 70 | 100 | 2 |
| 20ME607/MC | MC | Constitution of India | 2 | 0 | 0 | 2 | 30 | 0 | 0 | 0 |
| | | TOTAL | 17 | 0 | 12 | 29 | 300 | 630 | 930 | 21.5 |
| **Honors/Minors course (pool-III)** | | | **3** | **1** | **0** | **4** | **30** | **70** | **100** | **4** |
| **Grand Total** | | | **20** | **1** | **8** | **33** | **330** | **700** | **1030** | **25.5** |

**Professional Elective-II**

1. Finite Element Analysis
2. Advanced Manufacturing
3. Turbo Machinery
4. Operations Research

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

***(Autonomous)***
**PROPOSED SCHEME OF INSTRUCTION**
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech (SEMESTER – VII)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20ME701-PE | E-III | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME702-PE | PE-IV | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME703-PE | PE-V | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME704-OE | OE | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME705-OE | OE | | 3 | 0 | 0 | 3 | 30 | 70 | 100 | 3 |
| 20ME706-HSE | HSE | | 2 | 0 | 2 | 4 | 30 | 70 | 100 | 3 |
| 20ME707/SA | SA | 3D Printing | 0 | 1 | 2 | 3 | 30 | 70 | 100 | 2 |
| 20MEL701/ INT | INT | Summer Internship | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| TOTAL | | | 17 | 1 | 04 | 22 | 210 | 490 | 700 | 23 |
| **Honors/Minors course (pool-IV)** | | | **3** | **1** | **0** | **4** | **30** | **70** | **100** | **4** |
| **Grand Total** | | | **20** | **2** | **4** | **26** | **240** | **560** | **800** | **27** |

| **Professional Elective-III**<br>**20ME701-PE** | **Professional Elective-IV**<br>**20ME702-PE** | **Professional Elective-V**<br>**20ME703-PE** | **Humanities and Social Sciences Elective**<br>**20ME706-HSE** |
|---|---|---|---|
| 1. Mechanical Vibrations<br>2. Industrial Robotics<br>3. Power Plant Engineering<br>4. Refrigeration &Air Conditioning. | 1. Composite Materials<br>2. Automobile Engineering<br>3. Product Design and Development<br>4.Operations Management | 1.Mechatronics<br>2. Advanced Materials<br>3.Computer Integrated Manufacturing<br>4. Computational Fluid Dynamics | 1.Engineering Economics & Financial Analysis<br>2. Entrepreneurship Development<br>3. Optimisation Techniques<br>4. Management Information Systems |

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

**SCHEME OF INSTRUCTION & EXAMINATION (Semester System)**
**For**
***Mechanical Engineering***
**(R20 Regulations)**
**Second Year B.Tech(SEMESTER – VIII)**

| Code No. | Category Code | Subject | Scheme of Instruction (Hours per week) | | | | Scheme of Examination (Maximum marks) | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | CIE | SEE | Total Marks | |
| 20MEL801 | PROJ | Project Work | 0 | 0 | 0 | 0 | 50 | 100 | 150 | 12 |
| **Honors/Minors course (MOOCs-1)** | | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** |
| **Honors/Minors course (MOOCs-2)** | | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** |
| **Grand Total** | | | **0** | **0** | **0** | **0** | **50** | **100** | **150** | **16** |

*Students can complete Project work @ Industries/ Higher Learning Institutions/ APSSDC.

* Students has to Select 12 week MOOC's (NPTEL/Swayam) Program in opting the Programme Course Electives, for a maximum of two MOOC's (NPTEL/Swayam) Program's out of five Programme Course Electives.

**List of Open Electives**

| | |
|---|---|
| **Open Elective-I**<br>1. Green energy Systems<br>2. Optimization Techniques<br>3.Engineering Economics & Financial Analysis<br>4. Finite Element Analysis | **Open Elective-II**<br>1. Additive Manufacturing<br>2.Automobile Engineering<br>3. Project Management<br>4. Mechatronics |
| **Open Elective-III**<br>1. Total Quality Management<br>2. Product Design & Development<br>3. Entrepreneurship Development<br>4. Advanced Materials | **Open Elective-IV**<br>1. Supply chain Management<br>2. Nano Technology<br>3. Industrial Robotics<br>4. Fluid Power& Control Systems |

**List of Honors courses**

| | |
|---|---|
| **Pool-I**<br>Advanced Mechanics of Fluids<br>Advanced Manufacturing Processes<br>Analysis and Synthesis of Mechanisms<br>Advanced Thermodynamics<br>Gear Engineering | **Pool -II**<br>Experimental Methods in Fluid Mechanics<br>Computer Integrated Manufacturing<br>Green Engineering<br>Fuzzy Logic and Neural Networks<br>Processing of Polymers and Composites |
| **Pool –III**<br>Computational Fluid Dynamics<br>Lean Manufacturing<br>Robotics and Control<br>Food Processing & Preservation<br>Additive Manufacturing | **Pool -IV**<br>Microfluidics<br>Manufacturing Automation<br>Vibration and Noise Control<br>Design of Heat Transfer Equipment<br>Product Design And Process Planning |

*For obtaining Honors/Minors, the students has to complete two MOOC's (NPTEL/Swayam) Programs of eight weeks each, in-addition to the four courses scheduled in the course structure, not exceeding two courses out of the total six courses, in a semester.

## DEPARTMENT OF MECHANICAL ENGINEERING
## MINOR COURSES OFFERED BY MECHANICAL ENGINEERING:

| | SUBJECT | Pre-requisites | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | Engineering Thermodynamics | NIL | 4 | 0 | 0 | 4 |
| 2 | Manufacturing Science | NIL | 4 | 0 | 0 | 4 |
| 3 | Mechanics of Solids and Fluids | Engineering Mechanics | 4 | 0 | 0 | 4 |
| 4 | Kinematics and Dynamics of Machines | Engineering Mechanics | 4 | 0 | 0 | 4 |
| 5 | Applied Thermodynamics | Engineering Thermodynamics | 4 | 0 | 0 | 4 |
| 6 | Heat Transfer | Engineering Thermodynamics | 4 | 0 | 0 | 4 |
| 7 | Automobile Engineering | Engineering Thermodynamics | 4 | 0 | 0 | 4 |
| 8 | Fundamentals of Mechanical Design | Engineering Mechanics | 4 | 0 | 0 | 4 |
| 9 | Smart Materials | Material Science | 4 | 0 | 0 | 4 |
| 10 | CAD/CAM | Basic Engg Drawing | 4 | 0 | 0 | 4 |
| 11 | Robotics | Engineering Mechanics | 4 | 0 | 0 | 4 |
| 12 | Mechatronics | BEE | 4 | 0 | 0 | 4 |

**MATHEMATICS-I**

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

**(Linear Algebra and Ordinary Differential Equations)**
20ME101/MA01
***I$^{st}$ Year B. Tech. First Semester***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To learn about solving a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors
2. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and higher order ordinary differential equations.
3. Create and analyse mathematical models using first and second order differential equations to solve application problems that arises in engineering.
4. To learn about solving linear Differential equations with constant coefficients with the given initial conditions using Laplace transform technique.

**Course Outcomes:** Students will be able to

1. To learn about solving a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors.
2. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and higher order ordinaryDifferential equations.
3. Create and analyze mathematical models using first and second order differential equations to solve application problems that arises in engineering.
4. To learn about solving linear Differential equations with constant coefficients with the given initial conditions using Laplace transform technique

**UNIT-I**

**Linear Algebra**: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).

[Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

[12 Hours]

**UNIT-II**

**Differential Equations of first order**: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli‟s equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation M dx+ N dy=0. Applications of a first order Differential equations: Newton‟s law of cooling; Rate of decay of Radio-active materials.

[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6;

12.8] [12 Hours]

**UNIT-III**

**Linear Differential Equations**: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.

[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5] [12 Hours]

**UNIT-IV**

**Laplace Transforms:** Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by $t^n$; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace transforms.

[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

[12 Hours]

**TEXT BOOKS**

1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

**REFERENCE BOOKS**

1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 1 | | | | | | | | | | 1 | |
| CO2 | 3 | 1 | | 1 | | | | | | | | | | 1 | |
| CO3 | 3 | 3 | | 2 | | | | | | | | | | 2 | |
| CO4 | 3 | 3 | | 2 | | | | | | | | | | 3 | |

20ME102/PH01

*I^st Year B. Tech. First Semester*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To circulate the knowledge about the advanced optics and know its Engineering applications.
2. To familiarize the basis of quantum theory and to make students to solve the physical problems.
3. To classify solids and to have a basic idea about the structural determination of crystals.
4. To make aware of some of the analytical techniques for material testing.

**Course Outcomes:**

1. Student's ability to understand the principles in the production and application of lasers and their effective utilization in optical communications.
2. Students demonstrate appropriate competence and working knowledge of laws of modern physics in understanding advanced technical engineering courses.
3. Students demonstrate the ability to apply knowledge of band theory of solids and to make understand the concept of energy band gap and hole.
4. Ability to understand the crystal geometrics and estimation of crystal structure by X-ray diffraction technique.
5. Student's ability to understand the principle in the production and applications of ultrasonics and extend it for material testing using various nuclear techniques.

**UNIT-I**

**ADVANCED OPTICS**

**Lasers:** Interaction of radiation with matter. Einstein co-efficient, Properties of laser, Population inversion, LASER principle, pumping schemes-Three level and four level laser, Types of lasers: solid-state lasers (Ruby), gas lasers (He-Ne), Semiconductor lasers; applications of lasers in industry and medicine.

**Fibre Optics:** Importance of optical fibre, Structure and principle of optical fibre, acceptance angle and numerical aperture, Types of optical fibres based on modes and refractive index, V-number, losses associated with optical fibres, fibre optical communication, advantages of optical fibres

**UNIT-II**

**Quantum Mechanics**

Dual nature of light, de-Brogli‟s concept of matter waves, Davisson-Germer electron diffraction experiment, Heisenberg Uncertainty principle and applications (non-existence of electron in a nucleus and finite width of spectral lines), one dimensional time- independent and dependent Schrödinger wave equations, physical significance of wave function, applications of time-

independent Schrödinger wave equation to particle in a box (one dimensional), tunneling, the scanning tunneling microscope.

**UNIT-III**

**Band theory of solids and Structure determination**

**Band theory of Solids**: Failures of classical free electron theory, success and failures of quantum free electron theory, Bloch theorem statement, Kronig-Penny model (without derivation), effective mass of electron, concepts of energy band gap and hole.

**Structure determination:** Crystal lattices (Bravias), Crystal systems and structures, planes, Miller indices, Bragg‟s law, structural analysis of crystals using X-Ray powder diffraction method (XRD).

**UNIT-IV**

**Ultrasonics and Nuclear Techniques**

**Ultrasonics**: Properties of ultrasonics, General applications of ultrasonics.

**Applications of Ultrasonic Testing**: Weld inspection, Material analysis, corrosion testing, concrete under water measurements, Ultrasonic testing in the foundry industry.

**NDT**: Production of Ultrasonic waves, Pulse echo technique, time of flight diffraction technique, A –scan presentation, B- scan presentation, C –scan presentation.

**Nuclear Techniques**: Nuclear radio isotopes, Applications of radio isotopes (medical and industry) Properties of α,β,ɤ-rays and radiographic testing (NDT).

**TEXT BOOKS**

1. A Text Book of Engineering Physics ,M.N.Avadhanulu& P. Kshirsagar, S.Chand& Co., (Edition – 2013).
2. Engineering physics by S.O.Pillai

**REFERENCE BOOKS**

1. Engineering physics by R .K.Gour and S.L.Gupta. Dhanpatrai publications.
2. Engineering physics by M .R.Sreenivasan. New age international publications
3. Engineering physics by Palaniswamy. Scitechpublications.
4. Basic engineering physics – Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya publication
5. Applied physics - Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya publication
6. Engineering physics by Dr.D.Thirupathi Naidu, M. Veeranjaneyulu.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |

# BAPATLA ENGINEERING COLLEGE:: BAPATLA
**(Autonomous)**

**Basic Electrical and Electronics Engineering**
20ME103/EE01
***I$^{st}$ Year B. Tech. First Semester***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
| Continuous Internal Assessment | : | 30 | Semester End Examination (3 Hours) | : | 70 | | |

**Prerequisites:** Mathematics, Physics

**Course Objectives:**

CO1: To understand basic Laws in circuits, analysis of simple DC circuits, Theorems and its applications, fundamentals of AC circuits & its analysis and concepts of three phase balanced circuits.

CO2: To learn basic properties of magnetic materials and its applications.

CO3: To understand working principle, construction, applications and performance of DC machines and AC machines.

CO4: To learn basic concepts, working principal, characteristics and applications of semiconductor diode and transistor family.

CO5: To gain knowledge about the static converters and regulators.

CO6: To learn basic concepts of power transistors and operational amplifiers closer to practical applications.

**Course Outcomes:** Students will be able to

CO1: Solve problems involving with DC and AC excitation sources in electrical circuits.

CO2: Compare properties of magnetic materials and its applications.

CO3: Analyze construction, principle of operation, application and performance of DC machines and AC machines.

CO4: Explore characteristics and applications of semiconductor diode and transistor family.

CO5: Make the static converters and regulators.

CO6: Analyze concepts of power transistors and operational amplifiers closer to practical applications.

## UNIT – I

**Electrical Circuits**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation.Superposition, Thevenin and Norton Theorems. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three-phase balanced circuits, voltage and current relations in star and delta connections.

## UNIT –II

**Electrical Machines (18 hours)**

Magnetic materials, BH characteristics, Construction, working of DC machines, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.Auto-transformer. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, DOL starter. Single-phase induction motor.Construction and working of synchronous generators.

## UNIT-III

**Semiconductor Diodes and applications**

Semiconductor materials, semiconductor diode, Resistance levels, Diode equivalent circuits, Zener diode, Light emitting diode, Load line analysis, half wave rectification, Full wave rectification, Use of capacitor filter in rectifier, Zener diode voltage regulator, Clippers, Clampers

**Bipolar Junction Transistors**

Transistor construction and operation, Common base configuration, Transistor amplifying action, Common emitter configuration, Common collector configuration, Limits of operation.

## UNIT-IV

**Field Effect Transistors**

Construction and characteristics of JFET and MOSFET

**Operational Amplifiers**

Introduction, Differential and common mode operation, OP-AMP Basics, Practical OP-AMP circuits: Inverting amplifier, Non inverting amplifier, Unity follower, summing amplifier, Integrator and differentiator.

**TEXT BOOK**:

1. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publications
2. Robert L. Boylestad& Louis Nashelsky, ' Electronic Devices and circuit theory', PHI Pvt.Limited, 11th edition
3. "Basics of Electrical and Electronics Engineering", Nagsarkar T K and Sukhija M S, Oxford press University Press.

**Reference Books:**

1. David A. Bell, 'Electronic Devices and Circuits', oxford publisher,5th edition
2. "Basic Electrical, Electronics and Computer Engineering", Muthusubramanian R, Salivahanan S and Muraleedharan K A, Tata McGraw Hill, Second Edition, (2006).

## CO-PO MAPPING

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |

| Lectures | 2 | Tutorial | 1 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | : | 30 | Semester End Examination (3 Hours) | | | : | 70 |

**Prerequisites:** None

**Course Objectives:**
To introduce the students to basic laws and principles of Engineering Mechanics with emphasis on the analysis and application to practical Engineering problems, where bodies and systems are in static equilibrium.

**Course Outcomes:** After the completion of the course the students will be able to
1. Find the resultant and analyse the equilibrium of a coplanar concurrent and parallel force systems.
2. Find the resultant and analyse the equilibrium of a general force systems and apply Coulombs laws of dry friction and analyse bodies and systems subjected to coplanar forces.
3. Deduce the centroids of areas bounded by curves & composite areas.
4. Find the moment of inertias of areas bounded by curves & composite areas.

## UNIT I

**Introduction:**
Engineering Mechanics - Units and dimensions - Method of problem solution and the accuracy of solutions.
**Concurrent forces in a plane:**
Principles of statics - Composition and resolution of forces - Equilibrium of concurrent forces in a plane - Method of projections - Method of moments.
**Parallel forces in a plane:**
Couple - Resultant and Equilibrium of parallel forces in a plane.

## UNIT II

**General case of forces in a plane:**
Composition of forces in a plane - Equilibrium of forces in a plane - Analysis of trusses: Method of joints
**Friction:**
Introduction - Laws of dry friction - Problems involving dry friction: Connected bodies on rough horizontal and inclined planes, Ladder friction and Wedge friction.

## UNIT III

**Centroid, Centre of Mass and Centre of Gravity:**
Concept of Centroid, Centre of Mass and Centre of Gravity - Centroid of two-dimensional bodies - Problems on locating centroids of simple and composite plane figures and curves – Pappus theorems.

## UNIT IV

**Moments of Inertia of Plane figures:**

Moments of inertia of a plane figure with respect to an axis in its plane and an axis perpendicular to the plane of the figure - Parallel axis theorem - Moments of inertia of simple and composite figures.

**TEXT BOOKS:**

1. Engineering Mechanics (in SI units) by S Timoshenko, D H Young, J V Rao and SukumarPati, McGraw Hill Education, 5th edition, 2016.
2. Engineering Mechanics: Statics and Dynamics by A K Tayal, Umesh publications, 14th edition, 2015.

**REFERENCE BOOKS:**

1. Vector mechanics for Engineers: Statics and Dynamics by Ferdinand Beer, E Russell Johnston Jr, David Mazurek, Phillip Cornwell, Brian Self and SanjeevSanghi, McGraw Hill Education, 11th edition, 2017.
2. Engineering Mechanics: Statics and Dynamics by R C Hibbeler, Pearson, 14th edition, 2017.
3. Engineering Mechanics (Statics) by J L Meriam and L G Kraige, Wiley student edition, 7th edition.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | | | | | | | | 2 | 3 | |
| CO2 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| CO3 | 3 | 2 | | | | | | | | | | 1 | 2 | 2 | |
| CO4 | 3 | 2 | | | | | | | | | | 1 | 2 | 2 | |

***I Year B. Tech. First Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:** students will be able to

1. Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
2. Develop problem-solving skills to translate "English" described problems into programs written using C language.
3. Use Conditional Branching, Looping, and Functions.
4. Apply pointers for parameter passing, referencing and differencing and linking data structures.
5. Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File.

**Course Outcomes:** After completion of the course the students will be able to

1. Choose the right data representation formats based on the requirements of the problem.
2. Analyse a given problem and develop an algorithm to solve the problem.
3. Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.
4. Write the program on a computer, edit, compile, debug, correct, recompile and r unit.
5. Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

**UNIT-I**

Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing I/O Operations.Decision Making and Branching.

**Programming Exercises:** C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers.Computationofdiscountamountondifferenttypesofproductswithdifferent discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its upper case.

**UNIT-II**

Decision Making and Looping, Arrays, Character Arrays and Strings.

**Programming Exercises for Unit II:** To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number.To print graphic patterns of symbols and numbers.To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

**UNIT-III**

User-defined Functions, Structures and Unions, Pointers

**Programming Exercises for Unit - III:** Functions - Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers.

**UNIT-IV**

File Management in C, Dynamic Memory Allocation, Pre-processor

**Programming Exercises for Unit - IV**: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

**TEXT BOOKS**

1. Kernighan BW and Dennis Ritchie M, "C programming language", 2nded, Prentice Hall.
2. Yashavant P. Kanetkar, "Let us C", BPB Publications.
3. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata Mcgraw-Hill.
4. Ashok N.Kamthane, "Programming in C", PEARSON 2nd Edition.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 2 | 1 | | | | | | | | 2 | 2 |
| CO2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | | | | | | 1 | 2 | 2 |
| CO3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | | | | | | 2 | 2 | 2 |
| CO4 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | | | | | | 1 | 2 | 2 |

## PHYSICS LABORATORY

20MEL101/PHL01

***I$^{st}$ Year B. Tech.First Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**LIST OF EXPERIMENTS**

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands.
4. Determination of radius of curvature Plano convex lens by forming Newton rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.
8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using sonometer.
10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.

**Any three experiments are virtual**

**TEXT BOOK**:

1. Engineering physics laboratory manual P.Srinivasarao&K.Muralidhar, Himalaya publications.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |

## BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

20MEL102/EEL01

***I Year B. Tech. First Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

Lab experiments

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Parameters of choke coil
6. Measurement of low and medium resistance using volt ampere method
7. Study on various parts of DC and AC machines
8. OC & SC test of single-phase transformer
9. Load test on single phase transformer
10. V-I characteristics of PN junction Diode
11. V-I characteristics of Zener Diode
12. Characteristics of CE Configuration
13. Transfer and Drain Characteristics of JFET
14. Calculation of Ripple factor using Half wave rectifier
15. Calculation of Ripple factor using Full wave rectifier
16. Nonlinear wave shaping – clippers/clampers

Note: Minimum 10 experiments should be carried.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |

**PROBLEM SOLVING USING PROGRAMMING LAB**

20MEL103/CSL01

***I$^{st}$ Year B. Tech. First Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if-else statement).

| **Domestic Customer:** | | |
|---|---|---|
| **Consumption Units** | **Rate of Charges(Rs.)** | |
| 0 – 200 | 0.50 per unit | |
| 201 – 400 | 100 plus | 0.65 per unit |
| 401 – 600 | 230 plus | 0.80 per unit |
| 601 and above | 390 plus | 1.00 per unit |
| **Commercial Customer:** | | |
| **Consumption Units** | **Rate of Charges(Rs.)** | |
| 0 – 100 | 0.50 per unit | |
| 101 – 200 | 50 plus | 0.6 per unit |
| 201 – 300 | 100 plus | 0.70 per unit |
| 301 and above | 200 plus | 1.00 per unit |

2. Write a C program to evaluate the following (using loops):
   a) $1 + x^2/2! + x^4 / 4!+ \ldots$upto ten terms
   b) $x + x^3/3! + x^5/5!+ \ldots$ upto ten terms
3. Write a C program to check whether the given number is
   a) Prime or not.
   b) Perfect or Abundant or Deficient.

4. Write a C program to display statistical parameters (using one – dimensional array).
   a) Mean
   b) Mode
   c) Median
   d) Variance.

5. WriteaCprogramtoreadalistofnumbersandperformthefollowingoperations
   a) Print the list.
   b) Delete duplicates from the list.
   c) Reverse the list.
6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message “Element not found in the List”.

7. Write a C program to read two matrices and compute their sum and product.

8. Write a C program to read list of student names and perform the following operations

   a) To print the list of names.

b) To sort them in ascending order.
c) To print the list after sorting.

9. Write a C program that consists of recursive functions to

a) Find factorial of a given number
b) Solve towers of Hanoi with three towers ( A, B & C) and three disks initially on tower A.

10. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required ,if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.

11. Write a C program to read a data file of students' records with fields (Regd. no, Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

12. Write a C program to read a file as command line argument and count the given word frequency in a file

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 2 | 2 | 1 | | | | | | | | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | | | | | | | 2 | 2 |
| CO3 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | | | | | | | 2 | 2 |
| CO4 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | | | | | | | 2 | 2 |

**MATHEMATICS II**
(Numerical Methods And Advanced Calculus)
20ME201/MA02
***I$^{st}$Year B. Tech. Second Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To learn about some advanced numerical techniques e.g. solving a nonlinear equation, linear system of equations, Interpolation and Approximation techniques.
2. To learn about evaluation of double and triple integrals and their applications.
3. To learn some basic properties of scalar and vector point functions and their applications to line, surface and volume integrals.

**Course Outcomes:** Students will be able to

1. Tolearn about some advanced numerical techniques e.g. solving a nonlinear equation, linear system of equations.
2. To learn about some Interpolation and Approximation techniques.
3. To learn about evaluation of double and triple integrals and their applications.
4. To learn some basic properties of scalar and vector point functions and their applications to line, surface and volume integrals.

**UNIT-I**

**Numerical Solution of Equations**: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi‟s iterative method, Gauss-Seidel iterative method.

[Sections: 28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1;28.7.2]. [12 Hours]

**UNIT-II**

**Finite differences and Interpolation**: Finite differences: Forward differences, Backward differences; Newton‟s interpolation formulae: Newton‟s forward interpolation formula, Newton‟s backward interpolation formula; Interpolation with unequal intervals; Lagrange‟s interpolation formula; Divided differences; Newton‟s divided difference formula; Numerical integration; Trapezoidal rule; Simpson‟s one-third rule; Simpson‟s three-eighth rule; Numerical solution of ODE‟s: Introduction; Picard‟s method; Euler‟s method; Runge-Kutta method.

[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.2; 32.4; 32.7]. [12 Hours]

**UNIT-III**

**Multiple Integrals**: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integrals, Change of variables.

[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2]. [12 Hours]

**UNIT-IV**

**Vector calculus and its Applications:** Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green‟s theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem(without proof).

[Sections: 8.4; 8.5.1; 8.5.3; 8.6; 8.11; 8.12; 8.13; 8.14; 8.16] [12 Hours]

**TEXT BOOKS**

1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

**REFERENCE BOOKS**

1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 1 | | | | | | | | | | 2 | |
| CO2 | 3 | 2 | | 2 | | | | | | | | | | 2 | |
| CO3 | 3 | 3 | | 2 | | | | | | | | | | 1 | |
| CO4 | 3 | 3 | | 2 | | | | | | | | | | 1 | |

## ENGINEERING CHEMISTRY

20ME202/CY01

***I st Year B. Tech. Second Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. With the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.

2. To understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
3. With the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics.
4. With aim to gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

**Course Outcomes:** Students will be able to

1. Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion.
3. Have the capacity of applying energy sources efficiently and economically for various needs.
4. Design economically and new methods of organic synthesis and substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.

**UNIT-I**

**Water chemistry** **15hrs**

**Introduction:** water quality parameters

**Characteristics**: Alkalinity, Hardness - Estimation & simple numerical problems, **Boiler Troubles** - Sludges, Scales, Caustic embrittlement, boiler corrosion, Priming and foaming;

**Internal conditioning**- phosphate, calgon and carbonate methods.

**External conditioning** - Ion exchange process & Zeolite proess

WHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration. Disinfection methods: Chlorination, ozonization and UV treatment.

Salinity – Treatment of Brackish water by Reverse Osmosis and Electro-dialysis.

**UNIT-II** **15hrs**

**Thermodynamic functions**: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.

**Corrosion:** Types of corrosion - Chemical or dry corrosion, Electrochemical or wet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion, **Corrosion control** – Cathodic protection, and electro plating (Au) &electoless Ni plating.

**UNIT-III**

**Fuels** **15hrs**

Classification of fuels; Calorific value of fuels (lower, higher)

**Solid fuels**: Determination of calorific value (Bomb Calorimeter) & related problems, Coal ranking,

**Liquid Fuels:** Petroleum refining and fractions, composition and uses. Knocking and anti-knocking Agents, Octane number and Cetane number; Bio fuels- Biodiesel, general methods of preparation and advantages

**Gaseous fuels:** CNG and LPG, Flue gas analysis – Orsat apparatus.

**UNIT-IV**

**Organic reactions and synthesis of a drug molecule**

Introduction to reactions involving substitution ($SN^1$, $SN^2$), addition (Markownikoff‟s and anti-Markwnikoff‟s rules) , elimination ($E_1$& $E_2$), Synthesis of a commonly used drug molecule.(Aspirin and Paracetamol)

**Polymers:** Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications**.** Plastics: Thermoplasts and thermosetting plastics, Bskelite and PVC. Bio degradable polymers: types, examples-Polyhydroxybuterate (PHB), Polyhydroxybuterate-co-β-hydroxyvalerate (PHBV), applications.

**TEXT BOOKS**

1. P.C. Jain and Monica Jain, “Engineering Chemistry” DhanpatRai Pub, Co., New Delhi 17th edition (2017).
2. SeshiChawla, “Engineering Chemistry ”DhanpatRai Pub, Co LTD, New Delhi 13th edition, 2013.

**REFERENCE BOOKS**

1. Essential Of Physical Chemistry by ArunBahl, B.S. Bahl, G.D.Tuli, byArunBahl, B.S. Bahl, G.D.Tuli, Published byS Chand Publishers, 12th Edition, 2012.
2. Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
3. Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | | | 2 | 3 | | | | | | 2 | | |
| CO2 | 3 | 3 | 2 | | | 2 | 2 | | | | | | | | |
| CO3 | 3 | 3 | | | | 2 | 3 | | | | | | | | |
| CO4 | 3 | 3 | 2 | | | 2 | 1 | | | | | | | | 1 |

**COMMUNICATIVE ENGLISH**

20ME203/EL01

***I st Year B. Tech. Second Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**UNIT-I**

1.1 **Vocabulary Development**: Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes
1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles
1.3 **Basic Writing Skills**: Punctuation in writing
1.4 **Writing Practices**: Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

**UNIT-II**

2.1 **Vocabulary Development**: Synonyms and Antonyms
2.2 **Essential Grammar**: Concord, Modal Verbs, Common Errors
2.3 **Basic Writing Skills**: Using Phrases and clauses
2.4 **Writing Practices**: Hint Development, Essay Writing

**UNIT-III**

3.1 **Vocabulary Development**: One word Substitutes
3.2 **Essential Grammar**: Tenses, Voices
3.3 **Basic Writing Skills**: Sentence structures (Simple, Complex, Compound)
3.4 **Writing Practices**: Note Making

**UNIT-IV**

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors
4.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
4.4 **Writing Practices**: Paraphrasing &Summarising

**REFERENCE BOOKS**


- Communication Skills, Sanjay Kumar &PushpaLatha. Oxford University Press:2011.
- Practical English Usage, Michael Swan. Oxford University Press:1995.
- Remedial English Grammar, F.T.Wood. Macmillan:2007.
- Study Writing, Liz Hamplyons& Ben Heasley. Cambridge University Press:2006


**Course Objectives**

The course aims

1. at enhancing the vocabulary competency of the students
2. to enable the students to demonstrate proficiency in the use of written English, including proper spelling, grammar, and punctuation
3. to enhance theoretical and conceptual understanding of the elements of grammar
4. understand and apply the conventions of academic writing in English
5. to enhance the learners' ability of communicating accurately and fluently

**Course Outcomes**

1. able to build academic vocabulary to enrich their writing skills
2. produce accurate grammatical sentences

3. make inferences and predictions based on comprehension of a text
4. discuss and respond to content of the text in writing
5. produce coherent and unified paragraphs with adequate support and detail

*CO-PO Mapping*

| CO/PO | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 2 | | 4 | | 3 |
| 2 | | | | | | | 2 | 2 | | 4 | 4 | 3 |
| 3 | | | | | | | 2 | 2 | | 4 | 4 | 3 |
| 4 | | | | | | | | 2 | | 4 | 4 | 3 |
| 5 | | | | | | | 3 | 2 | | 4 | 3 | 3 |

**Engineering Mechanics – II**

20ME204

***I$^{st}$ Year B. Tech. Second Semester***

| Lectures | 2 | Tutorial | 1 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | : | 30 | Semester End Examination (3 Hours) | : | 70 | | |

**Course Objectives:**
To introduce the students to the principles of particle and rigid body dynamics in terms of kinematics and kinetics, with emphasis on the analysis and application to practical Engineering problems limited to motion in a plane.

**Course Outcomes:** After the completion of the course the students will be able to
1. Develop relationships between different parameters of motion of a particle in a plane to analyse rectilinear and curvilinear motions.
2. Analyze the motion parameters and forces acting on a particle by relating them using Newton's laws of motion and dynamic equilibrium concept.
3. To relate the motion parameters and forces acting on a particle using the principles of work & energy, impulse & momentum and derive the mass moment of inertia of 3D bodies.
4. Develop relationships between different parameters of motion and the forces to analyse bodies undergoing fixed axis rotation and general plane motion.

## UNIT I

**Kinematics of Particle: Rectilinear Translation**
Introduction to Dynamics – Displacement, Velocity and Acceleration – Graphical representations – Motion with uniform acceleration – Motion with variable acceleration.
**Kinematics of Particle: Curvilinear Translation**
Introduction – Position vector, Velocity and Acceleration – Components of motion: Rectangular and Normal & tangential.

## UNIT II

**Relative Motion**
Introduction – Relative motion between two particles: Position, Velocity and Acceleration.
**Kinetics of Particle: Equations of motion**
Equations of rectilinear motion – D'Alembert's principle in rectilinear motion - Equations of curvilinear motion: Rectangular components and Normal & tangential components - D'Alembert's principle in curvilinear motion.

## UNIT III

**Kinetics of Particle: Work and Energy – Impulse and Momentum – Impact**
Introduction – Principle of work and energy – Potential energy and conservative forces – Principle of conservation of energy – Principle of impulse and momentum – Conservation of momentum – Direct central impact.
**Moment of Inertia of Material bodies:**
Moment of inertia of a rigid body – Moment of inertia of laminas – Moment of inertia of three dimensional bodies: Solid right circular cone, Solid cylinder and Sphere

## UNIT IV

**Kinematics of Rigid Body:**
Introduction – Rotation – Parameters of motion of a body rotating about a fixed axis – General plane motion – Absolute and relative velocity in plane motion – Instantaneous centre of rotation in plane motion.
**Kinetics of Rigid Body: Equations of motion**
Introduction – Equations of motion – Relation between translatory motion and rotary motion of a body in plane motion – D'Alembert's principle in plane motion.

**TEXT BOOKS:**

3. Engineering Mechanics (in SI units) by S Timoshenko, D H Young, J V Rao and SukumarPati, McGraw Hill Education, 5th edition, 2016.
4. Engineering Mechanics: Statics and Dynamics by A K Tayal, Umesh publications, 14th edition, 2015.

**REFERENCE BOOKS:**

4. Vector mechanics for Engineers: Statics and Dynamics by Ferdinand Beer, E Russell Johnston Jr, David Mazurek, Phillip Cornwell, Brian Self and SanjeevSanghi, McGraw Hill Education, 11th edition, 2017.
5. Engineering Mechanics: Statics and Dynamics by R C Hibbeler, Pearson, 14th edition, 2017.
6. Engineering Mechanics (Dynamics) by J L Meriam and L G Kraige, Wiley student edition, 7th edition.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| CO2 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| CO3 | 2 | 2 | | | | | | | | | | 2 | 2 | 2 | |
| CO4 | 3 | 2 | | | | | | | | | | 2 | 2 | 2 | |

## ENVIRONMENTAL STUDIES

20MC01/CE01

***I Year B. Tech. Second Semester***

| Lectures | 2 | Tutorial | 0 | Practical | 0 | Credits | 0 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | NILL |

**Course Objectives:**

1. To develop an awareness, knowledge, and appreciation for the natural environment.
2. To understand different types of ecosystems exist in nature.
3. To know our biodiversity.
4. To understand different types of pollutants present in Environment.
5. To know the global environmental problems.

**Course Outcomes:** Students will be able to

1. Develop an appreciation for the local and natural history of the area.
2. Hope for the better future of environment in India which is based on many positive factors like Biodiversity, successive use of renewable energy resources and other resources, increasing number of people's movements focusing on environment.
3. Know how to manage the harmful pollutants.
4. Gain the knowledge of Environment.
5. Create awareness among the youth on environmental concerns important in the long-term interest of the society

**UNIT-I**

**Introduction:** Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries). *6 periods*

**Biodiversity:** Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. *Chipko movement case study* *6 periods*

**UNIT-II**

**Natural resources: Land**: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. **Forest**: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. **Water**: Uses, floods and drought, Dams - benefits and problems.

**Energy**: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. *Silent Valley Project and Narmada BachaoAndolan case studies8 periods*

**Sustainability:** Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.*6 periods + 6 hours field work/Demonstration*

**UNIT-III**

**Pollution:** Definition; Causes, effects and control of air, water and nuclear pollution; *Chernobyl Nuclear Disaster* case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermin-composting. *12 periods*

**Environmental acts:** Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act. *6 periods*

**UNIT-IV**

**Environmental issues:** Green house effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment. Environmental Standards (ISO 14000, etc.) *12 periods*

**Case Studies:** Bhopal Tragedy, Mathura Refinery and TajMahal, and Ralegan Siddhi (Anna Hazare). *6 periods*

**Field work:** Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture. *6 periods*

**TEXT BOOKS**

1. "Environmental Studies" by Benny Joseph, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. "Comprehensive environmental studies"- JP Sharma, Laxmi Publications.
3. Text Book of environmental Studies – ErachBharucha

**REFERENCE BOOKS**

1. "Environmental studies", R.Rajagopalan, Oxford University Press.
2. "Introduction to Environmental Science", Anjaneyulu Y, B S Publications
3. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |

## ENGINEERING GRAPHICS

20MEL201/MEL01

***I Year B. Tech. Second Semester***

| Lectures | 1 | Tutorial | 0 | Practical | 3 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. Clear picture about the importance of engineering graphics in the field of engineering
2. The drawing skills and impart students to follow Bureau of Indian Standards
3. To give an idea about Geometric constructions, Engineering curves, orthographic projections and pictorial projections
4. Imagination skills about orientation of points, lines, surfaces and solids
5. Basic drafting skills of AutoCAD

**Course Outcomes:** After completion of the course the students will be able to

1. Draw projections of points and projections of lines using Auto CAD
2. Plot projections of surfaces like circle, square and rhombus
3. Plot the Projections of solids like Prisms and pyramids
4. Convert the of Orthographic views into isometric views and vice-versa of simple objects

**UNIT-I**

**INTRODUCTION:** Introduction to Drawing instruments and their uses, geometrical construction procedures

**INTRODUCTION TO AUTOCAD:**

Basics of sheet selection, Draw tools, Modify tools, dimensioning

**METHOD OF PROJECTIONS:** Principles of projection - First angle and third angle projection of points. Projection of straight lines.Traces of lines.

**UNIT-II**

**PROJECTIONS OF PLANES:** Projections of plane figures: circle, square, rhombus, rectangle, triangle, pentagon and hexagon.

**UNIT-III**

**PROJECTIONS OF SOLIDS:** Projections of Cubes, Prisms, Pyramids, Cylinders and Cones Inclined to one plane.

**UNIT-IV**

**ISOMETRIC PROJECTIONS:** Isometric Projection and conversion of Orthographic views into isometric views. (Treatment is limited to simple objects only).

**UNIT-V**

**ORTHOGRAPHIC PROJECTIONS:** Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

**TEXT BOOKS**

1. Engineering Drawing with AutoCAD by Dhananjay M. Kulkarni (PHI publication)
2. Engineering Drawing by N.D. Bhatt & V.M. Panchal. (Charotar Publishing House, Anand). (First angle projection)

**REFERENCE BOOKS**

1. Engineering Drawing by Dhananjay A Jolhe, Tata McGraw hill publishers
2. Engineering Drawing by Prof.K.L.Narayana& Prof. R.K.Kannaiah.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | | | | | | | | | | 1 | 1 | 2 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 2 | 3 | 2 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 1 | 2 | 3 | | | | | | | | | | 1 | 3 | 2 |
| CO4 | 1 | 2 | 1 | | | | | | | | | | 1 | 2 | 2 |

## ENGINEERING CHEMISTRY LABORATORY

20MEL202/CYL01

***I$^{st}$ Year B. Tech. Second Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**LIST OF EXPERIMENTS**

1. **Introduction to Chemistry Lab** (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. and error, accuracy, precision, theory of indicators, use of volumetric titrations).
2. **Volumetric Analysis:**
    a. Estimation of Washing Soda.
    b. Estimation of Active Chlorine Content in Bleaching Powder
    c. Estimation of Mohr's salt by permanganometry.
    d. Estimation of given salt by using Ion-exchange resin using Dowex-50.
3. **Analysis of Water:**
    a. Determination of Alkalinity of Tap water.
    b. Determination of Total Hardness of ground water sample by EDTA method
    c. Determination of Salinity of water sample
4. **Estimation of properties of oil:**
    a. Estimation of Acidic Value.
    b. Estimation of Saponification Value.
5. **Preparations:**
    a. Preparation of Soap
    b. Preparation of Urea-formaldehyde resin
    c. Preparation of Phenyl benzoate
6. **Demonstration Experiments (Any two of the following):**
    a. Determination of $p^H$ of given sample.
    b. Determination of conductivity of given sample by conductometer.
    c. Potentiometric Determination of Iron.

**TEXT BOOK**:

1. Practical Engineering Chemistry by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad, 2009.
2. Inorganic quantitative analysis, Vogel, $5^{th}$ edition, Longman group Ltd. London, 1979.

**REFERENCE BOOKS:**

1. Text Book of engineering chemistry by R.n.Goyal and HarrmendraGoel.
2. A text book on experiments and calculations- Engineering Chemistry. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

**Course Outcomes:**

1. Familiar with fundamental basics of Chemistry lab
2. Ability to estimate purity of washing soda, bleaching powder and quantity of Iron and other salts.
3. Gain the knowledge regarding the quality parameters of water like salinity, hardness, alkalinity etc.
4. Ability to prepare high polymers and soap.
5. Able to analyse the given oil for saphonification and iodine value.
6. Ability to understand the estimation of quality parameters by instrumentation technics.

## CO-PO MAPPING

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | | | | |
| CO2 | 2 | 2 | 2 | 2 | | 2 | | | | | | 1 | | | |
| CO3 | 2 | 2 | 2 | 2 | | 2 | | | | | | 1 | | | |
| CO4 | 2 | 2 | 2 | 2 | | | | | | | | 1 | | | |
| CO5 | 2 | | | 2 | | | | | | | | 1 | | | |
| CO6 | 2 | 2 | 2 | 2 | | | | | | | | 1 | | | |

## ENGLISH COMMUNICATION SKILLS LABORATORY

20MEL203/ELL01

***I$^{st}$ Year B. Tech. Second Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**UNIT-I**

1.1 Listening Skills; Importance – Purpose- Process- Types
1.2 Barriers to Listening
1.3 Strategies for Effective Listening

**UNIT-II**

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds
2.2 Stress
2.3 Rhythm
2.4 Intonation

**UNIT-III**

3.1 Formal and Informal Situations
3.2 Expressions used in different situations
3.3 Introducing Yourself & Others-Greeting & Parting-Congratulating-Giving Suggestions & Advices-Expressing Opinions-Inviting People-Requesting-Seeking Permission-Giving Information- Giving Directions- Sympathizing- Convincing People- Complaining & Apologizing-Thanking Others- Shopping- Travelling- Conversational Gambits

**UNIT-IV**

4.1 JAM Session
4.2 Debates
4.3 Extempore

**REFERENCE BOOKS:**


- Communication Skills, Sanjay Kumar and PushpaLata. Oxford University Press. 2011
- Better English Pronunciation, J.D. O‟ Connor. Cambridge University Press:1984
- New Interchange (4rth Edition), Jack C Richards. Cambridge University Press: 2015v English Conversation Practice, Grant Taylor. McGraw Hill:2001


**SOFTWARE:**

- Buzzers for conversations, New Interchange series
- English in Mind series, Telephoning in English
- Speech Solutions, A Course in Listening and Speaking

**Course Objectives**

1. to comprehend the importance, barriers and strategies of listening skill in English.
2. to illustrate and impart practice Phonemic symbols, stress and intonation.
3. to practice oral skills and receive feedback on learners' performance.
4. to practice language in various contexts through pair work, role plays, group work and dialogue conversations.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 3 | 4 | 4 | 4 | 3 | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | | | | | | | | | | 4 | 3 | 3 | | | |
| CO3 | | | | | | | | 3 | 4 | 4 | 3 | 3 | | | |
| CO4 | | | | | | | | 3 | 4 | 4 | 4 | 3 | | | |

## WORKSHOP PRACTICE

20MEL204/MEL02

***I$^{st}$ Year B. Tech. Second Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To impart student knowledge on various hand tools for usage in engineering applications.
2. Be able to use analytical skills for the production of components.
3. Design and model different prototypes using carpentry, sheet metal and welding.
4. Make electrical connections for daily applications.
5. To make student aware of safety rules in working environments.

**Course Outcomes:** After completion of this course student should be able to:

1. Make half lap joint, Dovetail joint and Mortise &Tenon joint
2. Produce Lap joint, Tee joint and Butt joint using Gas welding
3. Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools
4. Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring.

**SYLLABUS:**

1. Carpentry
   a. Half Lap joint
   b. Dovetail joint
   c. Mortise &Tenon joint
2. Welding using electric arc welding process/gas welding
   a. Lap joint
   b. Tee joint
   c. Butt joint
3. Sheet metal operations with hand tools
   a. Trapezoidal tray
   b. Funnel
   c. T-joint
4. House wiring
   a. To control one lamp by a single switch
   b. To control two lamps by a single switch
   c. Stair-case wiring

**TEXT BOOKS:**

1. P.Kannaiah and K.L.Narayana, Workshop Manual, SciTech Publishers, 2009.
2. K. Venkata Reddy, Workshop Practice Manual, BS Publications, 2008.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | 2 | | 2 | | | 1 | | 2 | 1 | 2 | 3 |
| CO2 | 2 | 3 | 2 | | 2 | | 2 | | | 1 | | 2 | 1 | 2 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 2 | 3 | 2 | | 2 | | 2 | | | 1 | | 1 | 1 | 2 | 3 |
| CO4 | | | 2 | | 2 | | 2 | | | 1 | | 1 | | | 2 |

**R20**

## PROBABILITY AND STATISTICS

**20ME301/MA03**

***II Year B. Tech. (Mech) ---- Semester III***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Continuous Internal Assessment | 30 | Semester End Examination (3 Hours) | 70 |

| | |
|---|---|
| CO1 | Understand various continuous probability density functions and apply them to various problems in science and engineering. |
| CO2 | Estimate the point and interval estimators of the mean, variance and proportion for the given Sample data and apply Z-test, t-test to various real life problems |
| CO3 | Apply various sample tests like $\chi 2$ -test and F test for decision making regarding the population based on sample data to different realistic problems. |
| CO4 | Compute the level of correlation, the linear relationship for the given bivariate data and the best fit curve to the given data by the method of least squares. Also perform multiple regression analysis to the regression model arising in the field of engineering. |

**UNIT – I**

**Probability Densities**: Continuous Random Variables, The Normal Distribution, The Normal Approximation to the Binomial Distribution, The Uniform Distribution, The Gamma Distribution, The Beta Distribution, TheWeibull distribution, Joint Distributions- Discrete and Continuous.

**(Sections 5.1, 5.2, 5.3, 5.5,5.7, 5.8, 5.9, 5.10 of the Text Book)** [12 Hours]

**UNIT – II**

**Sampling Distributions**: Populations and Samples, The sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance.
**Inferences Concerning a Mean**: Point estimation, Interval estimation, Tests of Hypotheses, Null Hypotheses and Tests of hypotheses, Hypothesis concerning one mean.

**(Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6 of the Text Book)** [12 Hours]

**UNIT-III**

**Comparing Two Treatments**: Comparisons-Two independent Large samples, Comparisons-Two independent small samples, Matched pairs comparisons.
**Inferences Concerning Variances**: The estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances.
**(Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3 of the Text Book)** [12 Hours]

**UNIT –IV**
**Inferences Concerning Proportions**: Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions.
**Regression Analysis**: The method of least squares,Curvilinear regression, Multiple regression, Correlation.

**(10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6 of theText Book)** [12 Hours]

**Text Book**: Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI.

**Reference Book:** Probability & Statistics for Engineers and Scientists', 6th Edition, PHI, R.E Walpole, R.H. Myers & S.L. Myers.

## CO-PO Mapping

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | 2 | | | | | | | | | 1 | | |
| CO2 | 3 | 2 | | 2 | | | | | | | | | 3 | | |
| CO3 | 3 | 2 | | 3 | | | | | | | | | 3 | | |
| CO4 | 2 | 2 | | 3 | | | | | | | | | 2 | | |

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To enable students to understand basic casting processes used in the manufacturing industry.
2. To learn various aspects of different advanced casting techniques and their applicability in the modern manufacturing industries.
3. To obtain a broad knowledge in different welding and joining techniques and their applications.
4. To calculate of power and design requirements in sheet metal and metal forming operations.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to

1. Recommend the particular casting process required to be selected for a specific engineering application.
2. Design and model the required gating system for a given casting process.
3. Select a specific welding process to minimize defects and to develop sound joint.
4. Understand and design the metal working processes to produce wrought products.

**UNIT-I**

**METAL CASTING:** Introduction, advantages of casting method, pattern types, pattern materials and allowances. (6)

**SAND MOULDING:** Moulding Procedure, moulding materials and equipment, types of sand, properties, preparation, control and testing of moulding sands. (8)

**UNIT-II**

**GATING DESIGN:** Design Considerations and problems. (6)

**SPECIAL CASTING METHODS:** Permanent Mould Casting, Die Casting, Centrifugal casting, Investment casting, shell moulding, $CO_2$ process and continuous casting. Fettling of castings, casting defects: causes, remedies and testing. (10)

**UNIT-III**

**WELDING:** Gas and arc welding - Principles of oxy-acetylene welding, oxyacetylene flame cutting, MMAW (Manual metal arc welding), TIG, MIG, submerged arc welding. Resistance welding principles - Butt welding, Spot welding, Seam welding. Thermit Welding, Electro slag welding. Laser beam welding. Brazing & Soldering, welding defects - causes and remedies. (15)

**UNIT-IV**

**METAL WORKING PROCESSES:** Introduction, Hot and Cold working of metals. Rolling, Forging, Extrusion, Tube making, Swaging, Spinning, Coining, Embossing and Wire drawing. (6)

**SHEET METAL WORKING OPERATIONS:** Introduction, Types of Sheet metal working operations, Blanking and Punching operations, Clearance and shear as applied to

Punching/Blanking operations, Simple related problems, High energy rate forming of metals, Bending, deep drawing. (9)

**TEXT BOOKS**

1. Manufacturing Technology-Vol- I by P. N. Rao, TMH Publishers
2. Fundamentals of Modern Manufacturing – Mikell P. Groover, John Wiley & Sons Inc.,
3. Manufacturing Science - Amitabha Ghosh, Asok Kumar Mallik, Prentice Hall

**REFERENCE BOOKS**

1. Principles of Metal Casting - Heine, Loper, Rosenthal, TMH, Publishers
2. Welding Technology – Richard Little, TMH Publishers
3. Principles of Welding: Processes, Physics, Chemistry, and Metallurgy - Robert W. Messler Jr,. John Wiley & Sons Inc.,
4. Manufacturing Engineering & Technology - Kalpakjian, Pearson Education / PHI

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | | | | | | | 1 | 2 | | 2 | 2 | 1 |
| CO2 | 2 | | 1 | 2 | | | | 2 | | 1 | 1 | | 3 | 1 | |
| CO3 | 3 | 2 | 1 | | | | | | | 1 | | | 2 | | 2 |
| CO4 | 3 | | 2 | | | | | 1 | | 2 | | | 2 | 2 | |

**Strength of Materials**
**20ME303**
***II Year B. Tech. Third Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | : | 30 | Semester End Examination (3 Hours) | | | : | 70 |

**Prerequisites:** None

**Objective:** The objective of the course is to provide basic knowledge to analyze the various structural members subjected to axial, torsional and bending loads with respect to stresses, strains and deflections in order to facilitate design of members of structures.

**Course Outcomes:**

After undergoing this course the student should be able to

1. Understand the basic terms used in this course and be in a position to calculate the stresses and strains in determinate and indeterminate axially loaded members.
2. Determine the diameter of a shaft when it is transmitting certain power keeping in mind the stresses and deformations produced and also draw the S.F. and B.M. diagrams for statically determinate beams.
3. Calculate the stresses, strains and deflections of various types of beams.
4. Determine the principal and maximum shear stress in a member when it is in plane stress and find the buckling loads for long columns with different end connections.

**UNIT-I**

**TENSION, COMPRESSION AND SHEAR:** Introduction to Mechanics of materials, normal stress and strain, stress strain diagram for mild steel, elasticity and plasticity, linear elasticity, Hooke's law and Poisson's ratio, shear stress and strain and their sign conventions, allowable stresses and allowable loads. (9)

**AXIALLY LOADED MEMBERS:**Introduction, changes in lengths of axially loaded members (including bars with varying loads and dimensions), Statically indeterminatestructures– Flexibility method. (6)

**UNIT-II**

**TORSION:** Introduction, torsion of circular bars, non-uniform torsion, transmission of power by circular shafts. (5)

**SHEAR FORCE AND BENDING MOMENT:** Introduction, Types of Beams, Loads and Reactions. Shear force and bending moment, relationships between load, Shear force and bending moment, S.F. and B.M. diagrams for loads other than varying loads. (10)

**UNIT-III**

**STRESSES IN BEAMS:** Introduction, longitudinal strains and normal stresses in beams (flexural formula) (6)

**DEFLECTIONS OF BEAMS**: Introduction, Differential Equations of the Deflection Curve, Deflections by Integration of the Bending Moment Equation, Moment Area Method, Macaulay's Method. (9)

**UNIT-IV**

**ANALYSIS OF PLANE STRESSES:** Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress, Hooke's law for plane stress. (8)

**COLUMNS:**Introduction, concept of elastic stability, end conditions, Euler's theory for Columns with different end supports, Limitations of Euler's Formula, Rankine's Formula. (7)

**TEXT BOOKS**

1. 'Mechanics of Materials' by James M Gere, Thomson Brooks/Cole
2. 'Strength of Materials' by Dr. Sadhu Singh, Khanna Publishers.

**REFERENCE BOOKS**

1. 'Strength of materials' by G.H. Ryder: MacMillan India Ltd. publishers.
2. 'Mechanics of Materials' by Beer and Johnston, Published by McGraw-Hill Education.
3. 'Strength of Materials' by L.S.Srinath, Macmillan Publishers India
4. Strength of Materials by William A. Nash, Merle C. Potter, Schaum's Outline Series

| Course | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 2 | | 2 | | | | | | | | 3 | 2 | |
| **CO2** | 3 | | 2 | | 3 | | | | | | | | 3 | 2 | |
| **CO3** | 3 | | 2 | | 3 | | | | | | | | 3 | 2 | |
| **CO4** | 3 | | 2 | | 2 | | | | | | | | 3 | 2 | |

## ENGINEERING THERMODYNAMICS
## 20ME304/ES
## II Year B.Tech(Mech) Third semester

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Continuous Internal Assessment | 30 | Semester End Examination (3 Hours) | 70 |

**Course Objectives:**
To make the students:

1. To Understand the fundamental concepts and laws of thermodynamics.
2. To apply the laws of Thermodynamics.
3. To Understand the Concepts of Entropy and Availability.
4. To demonstrate the Gas power cycles and IC Engines.

**Course Outcomes:**
Upon successful completion of the course, the student will be able

1. To discuss the fundamental concepts and laws of thermodynamics.
2. To illustrate the application of laws of Thermodynamics.
3. To describe the Concepts of Entropy and Availability.
4. To describe the Gas power cycles and IC Engines.

**UNIT-I**

**FUNDAMENTAL CONCEPTS AND DEFINITIONS:** Introduction, Macroscopic and microscopic points of view, Thermodynamic system and control volume, Perfect gases, properties and state of a substance, Thermodynamic equilibrium and Quasi-static Process, Thermodynamic path, cycle, Path function and Point function, Internal energy and Enthalpy work and heat, Displacement work, Displacement work in various Quasi-Static processes, Forms of Work transfer. (10)

**LAWS OF THERMODYNAMICS:** zeroth law of thermodynamics, first law of thermodynamics and second law of thermodynamics (4)

**UNIT-II**

**FIRST LAW OF THERMODYNAMICS:** First law of thermodynamics for a closed system undergoing a cycle and a change of state, Energy- A property of the system, First law analysis for a closed system (Non-flow processes). Steady flow energy equation and its application to engineering equipment, Limitations of first law of thermodynamics, PMM of first kind. (7)

**SECOND LAW OF THERMODYNAMICS:** Heat engines and Refrigerators, Statements of Second law, PMM of second kind, reversible and irreversible processes, factors that render a process irreversible, Carnot cycle, Carnot theorem and its corollaries, Thermodynamic temperature scale. (7)

**UNIT-III**

**ENTROPY**: Inequality of Classius, Entropy change in reversible process, T-ds relations, Entropy change of a system during an irreversible process, Principle of increase of entropy, Applications, Entropy change of an ideal gas. (9)

**AVAILABILITY AND IRREVERSIBILITY**: Available and unavailable energy, Helmholtz & Gibb's function, Availability Function for a non-flow Process, Availability Function of Flow Processes, Irreversibility. (5)

**UNIT-IV**

**GAS POWER CYCLES:** Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycle. Brayton cycle. (6)

**INTERNAL COMBUSTION ENGINES:** Introduction, Basic engine nomenclature, Classification, Working of SI and CI engines (Both 4-stroke and 2-stroke engines).

**TEXT BOOKS**

1. Engineering Thermodynamics- P.K.Nag, TMH, New Delhi.
2. Thermal Science and Engineering- D.S.kumar, S.K.Katariapubl, New Delhi.
3. Thermodynamics—Rajput, LaxmiPubl, New Delhi.

**REFERENCE BOOKS**

1. Fundamentals of Engineering Thermodynamics-Rathakrishnan-PHI, New Delhi.
2. Thermodynamics -- J.P.Holman, MGH, New York.
3. Engineering Thermodynamics—Cengel& Boles, TMH

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | 2 | | | | | | | 1 | | |
| CO2 | 2 | 2 | | 1 | | | 1 | | | | | | 1 | 2 | |
| CO3 | 2 | 1 | | | | | 1 | | | | | | 1 | 2 | |
| CO4 | 2 | 2 | 1 | | | 1 | 1 | | | | | | 1 | 2 | |

**FLUID MECHANICS & HYDRAULIC MACHINES**

**20ME305**

***II Year B.Tech. (Mech) Third Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

To make the students to

1. Interpret the properties of fluids, fluid statics and kinematics.
2. Discuss dynamics of fluid flow and pipe flow.
3. Explain impact of jets and hydraulic turbines.
4. Demonstrate the working of reciprocating and centrifugal pumps

**Course Outcomes:**

After completion of the course the student will be able to:

1. Describe the static and kinematics of fluid flow.
2. Demonstrate dynamics of fluid flow and analyse pipe flow
3. Analyse the impact of jets on vanes and hydraulic turbines.
5. Illustrate the working principles of reciprocating and centrifugal pumps

**UNIT-I**

**INTRODUCTION:** Definition of fluid, Properties of a fluid – density, specific weight, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, Classification of fluids. (4)

**FLUID STATICS:** Pressure, variation of pressure in a fluid, measurement of pressure – simple and differential manometers, pressure head, Pascal's law, Total pressure and center of pressure on plane surfaces, Introduction to Buoyancy and Metacentric height. (5)

**FLUID KINEMATICS:** Velocity and acceleration of fluid particle, types of fluid flow, Description of flow pattern, velocity potential, stream function, flow net, continuity equation in Cartesian coordinates. (5)

**UNIT-II**

**FLUID DYNAMICS:** Introduction, Euler's equation of motion, Bernoulli's equation, Pitot tube, venturimeter, Introduction to orifice- various coefficients of an orifice. Impulse momentum Principle, Equation and Application - Force on pipe bend. (7)

**FLOW THROUGH PIPES:** Reynolds experiment, Darcy-Wiesbach equation, minor losses, pipes in series and parallel, transmission of power through a pipe, water hammer. (7)

**UNIT-III**

**IMPACT OF JETS:** Introduction, angular momentum principle, Force exerted by a fluid jet on stationary and moving flat plate and curved vanes, flow over radial curved vanes. (7)

**HYDRAULIC TURBINES:** Classification of turbines, Heads and efficiencies of a turbine, , Pelton, Francis and Kaplan turbines- Working, proportions of turbines, Introduction to draft tube theory, unit quantities, Specific speed. (7)

**UNIT-IV**

**RECIPROCATING PUMPS:** Types, Working principle, Power required by a Reciprocating pump, Coefficient of discharge, Slip and negative slip, Effect of Acceleration of piston on velocity and pressure in suction and delivery pipes, Indicator diagram, Maximum speed of a reciprocating pump. Introduction to Air vessels. (7)

**CENTRIFUGAL PUMPS:** Types, Working, Reciprocating vs. Centrifugal pump, Work done by impeller, Head of a pump, losses and efficiencies, Minimum starting speed, Specific speed, Multistage pumps, Pumps in parallel, Cavitation (7)

**TEXT BOOKS**

1. Hydraulics and fluid mechanics -P.N. Modi&S.M.Seth, Standard Book House, New Delhi.
2. Fluid Mechanics and hydraulic machines-R.K.Bansal

**REFERENCE BOOKS**

1. Fluid Mechanics and Fluid machines – Agarwal, TMH.
2. Fluid mechanics and fluid power engineering - D.S.Kumar, SK Kataria& Sons, New Delhi.
3. Fluid mechanics including Hydraulic machines - A.K.Jain. 4. Fluid Mechanics-K.L.Kumar

**CO-PO MAPPING**

| Course Outcomes | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 1 | | 1 | 1 | | | | | | 2 | 2 | |
| CO2 | 2 | 3 | 1 | 2 | | 2 | 2 | | | | | | 2 | 2 | |
| CO3 | 2 | 3 | 1 | 2 | | 2 | 2 | | | | | | 2 | 2 | |
| CO4 | 2 | 2 | 2 | 1 | | 2 | 1 | | | | | | 2 | 1 | |

**MACHINE DRAWING LAB**
**20MEL301**
***II Year B. Tech. (Mech) Third Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

To make the students

1. To understand the different commands in the drafting module of CAD software
2. To create sectional views of machine parts
3. To model the 2D part drawing of machine components.
4. To generate the 2D assemblies of machine components

**Course Outcomes:**

After completing the course, the student should be able to:

1. Execute steps required for 2D modelling.
2. Use of dimensioning of part models.
3. Sketch the parts of machine components.
4. Develop the assemblies of various machine components.

**Course Content:** 2D Drafting using any of the modelling packages

**List of Exercises**

1. Sectional views
2. Drafting of knuckle joint
3. Drafting of Universal coupling
4. 2D part drawing of machine components
5. 2D assemblies of machine components

**TEXT BOOKS**

1. A Text book of "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy New Age International (P) Ltd., Publishers; Sixth edition, 2019.
2. Engineering Drawing by N.D. Bhatt & V.M. Panchal. Charotar Publishing House Pvt Ltd., Fifty Third edition, 2014.

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | | | | | | | | | 2 | |
| CO2 | 2 | 1 | | | | | | | | | | | | 2 | |
| CO3 | 2 | 2 | | | | | | | | | | | | 2 | |
| CO4 | 2 | 2 | | | | | | | | | | | | 1 | |

## STRENGTH OF MATERIALS & FLUID MECHANICS LAB

**20MEL302**

***II Year B. Tech. (Mech) Third Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

**1.** To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures

2. To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

**Course Outcomes:**

After completion of the course student will be able to

1. Determine the mechanical properties like tensile strength, hardness and impact test under various conditions
2. Measure discharge in pipes and identification of type of flow.
3. Verify the Bernoulli's equation and determine energy loss in conduits
4. Evaluate the characteristics of turbines and pumps

**LIST OF EXPERIMENTS**

**Strength of Materials Lab**

1. Determination of shear strength on mild steel bar using UTM.
2. Find young's modulus using simply supported beam on steel and wood.
3. Find young's modulus using cantilever beam on steel.
4. Calculate rigidity modulus for the spring by using deflection formula.
5. Evaluate shear modulus by conducting torsion test on a mild steel bar.
6. Charpy test.
7. Conduct hardness tests (B.H.T & R.H.T.) on steel and brass specimens.
8. Tension test on U.T.M. to find elastic properties.

**Fluid Mechanics Lab**

1. Verification of Bernoulli's theorem
2. Venturi meter Determination of coefficient of discharge
3. Determination of friction factor for pipes of different materials
4. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion.
5. Measurement of force due to impact of jets on vanes of different types.
6. Performance study on Pelton turbine
7. Performance studies on single acting reciprocating pump
8. Performance studies on single stage centrifugal pump

**Note:** A minimum of 6 experiments shall be done and recorded from each lab.

| Course Outcomes | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | | | | | | | | | 2 | 2 | 1 |
| CO2 | 2 | 1 | 3 | 2 | | | | | | | | | 2 | 2 | 1 |
| CO3 | 2 | 2 | 2 | 3 | | | | | | | | | 2 | 2 | 1 |
| CO4 | 2 | 2 | 3 | 2 | | | | | | | | | 2 | 1 | 1 |

## BASIC MANUFACTURING PROCESSES LAB

**20MEL303**

*II Year B. Tech. (Mech) -III Semester*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objective:**

Basic Manufacturing Lab includes experiments in the areas of foundry, patternmaking, fitting and operations on lathe machines. Preparation of wooden pattern using carpentry tools and making sand mold using pattern enables the student to know the necessity of pattern, mold during the preparation of casting. Basic machining operations carried out using lathe machines equip the student's practical knowledge on machining of metals.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to

1. Prepare sand mould for different components using simple patterns.
2. Acquire knowledge on several fits and prepares different types of fitting joints.
3. Acquires practical knowledge on basic machining operations and can machine metals using lathe machines by selecting appropriate machining operation.
4. Prepare threads on a given surface of metallic rods

**Experiments**

1. Paring sand mould of stepped cone pulley
2. Preparing sand mould of hand wheel
3. Preparing sand mould of bush.
4. Cutting MS plate and preparing V-joint
5. Cutting MS plate and preparing square joint
6. Cutting MS plate and preparing dovetail –joint
7. Plain turning, facing and chamfering of an MS rod.
8. Step turning of an MS rod
9. Taper turning of an MS rod
10. Right –hand and left-hand thread cutting on an MS rod
11. Eccentric turning of an MS rod
12. Knurling and counter turning of an MS rod.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 1 | | | | | | | | | 1 | 1 | 1 | 1 |
| CO2 | 1 | 1 | | | | | | | | | | 1 | 1 | | |
| CO3 | 1 | 1 | 1 | | | | | | | | | 1 | 1 | 1 | |
| CO4 | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | | 2 | |

## PNEUMATIC & HYDRAULIC DRIVES LAB
**20ME307/SO**

***II Year B. Tech. (Mech) Third Semester***

| Lectures | 0 | Tutorial | 1 | Practical | 2 | Credits | 2 |
|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Continuous Internal Assessment | 30 | Semester End Examination (3 Hours) | 70 |

**Course Objectives:**

1. To understand the importance and applications of fluid power in industrial automation.
2. To get familiarized with the theoretical concepts like the process of power generation, transmission, and control of hydraulic and pneumatic drives.
3. To identify and select different components used in fluid power circuits.
4. To build Pneumatic and Hydraulic circuits for different applications and trouble shoot them.

**Course Outcomes:**

Upon Completion of the course the student will be able to

1. Understand the basic principles and applications of different components of pneumatic and hydraulic systems and identify the common hydraulic and pneumatic components, their uses and symbols.
2. Conduct experiments to identify pressure intensification and flow characteristics of single rod hydraulic cylinder.Assemble electrohydraulic circuits for hydraulic motor and check valve to know their applications in hydraulic drive systems.
3. Build and operatepneumatic circuits to gain knowledge aboutdifferent actuation methods, speed regulation andposition-time-pressure control.
4. Designand operate electro pneumatic circuits to perform experiments on AND, OR, Latching and signal overlapping functions.

**THEORY**

Overview of Fluid power:Introduction, Fluid Power, Basic Law, Application of Fluid Power, Advantages of Fluid Power Systems, Types of Fluid Power Systems. Hydraulic Systems: Pumps – Gear Pumps and Vane Pumps. Selection and Specification of Pumps. Hydraulic Actuators: Linear and Rotary Actuators.Control and Regulation Elements: Pressure, Flow and Direction Control Valves. Maintenance of Hydraulic Systems, Trouble Shooting of Hydraulic System.Introduction to Pneumatic Systems: Pneumatic fundamentals, Pneumatic Components and Pneumatic Circuits.

LIST OF EXPERIMENTS

**Hydraulics**

1. Pressure intensification of a single rodcylinder
2. Flow characteristics of a single rodcylinder
3. Characteristics of a Hydraulicmotor
4. Working of aHydraulic accumulator
5. Application of a check valve with manual operations

Pneumatics

1. Direct control, indirect control and speed regulation of a double actingcylinder.
2. Displacement, pressure and time dependent control of a double actingcylinder.
3. Basic circuits with AND function, OR function and electriclatching.
4. Sequential control of 2 double-acting cylinders without signals overlapping.
5. Sequential control of 2 double-acting cylinders with signals overlapping.

**TEXT BOOKS**

1. Andrew Parr, “Pneumatics and Hydraulics", Jaico Publishing House,1999.
2. Antony Esposito, "Fluid power with Applications", Sixth edition- Pearson education, 2000
3. W.Bolton,” Pneumatic and Hydraulic systems” Butterworth-Heinemann

**REFERENCE BOOKS**

1. Practice for professional‘s pneumatics trainee‘s manual-BOSCH-REXROTH.
2. Practice for professional‘s electro pneumatics trainee‘s manual-BOSCHREXROTH.
3. Project manual on industrial hydraulics-BOSCH-REXROTH

**WEB PAGE REFERENCES**

1. https://www.grc.nasa.gov/www/k-12/WindTunnel/Activities/Pascals_principle.html
2. http://www.vickers.sh.cn/pdfs/M-SRSR-MC001-E.pdf
3. http://file.seekpart.com/keywordpdf/2011/3/31/20113319837232.pdf
4. http://www.associatedgroups.com/EATON-CAT/pdfs/i3155s.pdf

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | 1 | | | | 1 | | |
| CO2 | 1 | | | | | | | | 1 | | | | 1 | | |
| CO3 | 1 | | | | | | | | 1 | | | | 1 | | |
| CO4 | 1 | | | | | | | | 1 | | | | 1 | | |

| Lectures | 2 | Tutorial | 0 | Practical | 0 | Credits | 0 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 0 |

**Course Objectives :**

1. To Understandthe human values of professionals
2. To study the Engineering Ethics and uses of ethical theories
3. To know the safety and risk
4. To deal with Global issues and to familiarize with Code of Ethics of several professional bodies

**Course Outcomes:**

Upon successful completion of the course, the student will be able

1. To apply ethics and Human Values in their professional career
2. To deal with various Variety of moral issues and Moral dilemmas
3. To know the problems encountered with Engineering Experimentation.
4. To realize various global issues and also to familiarize with the responsibilities of professional societies.

**Unit I** **7 Periods**

**Human Values**: Morals, Values and Ethics, Integrity, Work Ethic, Civic Virtue, Respect for others, Caring, Sharing, Honesty, Valuingtime, Empathy, Self Confidence, Character, Professionalism

**UNIT-II** **7 Periods**

**Engineering Ethics:**Senses of Engineering Ethics, Variety of Moral Issues, Types of Inquiry,Moral Dilemmas, Moral Autonomy, Kohlberg ‘s Theory, Gilligan ‘s Theory

**UNIT-III** **7 Periods**

**Engineering as Social Experimentation:** Engineering as Experimentation, Engineers asResponsible Experimenters, Safety, Responsibility and Rights: Safety and Risk – Assessmentof Safety and Risk, Risk Benefit Analysis and Reducing Risk.

**UNIT-IV** **7 Periods**

**Global Issues:**Multinational Corporations, Environmental Ethics, Computer Ethics, Weapon Development,

Sample codes of Ethics like ASME, IEEE, and Institution of Engineers(India)

**TEXT BOOKS**

1. Govindarajan. M, Natarajan. S, Senthilkimar.V.S, Engineering Ethics, PHI, 2004.
2. M.P.Raghavan, ProfessionalEthics and Human Values, Scitech Publications(India)Pvt.ltd., 2009.

**REFERENCE BOOKS**

1. Mike Martin and Roland Schinzinger, Ethics In Engineering, McGraw Hill, New York 1996.
2. Charles D Fleddermann, Engineering Ethics, Prentice Hall, New Jersey, 2004

**CO - PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 1 | | 1 | 2 | 1 | | | | | |
| CO2 | | | | | | 1 | 1 | 3 | 2 | 2 | 1 | | | | |
| CO3 | | | | | | 3 | 1 | 1 | | 1 | 2 | | | | |
| CO4 | | | | | | 2 | 3 | 1 | 2 | 1 | 2 | | | | |

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To familiarize with the basic meaning of crystalline and non-crystalline materials with a detailed understanding of crystal imperfection of alloys and compounds and their applications in engineering fields
2. To describe phase diagrams and phase transformations in the binary alloys and the iron-iron carbide system with the basic classification of steels and cast irons.
3. To describe different heat treatment routes to modify the properties of steels and tointroduce the composite materials classification and applications
4. To give an introduction to powder metallurgy and other advanced materials.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to

1. Describe and recommend the material type required to be selected for a specific engineering application.
2. Understand and calculate the phases and their relative amounts present in a given phase diagram and determine the material behavior with respect to its constituting phases.
3. Select a suitable heat treatment or strengthening route to alter the mechanical behavior of structures made of steels.
4. Understand and compare the performance of different modern engineered materials such as composite materials, powder metallurgy components and nanomaterials.

**UNIT-I**

**CRYSTALLOGRAPHY:** Basic material properties, classification of materials, crystalline and non-crystalline materials, classification of crystals – Bravi's lattices – Packing factor and coordination number in simple cubic, BCC, FCC and HCP systems — Miller indices for planes and directions, crystal imperfections – crystal deformation – Slip and Twinning. (10)

**CONSTITUTION OF ALLOYS:** Introduction to alloys and compounds, solid solutions, Hume-Rothery principles, compounds, electron compounds (4)

**UNIT-II**

**PHASE DIAGRAMS:** Gibb's Phase rule – one component system, two component system, Phase transformations - isomorphous, eutectic, peritectic systems. Phase transformations in solid state: eutectoid and peritectoid systems. (6)

**STEELS AND CAST IRONS:** Iron–Iron carbide equilibrium diagram and phase transformations, Cast irons: classification of cast irons (6)

**ISOTHERMAL TRANSFORMATINS:** TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformations (4)

**UNIT-III**

**HEAT TREATMENT OF STEELS:** Annealing, normalizing, hardening, tempering, age hardening, austempering, martempering and hardenability concept and experimental determination. (6)

**SURFACE HARDENING:** carburizing, nitriding, cyaniding, flame hardening and induction hardening. (6)

**STRENGTHENING MECHANISMS:** Strain hardening, solid solution strengthening, grain refinement, dispersion strengthening. (4)

**UNIT-IV**

**COMPOSITE MATERIALS:** Properties and applications of Particulate-reinforced composites, fibre reinforced composites, Laminar composites and metal matrix composites. (6)

**POWDER METALLURGY:** Powder metallurgy process, preparation of powders, characteristics of metal powders, mixing, compacting, sintering, Applications of Powder Metallurgy. (6)

**ADVANCED MATERIALS:** Introduction to Nanomaterials, biomaterials, smart materials, non-ferrous metals and their alloys: Brief study of copper and aluminium alloys, properties and applications. (4)

**TEXT BOOKS**

1. Introduction to Physical Metallurgy - Sidney H. Avner, McGrawHill
2. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI.
3. Material Science and Metallurgy - R. B. Choudary - Khanna Publications.

**REFERENCE BOOKS**

1. Material Science and Metallurgy - V. D. Kodgire, Everest Publishers
2. Textbook of Nanoscience and Nanotechnology - Murty, B.S., Springer
3. Biomaterials: an introduction – J. Park, Springer
4. Manufacturing Engineering & Technology – Kalpak Jain &Schmid, Pearson / PHI

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 1 | | | 2 | | | 1 | | 2 | | 2 |
| CO2 | 2 | | 1 | | | | | 2 | | | | | 3 | 1 | 2 |
| CO3 | 3 | 2 | 1 | | 2 | | | 1 | | | | | 2 | | 1 |
| CO4 | 3 | | 1 | | | | | 1 | | | 2 | | 3 | 1 | |

**METAL CUTTING AND MACHINE TOOLS**
**20ME402**
***II Year B.Tech. (Mech) Fourth Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Continuous Internal Assessment | 30 | Semester End Examination (3 Hours) | 70 |

**Course Objectives:**

1. To describe the primary and auxiliary motions in machine tools and parameters defining them.
2. To provide fundamental knowledge regarding working principle, classification, parts, mechanisms and operations performed on various machine tools.
3. To provide basic information regarding formation of chip and its types in metal cutting.
4. To establish relation between shear angle, chip thickness ratio, stress and strain in the chip and cutting forces.
5. To provide information regarding geometry of single point cutting tool, tool materials and their application.
6. To provide information about heat generation, temperature distribution and application of cutting fluids in metal cutting.

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Describe the parts, mechanisms, selection of cutting parameters and operations that can be done on a lathe machine.
2. Describe the parts, mechanisms and operations that can be done on drilling, shaping, planing and grinding machines.
3. Explain the construction, types and operations that can be done on a milling machine. Also discuss about milling cutters and methods of indexing.
4. Discuss about tool geometry, chip formation and heat generation in metal cutting. Also calculate shear angle, stress, strain, velocities and cutting forces in metal cutting.

**UNIT-I**

**MACHINING PROCESSES AND MACHINE TOOLS:** Introduction, Primary and Auxiliary Motions in Machine Tools, Parameters defining working motions of a Machine Tool. (3)

**LATHE:** Constructional details, specifications, classification of lathes**.**
Lathe Mechanisms: Spindle speed Mechanisms in Belt driven and All Geared Head stock, Apron and Half-nut mechanisms. Lathe accessories – various work holding devices. Lathe operations including taper turning and thread cutting and related problems. (12)

**UNIT-II**

**DRILLING MACHINES:** Types of drilling machines and specifications, drilling operations, drilling time. (4)

**SHAPING AND PLANING MACHINES:** Constructional details, types of shapers and planers, specifications, Quick Return Mechanism and automatic feed mechanisms, operations done on these machines. (4)

**GRINDING MACHINES:** General Principles, Types of grinding machines, Wheel materials, Selection and specification of grinding wheels, Truing and Dressing of grinding wheels. (7)

**UNIT-III**

**SURFACE FINISHING OPERATIONS:** Honing and Lapping operations. (3)

**MILLING MACHINES:**
Working Principle, Size and Specification, Types of milling machines, Description and working of Universal Milling machine, Up and Down Milling, Milling operations, Milling cutters, Indexing methods and Indexing Head, related problems. (12)

**UNIT-IV**

**THEORY OF METAL CUTTING:**

Introduction, Basic elements of machining, Nomenclature of single point cutting tool, Tool Geometry, Mechanics of chip formation, Types of chips. Determination of shear angle and chip thickness ratio, stress and strain in the chip, velocity relations, Merchant's theory of orthogonal cutting forces, related simple problems. (7)
Tool wear, Tool life and Tool life criteria (3)
Heat Generation and temperature distribution in metal cutting , cutting fluids- types and required characteristics. (3)
**CUTTING TOOL MATERIALS**: Requirements of tool materials and types. (2)

**TEXT BOOKS**

1. Workshop Technology Vol. II:Machine Tools by S.K. Hajra Choudhury, MPP Pvt.Ltd.
2. Production Engineering by P.C. Sharma, S.Chand& Co.

**REFERENCE BOOKS**

1. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser.
2. Machining and machining process by PN.Rao, TMH.
3. Manufacturing Science by Ghosh&Mallick
4. Manufacturing Engineering and Technology by Kalpakjian.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 1 | 1 | 1 | | | 1 | 1 | | | | 1 | | 1 |
| CO2 | 2 | | 1 | 1 | 1 | | | 1 | 1 | | | | 1 | | 1 |
| CO3 | 2 | | 1 | 1 | 1 | | | 1 | 1 | | | | 1 | | 1 |
| CO4 | 3 | 1 | | 1 | 2 | | 1 | 1 | 2 | | 1 | | 2 | 1 | 1 |

## KINEMATICS OF MACHINES

**20ME403**

***II Year B.Tech. (Mech) Fourth Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

1. To understand the concept of machines, mechanisms, related terminologies
2. To analyse a mechanism for displacement, velocity and acceleration
3. To develop cam profiles for specified motions
4. To understand the theory of gears, gear trains

**Course Outcomes:**

Upon Completion of the course the student will be able to

1. Understand and apply the fundamental concepts of kinematics of machines.
2. Carry out the velocity and acceleration analysis of various mechanisms.
3. Locate instantaneous centers for a mechanism and achieve the complicated output motions with the help of cams.
4. Understand kinematics of gears and gear trains.

## UNIT-I

**Introduction:**
Mechanisms and machines, Rigid and resistant bodies, Link, Kinematic pair, Classifications of Kinematic pairs, Types of constrained motions, Degrees of Freedom, kinematic-chain, Linkage, Mechanism and structure, Classification of mechanisms, Inversions of a mechanism, Inversions of Four –Link (bar)chain, Single Slider - Crank Chain, Double – Slider Chain.

.

## UNIT-II

**Velocity Analysis:**
Introduction, Absolute and Relative Motion, Vectors, Addition and subtraction of Vectors, Motion of a Link, Four Link Mechanism, Angular Velocity of Links, Velocity of Rubbing, Slider - Crank Mechanism, Crank and Slotted Lever Mechanism

**Acceleration analysis:**
Acceleration, Four-Link Mechanism, Angular acceleration of Links, Acceleration of Intermediate and offset points, slider-Crank Mechanism, Coriolis acceleration component, Crank and slotted lever Mechanism.

## UNIT-III

**Instantaneous Centre:**
Notation, Number of InstantaneousCentres, Kennedy's theorem, Locating InstantaneousCentres, determination of angular velocity by of links by Instantaneous Centre Method.

**Cams:**
Introduction, Types of cams, Types of Followers, Terminology – Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation, Graphical synthesis of cam profile (Knife Edge, Roller and Flat faced Followers).

## UNIT-IV

**Gears:**
Introduction, Classification gears, terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears, Minimum number of Teeth, Comparison of Cycloidal and Involute tooth forms.

**Gear Trains:**
Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train using Tabular Method.

## TEXT BOOKS

1. Theory of Machines by S.S.Rattan, McGraw Hill Education, 5th edition, 2019
2. Theory of Mechanisms and Machines by C.S.Sharma andKamleshPurohit, Prentice Hall India Learning Private Limited, 1st edition, 2006

## REFERENCE BOOKS

1. Theory of Mechanisms and Machines by A. Ghosh and A. K. Mallik, East West Press Private Ltd., 3rd edition, 2008
2. Theory of Machines and Mechanisms by Mechanism and Machine Theory by J. J.Uicker, G. R. Pennock and J. E.Shigley, Oxford University Press,5th edition, 2017

| Course | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 2 | | 1 | | | | | | | | 3 | 2 | |
| **CO2** | 3 | | 2 | | 3 | | | | | | | | 3 | 2 | |
| **CO3** | 3 | | 2 | | 2 | | | | | | | | 3 | 2 | |
| **CO4** | 2 | | 2 | | 2 | | | | | | | | 2 | 2 | |

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

To make the students:

1. To understand the phase diagrams and describe the vapour power cycles.
2. To demonstrate the working principles of boilers and steam nozzles.
3. To illustrate the working of steam condensers and steam turbines.
4. To describe the different Refrigeration systems, psychrometry and air conditioning.

**Course Outcomes:**

On successful completion of the course, the student will be able to,

1. Explain the properties of steam and apply them to vapour power cycles.
2. Explain the working principles of boilers and steam nozzles.
3. Distinguish and analyze the steam condensers and steam turbines.
4. Discuss the working of Refrigeration systems and to apply psychometric process to analyze the various air conditioning systems.

**UNIT-I**

**PURE SUBSTANCE:** Definition, process of steam generation, P-v, T-s and h-s diagrams, properties of saturated and superheated steam, Use of Steam Tables, Mollier chart. (7)

**VAPOR POWER CYCLES:** Rankine cycle, Effect of pressure and temperature on the Rankine cycle, reheat cycle, regenerative cycle. (7)

**UNIT-II**

**STEAM BOILERS:** Function, classification, working of Babcock and Wilcox boiler, Cochran boiler, Mountings & Accessories. (7)

**STEAM NOZZLES:** Types of nozzles, Isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical pressure ratio and maximum discharge, calculation of throat and exit areas using Mollier diagram. (7)

**UNIT-III**

**STEAM CONDENSERS:** Jet and Surface condensers, condenser vacuum and vacuum efficiency, Condenser efficiency, Thermodynamic analysis. (4)

**STEAM TURBINES:** Types of steam turbines, **Impulse turbines:** pressure and velocity compounding, velocity diagrams, work output, power, blade efficiency and stage efficiency. **Reaction turbines:** velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency. Governing of turbines, Overall efficiency and reheat factor. (10)

**UNIT-IV**

**REFRIGERATION:** Need for Refrigeration, Definitions, Methods of refrigeration, Bell Coleman cycle, Refrigerating effect, COP, Vapor compression refrigeration system, Influence of various parameters on cycle performance, Vapor absorption refrigeration cycle (7)

**PSYCHROMETRY AND AIR CONDITIONING:** -Introduction, Psychrometric properties, Psychrometric chart, Psychrometric processes, Types of Air conditioning systems. (7)

**TEXT BOOKS**

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, NewDelhi.
2. Thermal Engineering ---Rajput, LaxmiPubl, New Delhi.
3. Thermal Science and Engineering- D.S.kumar, S.K.katariaPubl, New Delhi.

**REFERENCE BOOKS**

1. Engineering Thermodynamics----Cengel and Boles, TMH.
2. Refrigeration and Air Conditioning -- C.P. Arora, TMH.
3. Engineering Thermodynamics—Achuthan, PHI, New Delhi

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | 1 | 1 | | | | | | 2 | 1 | |
| CO2 | 2 | 1 | | 1 | | 1 | 1 | | | | | | 2 | 1 | |
| CO3 | 2 | 2 | 2 | 1 | | 1 | 1 | | | | | | 2 | 1 | |
| CO4 | 2 | 1 | 2 | 2 | | 2 | 1 | | | | | | 1 | 2 | |

## INDUSTRIAL ENGINEERING AND MANAGEMENT
**20ME405**
***II Year B.Tech. (Mech) Fourth Semester***

| Lectures | 3 | Tutorial | 0 | Practical | 0 | Credits | 3 |
|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Continuous Internal Assessment | 30 | Semester End Examination (3 Hours) | 70 |

**Course Objectives:**

1. To develop the skills of the student in IndustrialEngineering such as productivity, Work Study.
2. To provide the working knowledge of management, organization, and Human Resource Management.
3. To imbibe the knowledge of Marketing Management and Financial Management.
4. To make the student develop the skills of decision making with regard to Materials ManagementandQuality Management.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to

CO1: Solve the problems of productivity and Work Study.
CO2: Understand concepts ofmanagement,organisation structures and Human Resource Management.
CO3: Illustrate the concepts of Marketing Management and Financial Management.
CO4: Compute the problems of Materials Management andQuality Management for its implementation in the industry.

**UNIT-I**

**Industrial Engineering:** Objective, Need and Scope of Industrial Engineering. (2)

**Productivity**: Introduction, methods to measure productivity, measures to improve productivity. (3)

**Work Study** – Definition, objectives and uses; Method study – Definition, objectives, procedure and uses; Time study – Definition, need, functions, and basic concepts of break down. (5)

**UNIT-II**

**Management**: Introduction, Levels of management, Evolution of management thought: Taylor's Scientific Management, Functions of management. (3)

**Organisation:**Introduction to organization, principles and types of organization structures. (3)

**Human Resource Management**: Functions of HR management, human resource planning, leadership styles, performance appraisal, Motivation Theories. (4)

**UNIT-III**

**Marketing Management:** Introduction, Marketing Vs Selling, marketing mix, distribution channels, and product life cycle based marketing strategies. (5)

**Financial Management:** Scope, objectives and functions of Financial Management**;** Reading Profit & Loss account and Balance sheet;Working Capital Management*:* Concepts and Objectives. (6)

## UNIT-IV

**Materials Management**: Inventory Control, Inventory costs, Basic EOQ model, Model with Price breaks, P and Q systems, ABC analysis. (5)
**Quality Management**: Importance of quality, Difference between Inspection and Quality control, Components of total quality, Acceptance sampling, Introduction to Taguchi methods (6)

## TEXT BOOKS

4. Management: A Global & Entrepreneurial Perspective, Heinz Weihrich, Mark Cannice, and Harold Koontz, McGraw hill Education, 2010.
5. Work study by ILO, IV Revised Edition.
6. Industrial Engineering and Management by A Ravi Shankar, second edition, Galgotia publications,2001
7. Handbook of industrial Engineering: Technology and Operations Management, GayrielSalvendy, 3rd Edition, Wiley publication,2007
8. Industrial Engineering and Production Management by Martand T Telsang, S Chand publication, 2018
9. Industrial Engineering and production Management by M Mahajan, Dhanpat Rai and Co. Publishers, 2014.

## REFERENCE BOOKS

1. Maynard's Industrial Engineering Handbook, Kjell B. Zandin, Fifth Edition, 2001, The McGraw-Hill Companies, Inc.
2. Principles of Marketing - Basic concepts of Marketing Philip T. Kotler, Gary Armstrong, et al., Pearson, 2018.

## CO-PO MAPPING

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | | 1 | | | | 1 | | | 3 | | 2 |
| CO2 | 3 | | | | | | | 1 | | 2 | | | 3 | | |
| CO3 | 3 | 2 | | 2 | | 1 | | | | 2 | 3 | | 3 | | |
| CO4 | 3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 3 | | 3 |

## MODELING LAB
## 20MEL401

*II[nd] Year B. Tech.(Mech) Forth Semester*

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Prerequisites:** None

**Course Objectives:**

5. To Paraphrase the capabilities of the software and commands
6. To enable the students create 3D models
7. To facilitate the students create 3D part drawing of machine components.
8. To generate the 3D assemblies of machine components

**Course Outcomes:** After the completion of the course the students will be able to

5. Exemplify different user interface and tool bars of modelling software
6. Implement the sketcher, features and dimensioning tool bar.
7. Interpreting the steps for generation of the 3D parts of a product.
8. Articulate the steps required for assemblies of various 3D machine components.

**Course Content:**

3D model generation using any of the modeling package

List of Exercises

6. Sketcher module
7. Part module
8. Special features in part module
9. 3D part modeling of machine components
10. 3D assemblies of machine components

**TEXT BOOKS:**

3. Lab manuals for 3D modelling

4. A Text book of "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy.

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| CO1 | 2 | 2 | | | 2 | | | | 1 | | | | | 2 | |
| CO2 | 2 | 1 | | | 1 | | | | 1 | | | | | 2 | |
| CO3 | 2 | 2 | | | 1 | | | | 2 | | | | | 2 | |
| CO4 | 2 | 2 | | | 3 | | | | 3 | | | | | 1 | |

**FUELS & OIL TESTING LAB**
**20MEL402**
**II Year B.Tech. (Mech) Fourth Semester**

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objective:**
To make the students to determine various thermal properties of fuels experimentally.

**Course Outcome:**

1. After completion of the course the student will be able to find various thermal properties of fuels experimentally.

Any **Ten** Experiments out of the following are to be performed

1. Viscosity measurement using Redwood No.I viscometer.
2. Viscosity measurement using Redwood No.II viscometer.
3. Viscosity measurement using Saybolt viscometer.
4. Viscosity measurement using Engler's viscometer.
5. Carbon residue test using Conradson's carbon residue apparatus
6. Calorific value of LPG using Junker's Gas Calorimeter
7. Measurement of flash point using Abel's apparatus
8. Measurement of flash point using Pensky-Martin's apparatus
9. Measurement of flash and fire points using Cleveland's open cup apparatus
10. Grease penetration test using Penetrometer apparatus
11. Calibration of pressure gauge using Dead weight pressure gauge.

**CO-PO MAPPING**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 2 | | |

**MACHINE SHOP PRACTICE**
**20MEL403**
***II Year B.Tech. (Mech) Fourth Semester***

| Lectures | 0 | Tutorial | 0 | Practical | 3 | Credits | 1.5 |
|---|---|---|---|---|---|---|---|
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

The objective of this course is to make each student to aware the various manufacturing operations in order to meet the current industrial need. For the designed course the students will learn the following objectives.

1. To know the students how to make various types of external threads and other cutting operations like drilling and internal thread cutting by using Lathe
2. To know the procedure how to drill holes and make internal threads by using drilling machine and hand taps respectively.
3. To train each student various parts of milling machine and know the procedure how to perform different milling operations like key-way cutting, spur and helical gear cutting
4. To know how to make gear specimens using gear hobbing machine
5. To know how to produce flat surfaces/stepped surfaces and slant surfaces by using shaping machine
6. To know how to make operations on large work pieces by using planing machine and slotting machine
7. To know the various components of surface grinder/ tool and cutter grinder and to know how to perform grinding operations on work pieces/ single point cutting tools

**Course Outcomes:**

Upon completion of the course the students will be able to

1. Perform various operations like drilling, boring, external and internal thread cutting operations on lathe machine, also perform drilling and tapping on drilling machine.
2. Produce spur, helical gears on milling machine.
3. Produce flat surface, stepped surface, dovetail surfaces on shaping machine.
4. Operate gear hobbing, slotting, planning and grinding machines.

**Syllabus:**

**TURNING :**

L.H & R.H Threading, Multi-start threading, Drilling, Boring and Internal threading

**DRILLING &TAPPING :**

Drilling and Tapping of Different threads

**MILLING :**

Key-way, Spur and Helical Gear Milling, Gear Hobbing.

**SHAPING :**
At least three models involving production of flat surface, Stepped surface, Cutting dovetail and rectangular grooves.

**PLANING AND SLOTTING :**
Working on Planing and Slotting Machines

**GRINDING :**
At least one model on surface grinder, cylindrical grinder or tool and cutter grinder.

## CO-PO MAPPING

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 1 | | | | 1 | 1 | | | | 1 | | |
| CO2 | | 2 | | 1 | | | | 1 | 1 | | | | 1 | | |
| CO3 | | 2 | | 1 | | | | 1 | 1 | | | | 1 | | |
| CO4 | | 2 | | 1 | | | | 1 | 1 | | | | 1 | | |

**IIYear B.Tech.(Mech) Fifth Semester**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | 0 | Tutorial | 1 | Practical | 2 | Credits | 2 |
| Continuous Internal Assessment | | | 30 | Semester End Examination (3 Hours) | | | 70 |

**Course Objectives:**

To make the students to understand and apply the concepts of sensors and PLC in automation.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to

1. Understand the principle & working of various sensors
2. Application of sensors in various automated systems
3. Understand the programming and function of PLC in automated manufacturing
4. Understand the interfacing of sensors and PLC in automation

**LIST OF EXPERIMENTS**

**Part A**

1. To study the characteristics of LVDT transducer.
2. To study the characteristics of RTD transducer.
3. To study the characteristics of Thermistor transducer.
4. To study the characteristics of Thermocouple transducer.
5. To study the characteristics of Pressure transducer.

**Part B**

1. Implementation of Logic gates using PLC
2. Implementation of Timers using PLC
3. Implementation of Counters using PLC.
4. Write a PLC program for Tank filling device simulator
5. Write a PLC program for Supervise equipment
6. Write a PLC program for Star-Delta starting up

**Part C**

1. Behaviour of inductive, capacitive and magnetic sensors.
2. Behaviour of through beam, reflex photoelectric and ultrasonic sensors.
3. Operating range, hysteresis and response curve of the inductive sensor.
4. Operating range, hysteresis and response curve of the capacitive sensor

| Course Outcomes | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | 2 | | | | | | | | 1 | 1 | |
| CO2 | 3 | 2 | | | 2 | | | | | | | | 1 | 2 | |
| CO3 | 2 | 1 | | | 1 | | | | | | | | 3 | 2 | |
| CO4 | 2 | 1 | | | 2 | | | | | | | | 3 | 2 | |