
FOREWORD

CMR Technical Campus, established in the year 2009, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, twice Accredited by NBA and has been bestowed with NAAC 'A' Grade of 3.12 score on 04 scale in February 2019 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CMR Technical Campus takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the College and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering and management graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Director to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering and management graduates.

DIRECTOR

CMR TECHNICAL CAMPUS

Vision:

To impart quality education in serene atmosphere thus strive for excellence in Technology and Research.

Mission:

- To create state of art facilities for effective Teaching – Learning process.
- Pursue and Disseminate knowledge based research to meet the needs of Industry & Society.
- Infuse Professional, Ethical and Societal values among Learning Community.

Quality Policy:

- The management is committed in assuring quality service to all its stakeholders like parents, students, alumni, employees, employers and the community.
- Continual quality improvement by establishing and implementing mechanisms and modalities.
- Transparency in procedures and access to information and actions.

Core Values:

The CMR Technical Campus is guided by the following core values in delivering its mission and pursuing its vision.

- **A**ccountability: Demonstrate responsibility for our actions; establish and communicate clearly defined and articulated goals and objectives.
- **B**enchmark: To develop and pursue high standards by encouraging skill development and entrepreneurship to meet industry and society needs.
- **C**ommitment: Focus on students and stakeholders needs; continuously evaluate and improve academics, research and infrastructure.
- **D**ignity: Recognize the expertise of all members of the institute and encourage individual contribution and also include stakeholders in the decisions that affect them.

**CMR TECHNICAL CAMPUS
UGC AUTONOMOUS**

Kandlakoya (V), Medchal Road, Hyderabad-501401, Telangana State (India)

Academic Regulations [R20]
B.Tech. - Regular Four Year Degree Programme
(For students admitted from the academic year 2020 - 21)
&
B.Tech. - Lateral Entry Scheme
(For students admitted from the academic year 2021 - 22)

CMR Technical Campus (CMRTC) offers a 4-year (8 semesters) Bachelor of Technology (B.Tech.) degree programme, under Choice Based Credit System (CBCS).

1. UNDER GRADUATE PROGRAMS OFFERED (E & T)

CMRTC (**Autonomous**), affiliated to JNTUH, offers 4 Year (8 Semesters) **B.Tech.** Degree Programme in the following Branches of Engineering:

- 1) Civil Engineering
- 2) Mechanical Engineering
- 3) Electronics and Communication Engineering
- 4) Computer Science and Engineering
- 5) Information Technology
- 6) Computer Science and Engineering (Artificial Intelligence and Machine Learning)
- 7) Computer Science and Engineering (Data Science)
- 8) Artificial Intelligence and Machine Learning
- 9) Computer Science and Design

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION**2.1. Admission into first year of four year B.Tech. (Regular) Degree Programme:**

2.1.1. Eligibility: A candidate seeking admission into the first year of four year B. Tech. Degree Programme should have:

- (i) Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.
- (ii) Secured a rank in the TSEAMCET examination conducted by TSCHE for allotment of a seat by the Convenor, TSEAMCET.

2.1.2. Admission Procedure: Admissions are made into the first year of four year B.Tech. Degree Programme as per the stipulations of the TSCHE.

- (a) Category A: 70% of the seats are filled through TSEAMCET counseling.
- (b) Category B: 30% of the seats are filled by the Management.

2.2. Admission into the second year of four-year B. Tech. (Regular) Degree Programme Under Lateral Entry Scheme.

2.2.1 Eligibility: A candidate seeking admission into the II year I Semester B. Tech. Regular Degree

Programme under Lateral Entry Scheme (LES) should have passed the qualifying examination (B.Sc. Mathematics or Diploma in concerned course) and have secured a rank at Engineering Common Entrance Test TSECET (FDH). Admissions are made in accordance with the instructions received from the Convenor, TSECET and Government of Telangana State.

2.2.2 Admission Procedure: Admissions are made into the II year of four year B.Tech. (Regular) Degree Programme through Convenor, TSECET (FDH) against the sanctioned intake in each Programme of study as lateral entry student.

2.3. Branch Transfers: There shall be no Branch transfers after the completion of Admission Process.

2.4. Medium of Instruction: The Medium of Instruction and Examinations for the entire B.Tech. programme will be in **English** only.

3. B.Tech. PROGRAMME STRUCTURE

3.1 Admitted under Four year B. Tech. (Regular) degree Programme:

3.1.1 A student after securing admission shall pursue the under graduate programme in B.Tech for a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which, students shall forfeit their seat in B.Tech course.

3.1.2 As per AICTE guidelines, a 3-week mandatory “**Induction Programme**” shall be offered to I - B.Tech newly admitted students to get acquainted with the professional environment and prepare them for the academic schedules ahead.

3.1.3 The entire B.Tech. programme is structured for a total of 160 credits. Distribution of credits Semester-wise is available in the respective course structure.

3.1.4 Each student shall register and secure 160 credits (with CGPA ≥ 5) for the completion of the under graduate programme and award of the B.Tech degree.

3.2 Admitted under Lateral Entry Scheme (LES) into B. Tech. degree Programme:

3.2.1 After securing admission into II year B.Tech. I Semester, the LES students shall pursue a course of study for not less than three academic years (6 Semesters) and not more than six academic years (12 Semesters), failing which students shall forfeit their seat in B.Tech. programme.

3.2.2 The student shall register and secure 120 credits (with CGPA ≥ 5) from II year to IV year B.Tech. programme (LES) for the award of B. Tech degree.

3.3 The Course Structure is organized based on the AICTE Model Curriculum (Jan-2018) for Under-Graduate Degree Courses in Engineering & Technology. **UGC / AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations / Norms, which are listed below:

3.3.1 Semester Scheme:

The evaluation of course is on the basis of Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC while the course Curriculum / Course Structure is as suggested by AICTE.

- B.Tech. (Regular) Programme is of 4 Academic Years (8 Semesters)
- B.Tech. (LES) Programme is of 3 Academic Years (6 Semesters),
- Each academic year is divided into two semesters
- Each semester is of 22 weeks (≥ 90 Instructional days per semester)
- Each Semester is having - ‘Continuous Internal Evaluation (CIE)’ and ‘End Semester Examination (ESE).

3.3.2 Credit Courses:

- a) All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods : Credits) Structure based on the following general pattern:

| Theory | | Practical | |
|--------------------|----------|-----------------------|------------|
| 1 Hr. Lecture (L) | 1 credit | 1 Hr. Practical (P) | 0.5 credit |
| 1 Hr. Tutorial (T) | 1 credit | 2 Hrs Practical (Lab) | 1.0 credit |

All Mandatory Courses, Study Tour, Guest Lecture, etc., will not carry any Credits.

- b) **Contact Hours:** Weekly contact hours – maximum of 30 hours per week (1 hour = 60 Minutes) including credit and non-credit courses.

3.3.3 Subject / Course Classification:

CMRTC has followed the guidelines specified by AICTE / UGC / JNTUH. The subjects / courses offered in B.Tech. programme are broadly classified as mentioned below.

| S. No. | Broad Course Classification | Course Group/ Category | Course Description |
|--------|-----------------------------|-------------------------------------|--|
| 1 | Foundation Courses | BS – Basic Sciences | Includes mathematics, physics and chemistry subjects |
| 2 | | ES - Engineering Sciences | Includes fundamental engineering subjects |
| 3 | | HS – Humanities and Social sciences | Includes subjects related to humanities, social sciences and management |
| 4 | Core Courses | PC – Professional Core | Includes core subjects related to the parent discipline/ department/ branch of Engineering. |
| 5 | Elective Courses | PE – Professional Electives | Includes elective subjects related to the parent discipline/ department/ branch of Engineering. |
| 6 | | OE – Open Electives | Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering. |
| 7 | Core Courses | PR- Project Work | B.Tech. project or UG project or UG major project or Project Stage I & II |
| 8 | | Industrial training/ Mini- project | Industrial training/ Summer Internship Industrial Oriented Mini-project/ Mini-project |
| 9 | | Seminar | Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering. |
| 10 | Minor courses | - | 1 or 2 Credit courses (subset of HS) |
| 11 | Mandatory Courses | MC | Mandatory courses (non-credit) |
| 12 | Audit Courses | AC | |

3.3.4 Subject Code Nomenclature:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|

- 1, 2 - Year of implementation of Regulation
- 3, 4 - Department Code (Course offering department)
- 5 - Serial No. of Semester (1 to 8)
- 6, 7 - Serial No. of Subject, Semester wise
- 8, 9 - Course Group/ Category

Example: - 19EC302PC

4. COURSE REGISTRATION

- 4.1** A **'Faculty Advisor/Mentor'** shall be assigned to each student to advise the student about the B.Tech. programme, course structure and curriculum, choice / option for subjects / courses, based on his/her competence, progress, pre-requisites and interest.
- 4.2** The academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring **'date and time stamping'**. The online registration requests for any 'current semester' shall be completed **before the commencement of ESEs (End Semester Examinations) of the 'preceding semester'**.
- 4.3** A student can apply for **online** registration, **only after** obtaining the **'written approval'** from his faculty advisor or Mentor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.
- 4.4** A student has to register for all subjects/courses in a semester as specified in the course structure and may be permitted to register one additional theory subject / course limited to 3 credits, based on the student's **progress** and SGPA / CGPA, and completion of the **'pre-requisites'** as indicated for various subjects/courses, in the department course structure and syllabus contents.
- 4.5** If the student submits ambiguous choices or multiple options or erroneous (incorrect) entries during **online** registration for the subject(s) / course(s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject / course in that category will be taken into consideration.
- 4.6** Subject / course options exercised through **online** registration are final and **cannot** be changed or inter- changed; further, alternate choices also will not be considered. However, if the subject / course that has already been listed for registration by Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the **first week** from the commencement of class-work for that semester.
- 4.7** Dropping of additional registered subject / course (refer 4.4) may be permitted only after obtaining prior approval from the faculty advisor / Mentor, **'within a period of 15 days'** from the commencement of that semester.
- 4.8** **Open electives:** Students can choose open electives, wherever offered, from the list of open electives given for their stream. However, student has to opt for at least one HS Open elective and cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.
- 4.9** **Professional electives:** Students have to choose professional elective, wherever offered, from the list of professional electives given. However, students may opt for professional

elective subjects offered in the related area.

4.10 Mandatory Courses (Non-Credit): All mandatory courses, wherever offered, require prior registration.

5. SUBJECTS / COURSES TO BE OFFERED

5.1 A typical Section (or Class) Strength for each Semester shall be 60. A subject / course may be offered to the students, **if only** a minimum 1/3 of students register to the course. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

- i) More than **one faculty member** may offer the **same subject** (lab / practical's may be included with the corresponding theory subject in the same semester) in any semester.
- ii) However, selection of choice for students will be based on '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).
- iii) If more entries for registration of a subject come into picture, then the concerned Head of the Department shall take necessary decision, whether or not to offer such a subject / course for **two (or multiple) sections**.

6. ATTENDANCE REQUIREMENTS

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum 75% of attendance in aggregate (excluding the days of midterm examinations) for all the subjects / courses, excluding attendance in mandatory courses in that semester.

6.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and / or open electives, the same may also be re-registered, if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7. ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 6.

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if student secures not less than 35% marks (24 out of 70 marks) in the End Semester Examination (ESE), and a minimum of 40% of marks (40 out of 100) in the sum total of the Continuous Internal Evaluation (CIE) and End Semester Examination (ESE) taken together; in terms of letter grades, this implies securing C grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits

allotted to summer internship and project courses, if student secures not less than 40% of the total marks in each of them. The student would be treated as failed, if student does not submit a report on his project(s), or does not make a presentation of the same before the evaluation committee as per the schedule. Student may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one re-appearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

7.3.1 B.Tech. (Regular):

| S. No. | Promotion | Conditions to be fulfilled |
|--------|-------------------------------------|--|
| 1 | First Semester to Second Semester | Regular course of study of First Semester |
| 2 | Second Semester to Third Semester | (i) Regular course of study of Second Semester Must have secured at least 50% credits (20 out of 40 credits) up to Second Semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not. |
| 3 | Third Semester to Fourth Semester | Regular course of study of Third Semester |
| 4 | Fourth Semester to Fifth Semester | (i) Regular course of study of Fourth Semester Must have secured at least 60% credits (48 out of 80 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Fifth Semester to Sixth Semester | Regular course of study of Fifth Semester |
| 6 | Sixth Semester to Seventh Semester | (i) Regular course of study of Sixth Semester Must have secured at least 60% credits (72 out of 120 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 7 | Seventh Semester to Eighth Semester | Regular course of study of Seventh Semester |

7.3.2 B. Tech - Lateral Entry Scheme (LES):

| S. No. | Promotion | Conditions to be fulfilled |
|--------|-------------------------------------|--|
| 1 | Third Semester to Fourth Semester | Regular course of study of Third Semester |
| 2 | Fourth Semester to Fifth Semester | (i) Regular course of study of Fourth Semester Must have secured at least 50% credits (20 out of 40 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3 | Fifth Semester to Sixth Semester | Regular course of study of Fifth Semester |
| 4 | Sixth Semester to Seventh Semester | (i) Regular course of study of Sixth Semester Must have secured at least 60% credits (48 out of 80 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Seventh Semester to Eighth Semester | Regular course of study of Seventh Semester |

- 7.4** A student has to register for all subjects covering 160 credits (120 credits in case of LES) as specified and listed (with the relevant course / subject classifications as mentioned) in the course structure, fulfill all the attendance and academic requirements for 160 credits (120 credits in case of LES) securing a minimum of 'C' grade or above in each subject, and 'earn all 160 credits (120 credits in case of LES) securing SGPA \geq 5.0 (in each semester), and CGPA (at the end of each successive semester) \geq 5.0, to successfully complete the under graduate programme.
- 7.5** If a student registers for '**additional subjects**' (in the parent department or other departments / branches of engineering) other than those listed subjects totaling to 160 credits (120 credits in case of LES) as specified in the course structure of parent department, the performances in those '**additional subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits (120 credits in case of LES)) will not be taken into account while calculating the SGPA and CGPA. For such '**additional subjects**' registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 to 7.4 above.
- 7.6** A student eligible to appear in the End Semester Examination for any subject / course, but absent from it or failed (thereby failing to secure 'C' grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the ESE supplementary examination for evaluating performance in that subject.
- 7.7** A student **detained in a semester due to shortage of attendance may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements.** The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which student has been detained.
- 7.8** A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been readmitted shall be applicable.

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

- 8.1** The performance of a student in each semester shall be evaluated subject-wise / course-wise (irrespective of credits assigned) with a maximum of 100 marks. These evaluations shall be based on 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for ESE (End Semester Examination), and a letter grade corresponding to the percentage of marks obtained shall be given.

8.2 Evaluation of Theory Subjects / Courses

A) Continuous Internal Evaluation: For each theory subject, during the semester, there shall be 2 Mid-term examinations of 30 marks each. Each Mid-term examination consists of subjective paper for 25 marks & assignment for 5 marks and the final CIE marks (for total of 30) are calculated by taking average of the two Mid-term examinations.

- The first Mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.
- The subjective paper shall be conducted for duration of 90 minutes. Each subjective paper shall contain 2 parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. Part-B consists of three questions carrying 5 marks each (may contain sub questions) with internal choice; the

student has to answer all the questions.

- First assignment should be submitted before the commencement of the first mid-term examinations, and the second assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.

B) End Semester Examinations: The duration of ESE is 3 hours. The details of the question paper pattern is as follows:

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part- A** for 20 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory, which consists of one question with ten sub questions (two from each unit) carrying 02 Marks each.
- Part-B consists of five questions (numbered from 02 to 11) carrying 10 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.3 Evaluation of Practical Subjects / Courses: In any semester, a student has to complete at least 08 to 10 experiments / exercises in each laboratory course and get the record certified by the Subject teacher and concerned Head of the Department to be eligible for End Semester Examination.

For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks and 70 marks for End Semester Examination (ESE).

A) Continuous Internal Evaluation (CIE): Out of the 30 marks, 15 marks are allocated for day-to-day work evaluation and the remaining 15 marks for internal practical examination. There shall be two internal practical examinations of 15 marks each conducted by the concerned laboratory teacher and the average of the two is considered.

B) End Semester Examination (ESE): The ESE for practical subject / course shall be conducted at the end of the semester with duration of 3 hours by one internal and one external examiner appointed by the Head of the Institution as per the recommendation of the concerned Head of the Department.

8.4 Evaluation of Design / Drawing Subjects / Courses: For the subjects such as Engineering Graphics, Machine Drawing, Production drawing and any such subject, the distribution shall be 30 marks for CIE (15 marks for day-to-day work and 15 marks for Mid-Term examination) and 70 marks for ESE.

A) Continuous Internal Evaluation: There shall be two Mid-Term examinations in a Semester and the Marks for 15 can be calculated taking average of the two Mid-term examinations and these are added to the marks obtained in day to day work evaluation.

B) End Semester Examinations: The duration of ESE is 03 hours consisting of five questions carrying 14 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.5 Evaluation of Summer Internship: The Summer internship (02 - 04 weeks) registered by the students in consultation with course coordinator and carried out in Industries and/or R&D Organizations immediately after their VI semester course work. The completion report will be assessed in VII semester for 'Satisfactory' or 'Unsatisfactory' by a committee consisting of Head of the Department, supervisor and a senior faculty member of the department.

8.6 Evaluation of Project work: Student(s) shall start the Project Work during the VII Semester

(IV-B.Tech.–I–Semester) as per the instructions of the Project Guide / Project Supervisor assigned by the Head of the Department. The topics for Summer Internship, Project Stage – I and Technical seminar shall be different from one another.

- a) The Project Work shall be carried out in two stages: Project-I (Stage – I) during VII Semester (IV-B.Tech.–I–Semester), and Project-II (Stage – II) during VIII Semester (IV-B.Tech.–II–Semester), and the student has to prepare two independent Project Work Reports – *one each during each stage*. First Report shall include the Project Work carried out under Stage – I, and the Second Report (Final Report) shall include the Project Work carried out under Stage – I and Stage – II put together. Stage – I and Stage – II of the Project Work shall be evaluated for 100 marks each.
- b) Out of the total 100 marks allotted for each stage of the Project Work, 30 marks shall be for the Continuous Internal Evaluation(CIE), and 70 marks shall be for the End Semester Viva-voce Examination (ESE). The marks earned under CIE for both the stages of the Project shall be awarded by the Project Guide / Supervisor (based on the continuous evaluation of student’s performance during the two Project Work stages); and the marks earned under ESE shall be awarded by the Project Viva-voce Committee / Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).
- c) For the Project Stage - I, the Viva-voce shall be conducted at the end of the VII Semester, before the commencement of the End semester Examinations, by the Project Evaluation Committee comprising of the Head of the Department or One Senior Faculty member and Supervisor and the Project Stage – II Viva-voce shall be conducted by the Committee comprising of an External Examiner appointed by the Head of the Institution, Head of the Department and Project Supervisor at the end of the VIII Semester, before the commencement of the End Semester Examinations.
- d) If a student does not appear (or fails) for any of the two Viva-voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Stage - I and/or Project Stage - II Viva-voce examinations, as and when they are scheduled again in that semester; if he fails in such ‘one reappearance’ evaluation also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate.

8.7 Evaluation of Technical Seminar: The student has to enroll and get approval for technical seminar on a specialized topic from the concerned advisor / Mentor in the beginning of VII semester (IV year I semester). The student should collect the information on a specialized topic, prepare a technical report, give seminar presentation on the topic and submit it to the department as notified by the concerned Head of the Department. It shall be evaluated by the departmental evaluation committee consisting of Head of the Department, seminar supervisor and two senior faculty members. The seminar report and the seminar presentation shall be evaluated for 100 marks. There shall be no End Semester Examination for the seminar.

8.8 Evaluation of Mandatory Non-Credit Courses: There shall be only CIE for all mandatory (non-credit) courses, instead of marks or letter grade. ‘Satisfactory’ or “Unsatisfactory’ shall be indicated and this will not be counted for the computation of SGPA / CGPA. The student has to maintain a minimum of 65% attendance and secure not less than 40% in the CIE and then only the student is declared as **pass** and will be qualified for the award of the degree.

8.9 MOOCs Courses through SWAYAM Portal: The approved list of SWAYAM courses shall be notified and made available at the beginning of the semester. The students are given option to choose Professional Electives / Open Electives in the curriculum offered by the institute or from the notified list. The maximum number of transferable credits through SWAYAM Courses are capped at 18 (06 Courses).

9. GRADING PROCEDURE

- 9.1 Grades will be awarded to indicate the performance of the student in each theory subject, lab / practical's, design/drawing practice, Summer Internship, Technical Seminar and Project-I & Project-II based on the percentage of marks obtained in Continuous Internal Evaluation plus End Semester Examination, both taken together, as specified in item 8 above, a corresponding letter grade shall be given.
- 9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following letter grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

| % of Marks Secured (Class Intervals) | Letter Grade (UGC Guidelines) | Grade Points |
|--|-------------------------------|--------------|
| 90% and above ($\geq 90\%$, $\leq 100\%$) | O (Outstanding) | 10 |
| Below 90% but not less than 80% ($\geq 80\%$, $< 90\%$) | A ⁺ (Excellent) | 9 |
| Below 80% but not less than 70% ($\geq 70\%$, $< 80\%$) | A (Very Good) | 8 |
| Below 70% but not less than 60% ($\geq 60\%$, $< 70\%$) | B ⁺ (Good) | 7 |
| Below 60% but not less than 50% ($\geq 50\%$, $< 60\%$) | B (above Average) | 6 |
| Below 50% but not less than 40% ($\geq 40\%$, $< 50\%$) | C (Average) | 5 |
| Below 40% ($< 40\%$) | F (Fail) | 0 |
| Absent | AB | 0 |

- 9.3 A student obtaining **F** grade or **AB** grade in any subject shall be considered '**failed**' in that subject and will be required to reappear in '**Supplementary Exam**' in the End Semester Examination (ESE), as and when offered. In such cases, Continuous Internal Examination (CIE) in those subject(s) will remain same as those obtained earlier.
- 9.4 A letter grade does not imply any specific % of marks.
- 9.5 In general, a student shall not be permitted to repeat any subject/course (s) only for the sake of '**grade improvement**' or '**SGPA / CGPA improvement**'. However, student has to repeat all the subjects / courses pertaining to that semester, if detained.
- 9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade obtained in that subject/course (excluding mandatory non-credit courses). Then the corresponding '**credit points**' (CP) are computed by multiplying the grade point with credits for that particular subject/course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits}$$

- 9.7 The student passes the subject / course only when $GP \geq 5$ (C grade or above).
- 9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\text{SGPA (S}_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

- 9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative

performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** Semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year, I semester onwards, at the end of each semester, as per the formula:

$$\text{CGPA} = \frac{\sum (C_j \times S_i)}{\sum C_j}$$

where S_i is the SGPA of the j^{th} semester and C_j is the total number of credits in that semester.

| Illustration of calculation of SGPA | | | | | Illustration of calculation of CGPA | | | |
|-------------------------------------|-----------|--------------|--------------|---------------|-------------------------------------|------------|------|------------------|
| Course /Subject | Credits | Letter Grade | Grade Points | Credit Points | Sem. | Credits | SGPA | Credits x SGPA |
| Course 1 | 4 | A | 8 | 4 x 8 = 32 | Sem I | 19 | 7 | 19 x 7 = 133 |
| Course 2 | 3 | O | 10 | 3 x 10 = 30 | Sem II | 19 | 6 | 19 x 6 = 114 |
| Course 3 | 3 | C | 5 | 3 x 5 = 15 | Sem III | 21 | 6.5 | 21 x 6.5 = 136.5 |
| Course 4 | 3 | B | 6 | 3 x 6 = 18 | Sem IV | 21 | 6 | 21 x 6 = 126 |
| Course 5 | 1.5 | A+ | 9 | 1.5x9 = 13.5 | Sem V | 21 | 7.5 | 21 x 7.5 = 157.5 |
| Course 6 | 1.5 | A | 8 | 1.5x8 = 12 | Sem VI | 21 | 8 | 21 x 8 = 168 |
| Course 7 | 1.5 | B+ | 7 | 1.5x7 = 10.5 | Sem VII | 21 | 8.5 | 21 x 8.5 = 178.5 |
| Course 8 | 1.5 | A+ | 9 | 1.5x9 = 13.5 | Sem VIII | 17 | 8 | 17 x 8 = 136 |
| Total | 19 | | 62 | 144.5 | Total | 160 | | 1161.5 |
| SGPA = 144.5/19 = 7.60 | | | | | CGPA = 1161.5/160 = 7.26 | | | |

9.10 For merit ranking or comparison purposes or any other listing, **only** the ‘rounded off’ values of the CGPAs will be used.

9.11 For calculations listed in Item 9.6–9.9, performance in failed subjects/courses (securing **F** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations. However, mandatory courses will not be taken into consideration.

10 PASSING STANDARDS

10.1 A student shall be declared ‘**successful**’ or ‘**passed**’ in a semester, if student secures a GP ≥ 5 (‘C’ grade or above) in every subject/course in that semester (i.e. when student gets an SGPA ≥ 5.00 at the end of that particular semester); and a student shall be declared ‘**successful**’ or ‘**passed**’ in the entire under graduate programme, only when a student gets a CGPA ≥ 5.00 for the award of the degree as required.

10.2 After the completion of semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned etc.), credits earned, SGPA, and CGPA.

11 DECLARATION OF RESULTS

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 – 9.9.

11.2 For Final percentage of marks equivalent to the computed final CGPA, the following formula may be used:

$$\text{Percentage of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12 AWARD OF DEGREE

12.1 After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. degree the student shall be placed in one of the following four classes based on CGPA:

| Class Awarded | Grade to be Secured | Remarks |
|---------------|---------------------|---------|
|---------------|---------------------|---------|

| | | |
|------------------------------|-----------------------------|--|
| First Class with Distinction | ≥ 8 CGPA | From the aggregate marks secured from 160 Credits for Regular Students and 120 Credits for Lateral Entry Students. |
| First Class | ≥ 6.5 to < 8 CGPA | |
| Second Class | ≥ 5.5 to < 6.5 CGPA | |
| Pass Class | ≥ 5.00 to < 5.5 CGPA | |
| FAIL | CGPA < 5 | |

- 12.2** First class with distinction will be awarded to those students who clear all the subjects during his / her regular course of study by fulfilling the following conditions:
- Should have passed all the subjects/courses within the first 4 academic years (or 8 sequential semesters) for B.Tech. (Regular) and first 3 academic years (or 6 sequential semesters) for B.Tech. (LES) from the date of commencement of first year first semester for B.Tech. (Regular) and II year I semester for B.Tech. (LES).
 - Should have secured a CGPA ≥ 8.00 , at the end of each of the 8 sequential semesters (6 sequential semesters for LES), starting from I year I semester (starting from II year I semester for LES) onwards.
 - Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction**'.

A Student not fulfilling any of the above condition and having final CGPA ≥ 8.00 shall be placed in "First Class".

- 12.3 B. Tech (Honors):** The student who accrue 20 credits from NPTEL in addition to their regular course work, will be awarded with Honors Degree.
- 12.4 Award of Medals:** Students fulfilling the conditions listed under item 12.2 alone will be eligible for award of '**College Ranks**' and '**Medals**'.
- 12.5 Graduation Day:** The College shall have its own Annual Graduation Day for the award of Degrees issued by the University.
- 12.6 Transcripts:** After successful completion of prerequisite credits for the award of degree a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13 WITHHOLDING OF RESULTS

If the student has not paid the fees to the Institute at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subjects will be conducted along with even semester regular examinations and vice versa.

15. TRANSITORY REGULATIONS

- A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set / category of electives or equivalents

suggested, as the case maybe) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

- b) A student who has failed in any subject under any regulation has to pass those subjects in the respective regulations.
- c) The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R19 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.
- d) If a student readmitted to R19 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R19 Regulations will be substituted by another subject to be suggested by the CMRTC Academic Council.
- e) **Promotion Rule:** Where the credits allotted to a semester/year under the regulations studied in are different from that under R19 regulations for the corresponding semester/year, the promotion rules of R19 vide section 7.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under R19 regulations and revising the secured credits also in the same proportion.

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

- 17.1 Any attempt by any student to influence the teachers, examiners, faculty members and staff of Controller of Examination office for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice case and the student can be debarred from the college.
- 17.2 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, student is awarded zero marks in that subject(s).
- 17.3 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Malpractice Prevention Committee is final.

18. MALPRACTICE

18.1 **Malpractice Prevention Committee:** The committee shall examine the student's malpractice and indiscipline cases occurred, while conducting the examinations and recommend appropriate punishment to the Academic Council after taking explanation from the student and concerned invigilator as per the malpractice rules mentioned below. The committee consists of

- a) Controller of Examinations - Chairman
- b) Addl. Controller of Examinations.- Convener
- c) Subject Expert - Member
- d) Head of the Department of which the student belongs to - Member
- e) The Invigilator concerned - Member

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

| S. No. | Nature of Malpractices / Improper Conduct | Punishment |
|--------|--|---|
| 1(a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| 1(b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 2 | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate shall be cancelled. |
| 3 | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4 | Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not |

| | | |
|---|--|---|
| | during or after the examination. | be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5 | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 6 | Refuses to obey the orders of the Controller of examinations / 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 addl. Controller of examinations 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 addl. Controller of examinations, 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 subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. |
| 7 | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8 | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that |

| | | |
|----|---|---|
| | | subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. |
| 9 | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8. | Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. |
| 10 | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. |
| 11 | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 12 | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Chief Superintendent for further action to award suitable punishment. | |

19. SCOPE

- i) Wherever the words 'he, him, his' occur in the regulations, they shall include 'she, her'.
- ii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
- iii) The above mentioned rules and regulations are applicable in general to both B.Tech. (Regular) and B.Tech. (LES), unless and otherwise specific.
- iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the Academic Council.

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B.Tech. I Year Syllabus

Common for Civil, Mechanical

I SEMESTER

| S. No | Course Code | Course Title | L | T | P | Credits |
|----------------------|-------------|--|-----------|----------|-----------|-----------|
| 1 | 20MA101BS | Algebra and Calculus | 3 | 1 | 0 | 4 |
| 2 | 20PH102BS | Engineering Physics | 3 | 1 | 0 | 4 |
| 3 | 20EC103ES | Basic Electrical & Electronics Engineering | 3 | 1 | 0 | 4 |
| 4 | 20ME104ES | Engineering Graphics | 2 | 0 | 4 | 4 |
| 5 | 20PH105BS | Engineering Physics Lab | 0 | 0 | 3 | 1.5 |
| 6 | 20EC106ES | Basic Electrical & Electronics Engineering Lab | 0 | 0 | 3 | 1.5 |
| 7 | 20EC107ES | Basic Elements of Engineering Technology | 0 | 0 | 2 | 1 |
| 8 | 20MC108ES | Environmental Science | 3 | 0 | 0 | 0 |
| | | Induction Programme | | | | |
| Total Credits | | | 14 | 3 | 12 | 20 |

II SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|----------------------|-------------|---|-----------|----------|-----------|-----------|
| 1 | 20MA201BS | Ordinary Differential Equations and Vector Calculus | 3 | 1 | 0 | 4 |
| 2 | 20CH202BS | Engineering Chemistry | 3 | 1 | 0 | 4 |
| 3 | 20CS203ES | Programming for problem solving | 3 | 1 | 0 | 4 |
| 4 | 20EN204HS | English | 2 | 0 | 0 | 2 |
| 5 | 20ME205ES | Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 6 | 20CH206BS | Engineering Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | 20EN207HS | English Language and Communication Skills Lab | 0 | 0 | 3 | 1.5 |
| 8 | 20CS208ES | Programming for problem solving Lab | 0 | 0 | 3 | 1.5 |
| Total Credits | | | 11 | 3 | 12 | 20 |

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B.Tech. II Year Syllabus

Mechanical Engineering

III SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|--|-----------|----------|-----------|-----------|
| 1 | 20ME301ES | Engineering Mechanics | 3 | 0 | 0 | 3 |
| 2 | 20ME302PC | Metallurgy and Material Science | 3 | 0 | 0 | 3 |
| 3 | 20ME303PC | Thermodynamics | 3 | 0 | 0 | 3 |
| 4 | 20ME304PC | Computer Aided Machine Drawing | 2 | 0 | 4 | 4 |
| 5 | 20ME305PC | Fluid Mechanics and Hydraulic Machines | 3 | 0 | 0 | 3 |
| 6 | 20ME306PC | Fuels and Lubricants -Lab | 0 | 0 | 2 | 1 |
| 7 | 20ME307PC | Fluid Mechanics and Hydraulic Machines Lab | 0 | 0 | 3 | 1.5 |
| 8 | 20ME308PC | Metallurgy and Material Science -Lab | 0 | 0 | 3 | 1.5 |
| 9 | 20MC309CI | Constitution of India | 3 | 0 | 0 | 0 |
| | | Total Credits | 17 | 0 | 12 | 20 |

IV SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|-----------------------------------|-----------|----------|-----------|-----------|
| 1 | 20MA401BS | Statistical and Numerical Methods | 3 | 1 | 0 | 4 |
| 2 | 20ME402PC | Applied Thermodynamics | 3 | 0 | 0 | 3 |
| 3 | 20ME403PC | Mechanics of Solids | 3 | 0 | 0 | 3 |
| 4 | 20ME404PC | Manufacturing Process | 3 | 0 | 0 | 3 |
| 5 | 20ME405PC | Kinematics of Machinery | 3 | 0 | 0 | 3 |
| 6 | 20ME406PC | Mechanics of Solids -Lab | 0 | 0 | 3 | 1 |
| 7 | 20ME407PC | Applied Thermodynamics -Lab | 0 | 0 | 3 | 1.5 |
| 8 | 20ME408PC | Manufacturing Process- Lab | 0 | 0 | 3 | 1.5 |
| 9 | 20MC409GS | Gender Sensitization Lab | 0 | 0 | 2 | 0 |
| | | Total Credits | 15 | 1 | 11 | 20 |

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. III Year Syllabus

Mechanical

V SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|--|-----------|----------|----------|-----------|
| 1 | 20ME501PC | Instrumentation and Control systems | 3 | 0 | 0 | 3 |
| 2 | 20ME502PC | Thermal Engineering | 3 | 0 | 0 | 3 |
| 3 | 20ME503PC | Design of Machine Members-I | 3 | 1 | 0 | 4 |
| 4 | 20ME504PC | Metrology and Machine Tools | 3 | 0 | 0 | 3 |
| 5 | 20ME505PC | Dynamics of Machinery | 3 | 0 | 0 | 3 |
| 6 | 20ME506PC | Machine Tools & Metrology-Lab | 0 | 0 | 3 | 1.5 |
| 7 | 20ME507PC | Instrumentation and control systems -Lab | 0 | 0 | 3 | 1.5 |
| 8 | 20ME508PC | Kinematics & Dynamics Lab | 0 | 0 | 2 | 1 |
| 9 | 20MC509IP | Intellectual Property Rights | 3 | 0 | 0 | 0 |
| 10 | 20MC510CS | Cyber Security | 3 | 0 | 0 | 0 |
| | | Total Credits | 21 | 1 | 8 | 20 |

VI SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|--|-----------|----------|----------|-----------|
| 1 | 20ME601PC | CAD/CAM | 3 | 0 | 0 | 3 |
| 2 | 20ME602PC | Design of Machine Members-II | 3 | 0 | 0 | 3 |
| 3 | 20ME603PC | Heat Transfer | 3 | 1 | 0 | 4 |
| 4 | | Professional Elective-I | 3 | 0 | 0 | 3 |
| 5 | | Open Elective-I | 3 | 0 | 0 | 3 |
| 6 | 20ME604PC | Heat Transfer-Lab | 0 | 0 | 3 | 1.5 |
| 7 | 20ME605PC | CAD/CAM - Lab | 0 | 0 | 3 | 1.5 |
| 8 | 20EN607HS | Advanced English Communication skill Lab | 0 | 0 | 2 | 1 |
| 9 | 20MC609AI | Artificial Intelligence | 3 | 0 | 0 | 0 |
| | | Total Credits | 18 | 1 | 8 | 20 |

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. IV Year Syllabus (A.Y. 2023-24)

Mechanical

VII SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|---|-----------|----------|-----------|-----------|
| 1 | 20MB701HS | Business Economics & Financial Analysis | 3 | 0 | 0 | 3 |
| 2 | 20ME702PC | Refrigeration & Air Conditioning | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective-II | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective-III | 3 | 0 | 0 | 3 |
| 5 | | Open Elective-II | 3 | 0 | 0 | 3 |
| 6 | 20ME703PC | Seminar | 0 | 0 | 2 | 1 |
| 7 | 20ME704PR | Project Phase-I | 0 | 0 | 4 | 2 |
| 8 | 20ME705PR | Internship/Industrial Training | 0 | 0 | 4 | 2 |
| | | Total Credits | 15 | 0 | 10 | 20 |

VIII SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|---------------------------------|----------|----------|-----------|-----------|
| 1 | | Professional Elective-IV | 3 | 1 | 0 | 4 |
| 2 | | Professional Elective-V | 3 | 0 | 0 | 3 |
| 3 | | Open Elective-III | 3 | 0 | 0 | 3 |
| 4 | 20ME804PR | Project Phase-II | 0 | 0 | 20 | 10 |
| | | Total Credits | 9 | 1 | 20 | 20 |

Professional Elective - I

| | |
|-----------|------------------------------------|
| 20ME611PE | Unconventional Machining Processes |
| 20ME612PE | Additive Manufacturing Technology |
| 20ME613PE | Engineering Tribology |

Professional Elective – II

| | |
|-----------|-------------------------|
| 20ME721PE | Power Plant Engineering |
| 20ME722PE | Finite Element Methods |
| 20ME723PE | Industrial Management |

Professional Elective – III

| | |
|-----------|------------------------------|
| 20ME731PE | Operations Research |
| 20ME732PE | Computational Fluid Dynamics |
| 20ME733PE | Robotics |

Professional Elective – IV

| | |
|-----------|-----------------------------|
| 20ME841PE | Renewable Energy Sources |
| 20ME842PE | IC Engines and Gas Turbines |
| 20ME843PE | CNC Technology |

Professional Elective – V

| | |
|-----------|---------------------------------|
| 20ME851PE | Production Planning and Control |
| 20ME852PE | Fluid Power System |
| 20ME853PE | Automation in Manufacturing |

Note: As Engineering mechanics subject is moved to second year from first year ,ICS subject is shifted to final year from second year.

***Open Elective** subjects' syllabus is provided in a separate document.

***Open Elective** – Students should take Open Electives from the List of Open Electives Offered by Other Departments/Branches Only.

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

| S.No. | Name of the Department Offering Open Electives | Open Elective – I (Semester – V) | Open Elective – II (Semester – VI) |
|-------|---|---|---|
| 1 | Aeronautical Engg. | AE511OE: Introduction to Space Technology | AE621OE: Introduction to Aerospace Engineering |
| 2 | Automobile Engg. | CE511OE: Disaster Management MT512OE: Intellectual Property Rights | MT621OE: Data Structures MT622OE: Artificial Neural Networks |
| 3 | Biomedical Engg. | BM511OE: Reliability Engineering | BM621OE: Medical Electronics |
| 4 | Civil Engg. | 19CE505OE: Disaster Management | CE621OE: Remote Sensing and GIS CE622OE: Geo- Informatics 19CE605OE: Intellectual Property Rights |
| 5 | Civil and Environmental Engg. | CE511OE: Disaster Management | CN621OE: Environmental Impact Assessment CE623OE: Intellectual Property Rights |
| 6 | Computer Science and Engg. / Information Technology | CS511OE: Operating Systems CS512OE: Database Management Systems | CS621OE: Java Programming CS622OE: Software Testing Methodologies CS623OE: Cyber Security |

| | | | |
|----|--|--|--|
| 7 | Electronics and Communication Engg. / Electronics and Telematics Engg. | EC511OE: Principles of Electronic Communications | EC621OE: Principles of Computer Communications and Networks |
| 8 | Electronics and Computer Engg. | EM511OE: Scripting Languages | EM621OE: Soft Computing Techniques |
| 9 | Electrical and Electronics Engg. | EE511OE: Non-Conventional Power Generation EE512OE: Electrical Engineering Materials EE513OE: Nanotechnology | EE621OE: Design Estimation and Costing of Electrical Systems EE622OE: Energy Storage Systems EE623OE: Introduction to Mechatronics |
| 10 | Electronic and Instrumentation Engg. | EI511OE: Electronic Measurements and Instrumentation | EI621OE: Industrial Electronics |
| 11 | Mechanical Engg. | ME511OE: Optimization Techniques ME512OE: Computer Graphics ME513OE: Introduction | ME621OE: World Class Manufacturing ME622OE: Fundamentals of Robotics ME623OE: Fabrication |
| | | to Mechatronics ME514OE: Fundamentals of Mechanical Engineering | Processes |
| 12 | Mechanical Engg. (Material Science and Nanotechnology) | NT511OE: Fabrication Processes NT512OE: Non Destructive Testing Methods NT513OE: Fundamentals of Engineering Materials | NT621OE: Introduction to Material Handling NT622OE: Non- Conventional Energy Sources NT623OE: Robotics |
| 13 | Mechanical Engg. (mechatronics) | MT511OE: Analog and Digital I.C. Applications MT512OE: Intellectual Property Rights MT513OE: Computer Organization | MT621OE: Data Structures MT622OE: Artificial Neural Networks MT623OE: Industrial Management |
| 14 | Metallurgical and Materials Engg. | MM511OE: Materials Characterization Techniques | MM621OE: Science and Technology of Nano Materials MM622OE: Metallurgy of Non Metallurgists |
| 15 | Mining Engg. | MN511OE: Introduction to Mining Technology | MN621OE: Coal Gasification, Coal Bed Methane and Shale Gas |

| | | | |
|---------------|--|---|---|
| 16 | Petroleum Engg. | PE511OE: Materials Science and Engineering PE512OE: Renewable Energy Sources PE513OE: Environmental Engineering | PE621OE: Energy and Management PE622OE: Conservation and Optimization Techniques PE623OE: Entrepreneurship and Small Business Enterprises |
| S. No. | Name of the Department Offering Open Electives | Open Elective –III (Semester – VIII) | |
| 1 | Aeronautical Engg. | AE831OE: Air Transportation Systems AE832OE: Rockets and Missiles | |
| 2 | Automobile Engg. | AM831OE: Introduction to Mechatronics AM832OE: Microprocessors and Microcontrollers | |
| 3 | Biomedical Engg. | BM831OE: Telemetry and Tele control and BM832OE: Electromagnetic Interference Compatibility | |
| 4 | Civil Engg. | CE831OE: Environmental Impact Assessment CE832OE: Optimization Techniques in Engineering CE833OE: Entrepreneurship and Small Business Enterprises | |
| 5 | Civil and Environmental Engg. | CN831OE: Remote Sensing and GIS CE833OE: Entrepreneurship and Small Business Enterprises | |
| 6 | Computer Science and Engg./Information Technology | CS831OE: Linux Programming CS832OE: R Programming CS833OE: PHP Programming | |
| 7 | Electronics and Communication Engg. / Electronics and Telematics Engg. | EC831OE: Electronic Measuring Instruments | |
| 8 | Electronics and Computer Engg. | EM831OE: Data Analytics | |
| 9 | Electrical and Electronics Engg. | EE831OE: Entrepreneur Resource Planning EE832OE: Management Information Systems EE833OE: Organizational Behaviour | |
| 10 | Electronics and Instrumentation Engg. | EI831OE: Sensors and Transducers, EI832OE: PC Based Instrumentation | |
| 11 | Mechanical Engg. | ME831OE: Total Quality Management ME832OE: Industrial Safety, Health, and Environmental Engineering ME833OE: Basics of Thermodynamics ME834OE: Reliability Engineering | |
| 12 | Mechanical Engg. (Material Science and Nanotechnology) | NT831OE: Concepts of Nano Science and Technology NT832OE: Synthesis of Nanomaterials NT833OE: Characterization of Nanomaterials | |
| 13 | Mechanical Engg. (mechatronics) | MT831OE: Renewable Energy Sources MT832OE: Production Planning and Control CE833OE: Entrepreneurship and Small Business Enterprises | |

| | | |
|----|-----------------------------------|---|
| 14 | Metallurgical and Materials Engg. | MM831OE: Design and Selection of Engineering Materials |
| 15 | Mining Engg. | MN831OE: Solid Fuel Technology MN832OE: Health & Safety in Mines |
| 16 | Petroleum Engg. | PE831OE: Disaster Management PE832OE: Fundamentals of Liquefied Natural Gas PE833OE: Health, Safety and Environment in Petroleum Industry |

20MA101BS: Algebra and Calculus**B.Tech. I SEM**

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Course Objectives: To learn

1. Types of matrices and their properties, rank of the matrix, consistency and solving the system of linear equations.
2. Concept of Eigen values and eigenvectors and to reduce the Quadratic form to Canonical form.
3. Concept of Sequences and nature of the series.
4. Geometrical approach to the mean value theorems and their application to the mathematical problems and evaluation of improper integrals using Beta and Gamma functions.
5. Partial differentiation, concept of total derivative, finding maxima and minima of function of two and three variables.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations.
2. Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.
3. Analyze the nature of convergence of sequence and series.
4. Solve problems involving mean value theorems and evaluate the improper integrals using Beta and Gamma functions.
5. Find the extreme values of functions of two variables with/ without constraints.

UNIT-I: Matrices**10L**

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; Orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations. Gauss -elimination method; Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors**10L**

Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and nature of the Quadratic Forms; Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Sequences & Series**10L**

Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences. Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test; Cauchy's Integral test; Cauchy's n^{th} root test. Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

UNIT-IV: Calculus**12L**

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem(without proof) with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem(without proof), Taylor's series of single variable. Definition of improper integral: Beta and Gamma functions and their applications.

UNIT-V: Multivariable calculus (Partial Differentiation and applications)**8L****Definitions of Limit and continuity. Partial Differentiation; Euler's Theorem; Total derivative;**

Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXTBOOKS:

- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCES:

- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publications, Reprint, 2008.
- Higher Engineering Mathematics, (11th Reprint), Ramana B.V., Tata McGraw Hill New Delhi, 2010.
- Engineering Mathematics – I, T.K.V. Iyengar, B. Krishna Gandhi & Others, Edition S.Chand 2013.

20PH102BS: Engineering Physics**B.Tech. I SEM**

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Course Objectives:

1. Quantum mechanics is one of the two foundational theories on which modern physics rests. The concept of wave function developed by Schrödinger and its formulation one-dimensional box are reinforced through relatively simple problems with analytic solutions.
2. The basics of semiconductors, energy bands formation, transport properties and generation recombination phenomena; Principle of operation of diodes and transistors including p-n junctions, Zener diode and BJTs provides background for subsequent courses in electronics.
3. Wave characteristics are those associated with interference and diffraction. An accurate technique for determining how and where waves propagate is given by Huygens's principle. Cosine law for thin film interference, Newtons ring's experiment and interferometer are discussed. The concept of Diffraction and resolving power of grating are explained.
4. LASER explains the basic mechanisms involved in the interaction between the laser medium and the light source. To expose on different types of laser, according to their amplifying medium and its applications. Optical fibre exposes students with the principle of optical fibre and basics of signal propagation through optical fibres and its applications.
5. Magnetic, dielectric behaviour of various materials are exposed to students to apply in industry and engineering.

Course Outcomes:

1. The student would be able to learn the fundamental concepts on Quantum behaviour of matter in its micro state.
2. The knowledge of fundamentals of Semiconductor physics, will enable the students to apply to various systems like pn junction diodes, transistors, communication and so on.
3. The students can gain knowledge on the optical phenomena like Interference and diffraction.
4. LASER explains the basic mechanisms involved in the interaction between the laser medium and the light source. Students would be able to learn Optical fibre principle and its applications as new materials for various engineering applications.
5. The course also helps the students to be exposed to the magnetic materials and dielectric materials.

UNIT-I: Quantum Mechanics**10L**

Introduction to quantum physics, Black body radiation, Planck's law, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

UNIT-II: Semiconductor Physics**10L**

Introduction to semiconductors, calculation of intrinsic carrier concentration and extrinsic carrier concentration, Dependence of Fermi level on carrier concentration and temperature, Carrier transport: diffusion and drift currents, Hall effect, p-n junction diode, Zener diode and their V-I Characteristics, Bipolar Junction transistor(BJT): construction and operation.

UNIT-III: Wave Optics**10L**

Introduction, Huygen's principle, Superposition of waves, Interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Interference in thin films by reflection-Cosine law, Newton's rings, Michelson's interferometer, Frunhofer diffraction due to single slit and double slit, Diffraction grating- resolving power.

UNIT-IV: Lasers and Fibre Optics**8L**

Lasers: Introduction, Characteristics of Lasers, Einstein's coefficients, absorption, spontaneous emission, stimulated emission, population inversion, Pumping, lasing action, Types of Lasers: Ruby laser, He-Ne laser, semiconductor laser, Applications of laser.

Fibre Optics: Introduction, working principle of optical fibre, construction of optical fibre, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, optical fibres in communication system.

UNIT-V: Dielectric and Magnetic Properties of Materials**12L**

Dielectric Properties: Introduction to dielectrics, Polarisation, Permittivity and Dielectric constant, classification of polarizabilities, calculation of polarizabilities: electronic polarizability, ionic polarizability, Internal fields in a solid, Clausius-Mossotti equation, Ferroelectrics and Piezoelectrics, applications of dielectric materials.

Magnetic Properties: Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, soft and hard magnetic materials, Applications of magnetic materials.

TEXT BOOKS

1. Applied Physics, B K Pandey, S. Chaturvedi, T Vijaya Krishna, T Madhu mohan, Cengage publisher
2. Engineering Physics, M K Harbola, Cengage publisher

REFERENCE BOOKS:

1. Engineering Physics, B.K.Pandey, S. Chaturvedi, Cengage Learning
2. Engineering Physics by Dr M N Avadhanulu, S-Chand publications

20EC103ES: Basic Electrical & Electronics Engineering**B.Tech. I SEM**

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Course Objective:

1. To introduce the concepts of electrical circuits and its components.
2. To understand DC circuits and AC Circutes.
3. To study and understand the different types of electrical machines and various electrical installations.
4. To introduce the concepts of diodes & transistors.
5. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve the basic Electrical circuits using different network reduction techniques.
2. To understand the components of low Voltage Electrical Installations.
3. To study the working principles of Electrical Machines.
4. To identify and characterize diodes and their applications.
5. To identify and characterize of transistors and their applications.

UNIT – I**10L**

D.C. CIRCUITS: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.

A.C. CIRCUITS: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits RL, RC, RLC series combination. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT – II**10L**

TRANSFORMERS: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, O.C. and S.C. Tests, Three-phase transformer connections.

ELECTRICAL INSTALLATIONS: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

UNIT – III**10L**

ELECTRICAL MACHINES: Construction and working principle of DC generators, types, emf equation, working principle of DC motors, Torque equation and Speed control of DC shunt motors, Construction and working principle of Three-phase Induction motor, Torque- slip Characteristics

UNIT – IV**08L**

P-N JUNCTION AND ZENER DIODE: Principle of Operation Diode equation, Volt-Ampere characteristics, Static and dynamic resistances, Diode Capacitance-Diffusion and Transition capacitance, a Zener diode characteristics and applications.

RECTIFIERS: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Simple problems.

UNIT – V**10L**

BIPOLAR JUNCTION TRANSISTOR (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. SCR-Construction, Operation and V-I characteristic.

TEXTBOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education
3. Principles of Electrical Engineering and Electronics – V.K. Mehta, Rohit Mehta, S.Chand Publications
4. Electronic Devices and circuits – S. Salivahanan, N.Suresh Kumar, McGraw Hill

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
7. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

20ME104ES: Engineering Graphics**B.Tech. I SEM**

| L | T | P | C |
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Course objectives:

1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solid.
4. To draw surfaces development of solid and prisms.
5. To draw isometric views of solids and basic concept of CAD software

Course Outcomes:

After successful completion of this course, the students should be able to

1. understand the conventions and the methods of drawing engineering curves and scales.[Unit-I]
2. understand and draw the projections of points, lines and planes in different types of projections. [Unit-II]
3. understand and draw projections of solids and sectional views of solid (prisms),Auxiliary views. [Unit-III]
4. understand and sketch the development of surfaces to Right Regular Solids-prism, intersection of Solids.[Unit-IV]
5. prepare 2D & 3D drawings of solids and their transformations .isometric views of lines, plane figures and conversion of Isometric views to Ortho graphic views, Introduction of CAD software.[Unit-V]

UNIT- I**INTRODUCTION TO ENGINEERING DRAWING:****10L**

Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Involute. Scales – Plain, Diagonal and Vernier Scales. Introduction to CAD Software commands and practice.

UNIT - II**ORTHOGRAPHIC PROJECTIONS:****10L**

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.

UNIT –III**10L**

Projections of Regular Solids – Auxiliary Views.

UNIT- IV

Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT –V**10L****ISOMETRIC PROJECTIONS:**

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions –

Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa

Note: - The End Semester Examination will be conducted by using Auto Cad Software.

TEXTBOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:

1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

20PH105BS: Engineering Physics Lab**B.Tech. I SEM**

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Course objectives

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes

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

1. Apply the various procedures and techniques for the experiments.
2. Use the different measuring devices and meters to record the data with precision.
3. Apply the mathematical concepts/equations to obtain quantitative results.
4. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

List of Experiments:

1. Torsional pendulum:
To determine the rigidity modulus of the material of the given wire using torsional pendulum.
2. Newton's rings:
To determine the radius of curvature of the lens by forming Newton's rings.
3. Dispersive power:
To determine the dispersive power of prism by using spectrometer.
4. LCR Circuit:
To determine quality factor and the resonant frequency of LCR circuit.
5. a. To study the V-I characteristics of LASER sources.
b. Plot V-I characteristics of light emitting diode.
6. Optical fibre:
a. To determine the bending losses of Optical fibres
b. To determine the Numerical aperture of a given fibre.
7. R-C Circuit:
To determine the time constant of R-C circuit.
8. Solar Cell:
To study the V-I Characteristics of solar cell.
9. Stewart – Gee's experiment:
Determination of magnetic field along the axis of a current carrying coil.
10. Energy gap of P-N junction diode:
To determine the energy gap of a semiconductor diode.

Note: Minimum 8 experiments are to be performed

20EC106ES: Basic Electrical & Electronics Engineering Lab**B.Tech. I SEM**

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SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL and KVL.
2. Verification of Ohms Law.
3. Three-phase transformer: Verification of Relationship between voltages and currents.(Star –Star, Star – Delta, Delta – star, Delta - Delta)
4. Load Test on Single-phase transformer.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. No Load Characteristics of 3 phase Alternator.

SECTION B: ELECTRONICS ENGINEERING:

1. Study and operation of
(i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies
2. PN Junction Diode Characteristics (Forward bias, Reverse bias)
3. Zener Diode Characteristics
4. Study of CRO.
5. Transistor CE Characteristics
6. Rectifier without Filters (Full wave & Half wave)
7. Rectifier with Filters (Full wave & half wave).

Note: Total 10 experiments are to be conducted.

(Five experiments from PART-A, Five experiments from PART-B)

20EC107ES: Basic Elements of Engineering Technology

B.Tech. I SEM

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Objectives:

- Exploring different engineering technologies and their applications.
- Student should be able to understand IT Networking, Protocols and Computations.
- Understanding the principle of IoT and its architecture.
- Knowledge towards Assembling and testing of robots.
- Understanding functionality of 3D printers and their application.
- Developing team work and insight towards different disciplines of Engineering.

Module I: Network & Computing

PC Hardware: Identify the peripherals of a computer, components in a CPU and its functions. Block diagram of the CPU along with the configuration of each peripheral, disassemble and assemble the PC back to working condition. Install MS Windows / Linux on the personal Computer / Laptop and dual boot configuration.

Connectivity Boot Camp: Connecting to their Local Area Network and access the Internet. Configuration of the TCP/IP setting, access the websites and email.

Web Browsers, Surfing the Web: Customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Module II: Internet of Things

Overview of IoT and Architecture: Brief History, evolution of IoT, Architecture, trends in the Adoption of IoT, Societal Benefits of IoT, Risks, Privacy, Security, Embedded Systems Components, Micro-controller Architecture and Properties and Installing and Setting up the Arduino and Raspberry Pi (RPi) development environment. Build Simple IoT Applications by using Arduino or RPi.

Module III: Robotics

Introduction, Different types of robots, Components of a Robot, Working principle of robots, Applications of robots in various fields, Innovation challenges, Scope of robotics research & its current trends, assembling and testing of Robot.

Module IV: 3D Printing

Introduction, Product Design & Development, 3D Scanning & Printing using different types of materials. Components of 3D Printer, Applications of 3D printed products in various fields, Hands on Experience on 3D printing Machines.

Module V: Case Studies

Students has to submit a report by doing a study on various Engineering applications related to Manufacturing, Retail, Automotive, Logistics, Healthcare, Entertainment and E-Governance.

REFERENCE BOOKS:

1. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
2. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547.
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
5. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
6. Deb S R.and DebS., —Robotics Technology and Flexible Automation, Tata McGraw Hill Education Pvt. Ltd, 2010.
7. Mikell P Groover, —Automation, Production Systems, and computer integrated Manufacturing, Prentice Hall, 2001.
8. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping.
9. Andreas Gebhardt, Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing

20MC108ES: Environmental Science**B. Tech. I SEM**

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Course objectives:**The students should be able to understand**

1. Ecosystem responses to environmental change it will be used to communicate central Eco-system characteristics to a wider community. The main objectives of natural resources is to better understand the roll of resources in economy older to develop more sustainable methods of mapping those resources to ensure their ability to future generation.
2. The main objectives of natural resources is to better understand the roll of resources in economy older to develop more sustainable methods of mapping those resources to ensure their ability to future generation.
3. Bio-diversity is the degree of variation of life resources forms within a given species. it describes organisms in the natural environment, which provided the eco-system service that form our natural capital.
4. Control of pollution at source the maximum extent possible with due regard to technology achievement and economic viability as well as sensitive of the receiving environment.
5. Ensure it environmental factors are consider in the decision making process and adverse environmental impacts or identified, avoided and minimized. Enforce environmental registration for which the council is responsible.

Course outcomes:**The students should be able to**

1. A student will be able to understand the basics of biotic and abiotic things present in the environment and their effects on environment.
2. A student will be able to understand the basics of natural resources and impacts of things present in the environment and their effects.
3. A student will be able to understand the varieties of life forms and conservation techniques.
4. A student will be able to understand the effects of technological, scientific development on environment.
5. A student will be able to assess the impacts on environment and strategic management of environment as stipulated by the local legislative rules, regulations and concepts of sustainable growth related to human life.

UNIT-I:**10L****Ecosystems:**

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:**5L****Natural Resources: Classification of Resources:**

Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:**7L****Biodiversity And Biotic Resources:**

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a

mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:**13L****Environmental Pollution and Control Technologies:**

Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management.

Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC - GOI Initiatives.

UNIT-V:**7L****Environmental Policy, Legislation & EIA:**

Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

20MA201BS: Ordinary Differential Equations and Vector Calculus**B. Tech. II SEM**

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Course Objectives: To learn

1. Methods of solving the differential equations of first and higher order.
2. Applications of first order ordinary differential equations (Orthogonal trajectories, Newton's law of cooling, Natural growth and Decay)
3. Evaluation of surface areas and volumes of revolution of curves.
4. The physical quantities involved in engineering field related to the vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and Volume integrals.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Identify whether the given differential equation of first order is exact or not.
2. Solve higher order differential equation and apply the concept of differential equation to real World problems.
3. Evaluate the multiple integrals and apply the concept to find area and volumes of revolution of curves.
4. Evaluate Gradient, Divergence and Curl of vector differential operator.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: First Order Differential Equations and Applications**12L**

Formation of Differential Equation, Differential Equations of first order and first degree: Variable Separable, Homogeneous Differential Equations, Exact Differential Equation- Reducible to exact, Linear and Bernoulli's equations.

Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Higher Order Differential Equations**10L**

Linear Differential Equations of Second and Higher Order with constant coefficients: Non-Homogeneous terms of the type $f(x) = e^{ax}$, $\sin ax$, $\cos ax$, polynomial in x , $e^{ax}(x)$ and $x(x)$; Method of variation of parameters; Cauchy Homogeneous Linear equation .

UNIT-III: Multivariable Calculus (Integration)**10L**

Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double. Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates).

UNIT-IV: Vector Differentiation**8L**

Vector Differentiation: Scalar and vector point functions, Gradient, Divergence, and Curl. Directional derivatives, tangent plane and normal line, vector identities scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration**10L**

Vector Integration: Line Integral, Work done by force, surface and volume integrals. Vector integral theorems: Green's, Stoke's and Gauss divergence theorems (without proof) and their applications.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42 nd Edition, 2012
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, 4th Ed., Narosa Publishing House, New Delhi,2014.
3. T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganathan and M.V.S.S.N.Prasad, Engineering Mathematics.

REFERENCES:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Ed Wiley ,2012.
2. B.V. Ramana , Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi,2009.
3. A textbook of Engineering Mathematics, Ninth Edition by N. P. Bali, Dr Manish Goyal.

20CH202BS: Engineering Chemistry**B.Tech. II SEM**

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Course Objectives:

1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
3. To acquire the knowledge of electro chemistry, corrosion and water treatment which are essential for the engineers and in industry.
4. To acquire the knowledge about electronic, infra red and NMR spectra.
5. To impart the knowledge of stereo chemistry and synthetic aspects useful for understanding reaction pathways.

Course Outcomes:

The basic concepts included in this course will help the student to gain:

1. The knowledge of atomic, molecular and complex compound structures.
2. The required skills to get clear concepts on hard water, hardness and different purification methods of water.
3. The required principles and concepts of electro chemistry, corrosion and in understanding the problem of water and its treatments.
4. The knowledge of configurational and conformational analysis of molecules and reaction mechanisms.
5. The knowledge of electronic, infrared and NMR spectra.

UNIT-I:**10L****Molecular structure and Theories of Bonding: Atomic and Molecular orbitals**

Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N₂, O₂, O₂⁻, CO, NO and F₂ molecules. π -molecular orbitals of butadiene and benzene.

Crystal Field Theory (CFT): Salient Features of CFT–Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries.

UNIT-II:**8L****Water Chemistry: (08 Hours)**

Introduction-hardness of water-Causes of hardness-Types of hardness: temporary and permanent-expression and units of hardness-Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water–Disinfection of water by chlorination and ozonization. Boiler feed water and its treatment-Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water-Ion exchange process. Desalination of water-Reverse osmosis. Numerical problems.

UNIT –III:**12L****Electrochemistry and corrosion:**

Electrochemistry: Electrochemical cells-electrode potential, standard electrode potential, types of electrodes-calomel, Quinhydrone and glass electrode. Nernst equation- Determination of pH of a solution by using glass electrode. Electrochemical series and its applications. Numerical problems.

Batteries: Primary (Lithium cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery).

Corrosion: Causes and effects of corrosion-theories of corrosion: chemical and electrochemical corrosion-mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods-Cathodic

protection-Sacrificial anodic and impressed current cathodic protection. Surface coatings-metallic coating methods: Hot dipping, Electroplating and Electroless plating of Nickel.

UNIT – IV:**10L****Stereochemistry, Reaction Mechanism and synthesis of drug molecules.**

Stereochemistry: Isomerism: structural and stereo isomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and absolute configuration. Conformational analysis of n-butane.

Reaction Mechanism: Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN^1 , SN^2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard addition of carbonyl compounds. Elimination reactions: Dehydrohalogenation of alkylhalides-Saytzeff's rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromic acid. Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$ & $NaBH_4$.

Drug molecules: Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

UNIT-V:**10L****Spectroscopic techniques and applications.**

Introduction to spectroscopy, electromagnetic spectrum: Principles of electronic magnetic spectroscopy spectroscopy-Lambert –Beer's Law, selection rules: Woodward–Fieser rule. Chromophore, auxochrome and various shifts. Applications of electronic spectroscopy. Principle and selection rules of vibrational and rotational spectroscopy. Applications of vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift and splitting pattern of NMR signals. Applications of NMR: Introduction to Magnetic resonance imaging.

TEXT BOOKS:

1. Engineering Chemistry by P. C Jain and M. Jain, Dhanpat Rai Publications, New Delhi, 16th Edition.
2. Text book of Engineering chemistry by Jaya shree Anireddy, Wiley Publications.
3. Engineering Chemistry by Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy, Subhendu Chakroborty, Cengage Publications, New Delhi-2018.
4. A Textbook of Engineering Chemistry by Dr. Bharathi Kumari Yalamanchili, VGS Techno Series (R18 Syllabus)
5. A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publications, New Delhi.

REFERENCES:

1. Engineering Chemistry by S. S. Dara, S. Chand & Company Ltd, New Delhi.
2. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, New Delhi.
3. Engineering Chemistry by B. Sivasankar, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

20CS203ES: Programming for Problem Solving**B.Tech. II SEM**

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Course Objectives:

1. To learn the fundamentals of computers, algorithms and flowcharts.
2. To learn how arrays, pointer, structure and union are used.
3. To learn preprocess command and implement file in c
4. To learn the concepts code reusability using Functions.
5. To learn various searching and sorting techniques using Arrays

Course Outcomes: The student will learn

1. To write algorithms and to draw flowcharts for solving problems.
2. To understand use arrays, pointers, strings and structures to write C programs.
3. To understand the files using C programs.
4. To decompose a problem into functions and to develop modular reusable code.
5. To understand the Searching and sorting problems.

UNIT - 1: Introduction to Programming**12L**

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators.

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers**10L**

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation), Enumeration data type.

UNIT - III: Preprocessor and File handling in C**9L**

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

UNIT - IV: Function and Dynamic Memory Allocation**9L**

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

UNIT - V: Introduction to Algorithms:**10L**

Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number, etc.

Basic searching in an array of elements (linear and binary search techniques),

Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms),

Basic concept of order of complexity through the example programs

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

20EN204HS: English**B.Tech. II SEM**

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Course Objectives:

The course will help students to-

1. Apply their knowledge of English grammar and vocabulary in a variety of written compositions.
2. Examine a given text accurately to achieve optimum comprehension.
3. Develop study skills and techniques.
4. Analyze the content of other academic subjects critically.
5. Express cognitive and affective ideas and experiences clearly.

Course Outcomes:

Students should be able to-

1. Generate ideas and create effective sentence structures in spoken and written forms.
2. Comprehend passages and texts critically and respond appropriately.
3. Select specific approaches to study and retain information.
4. Interpret technical content using theoretical and practical components of English language.
5. Communicate effectively in formal and informal contexts.

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students.

In English classes, the focus should be on the enhancement of skills in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development and also on personality development fostering ideas and practice of language skills and exhibiting the right values and ethics in various contexts and cultures.

Learning Objectives: The course will help to

6. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
7. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
8. Develop Study Skills and Communication Skills in formal and informal situations.
9. Integrate Value Education and Ethics.

Course Outcomes: Students should be able to

10. Use English Language effectively in spoken and written forms.
11. Comprehend the given texts and respond appropriately.
12. Communicate confidently and assertively in various contexts and different cultures.
13. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

UNIT –I:**8L****‘Mokshagundam Visvesvaraya’ from the prescribed text book by JNTUH****‘Epitome of Wisdom’ - Maruthi Publications.****Vocabulary Building:** The Concept of Word Formation -The Use of Prefixes and Suffixes.**Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions.**Reading:** Reading and Its Importance- Techniques for Effective Reading.**Basic Writing Skills:** Sentence Structures - Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.**UNIT –II:****8L****‘Ancient Architecture in India’ from the prescribed textbook ‘English for Engineers’ published by Cambridge University Press.****Vocabulary:** Synonyms and Antonyms.**Grammar:** Identifying Common Errors in Writing with Reference to Noun - Pronoun Agreement and Subject-verb Agreement.**Reading:** Improving Comprehension Skills – Techniques for Good Comprehension.**Writing:** Format of a Formal Letter - **Writing Formal Letters-** Letter of Complaint, Letter of Requisition, Job Application with Resume.**UNIT –III:****9L****‘Blue Jeans’ from the prescribed textbook ‘English for Engineers’ published by Cambridge University Press.****Vocabulary-** Homonyms, Homophones, One-word substitutes.**Grammar-** Misplaced Modifiers and Tenses.**Reading-** Reading poem ‘Stopping by Woods on a Snowy Evening’ by Robert Frost.**Writing-** Note-making, Information Transfer.**UNIT –IV:****8L****‘What Should You Be Eating’ from the prescribed textbook ‘English for Engineers’ published by Cambridge University Press.****Vocabulary:** Standard Abbreviations and Acronyms in English.**Grammar:** Redundancies and Clichés in Oral and Written Communication.**Reading:** Comprehension- Intensive Reading and Extensive Reading.**Writing:** Essay Writing-Précis Writing.**UNIT –V:****10L****‘How a Chinese Billionaire Built Her Fortune’ from the prescribed textbook ‘English for Engineers’ published by Cambridge University Press.****Vocabulary:** Technical Vocabulary**Grammar:** Common Errors in English**Reading:** Reading Comprehension-Exercises for Practice**Writing:** Technical Reports- Introduction – Characteristics of a Report - Categories of Report - Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.**PRESCRIBED TEXTBOOK:****Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.****REFERENCES:**

1. Epitome of Wisdom – Maruthi Publications
2. English Grammar by David Green

3. Swan, M.(2016). Practical English Usage. Oxford University Press.
4. Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.
5. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
6. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
7. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
8. Exercises in Spoken English. Parts I–III. CIEFL, Hyderabad. Oxford University Press.

20ME205ES: Engineering Workshop**B.Tech. II SEM**

| L | T | P | C |
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Course Objective:

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems.

Course Outcomes: On completion of the course, students will be able to

1. Create the different patterns with desired shape and size by using wood.
2. Align and assemble different components to create a product by fitting operations.
3. Fabricate the given material to desired product in a particular pattern by tin smithy.
4. Explain the basic principles of electrical systems in day-to-day applications.
5. Mould the component to desire pattern and shape by black smithy.
6. Create the object by casting process using molten metal.
7. Assemble the components with permanent joint by welding process.
8. Describe the process, transfer of fluid or gases from one place to another place by connecting set of pipes with different requirements in plumbing process

I. (Two experiments each from any six trades of the following)

1. Carpentry
2. Fitting
3. Tin-smithy
4. House-wiring
5. Foundry
6. Plumbing
7. Welding
8. Black smithy

II. Trades for Demonstration and Exposure:

1. Power tools
2. Machine Tools- Operations on Lathe.

Course Outcomes: On completion of the course, students will be able to

1. Create the different patterns with desired shape and size by using wood.
2. Align and assemble different components to create a product by fitting operations.
3. Fabricate the given material to desired product in a particular pattern by tin smithy.
4. Explain the basic principles of electrical systems in day-to-day applications.
5. Mould the component to desire pattern and shape by black smithy.
6. Create the object by casting process using molten metal.
7. Assemble the components with permanent joint by welding process.
8. Describe the process, transfer of fluid or gases from one place to another place by connecting set of pipes with different requirements in plumbing process

TEXT BOOK:

1. P Kannaiah and K L Narayana, Workshop Manual, Scitech publishers, Second Edition.

20CH206BS: Engineering Chemistry Lab**B.Tech. II SEM**

| L | T | P | C |
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| 0 | 0 | 3 | 1.5 |

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
2. To determine the rate constant of reactions from concentrations as a function of time.
3. The measurement of physical properties like surface tension and viscosity.
4. To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.
5. To estimate amount of compound by instrumental titration methods like conductometry, potentiometry and colorimetry.

Course Outcomes: The experiments will make the student gain skills on:

1. Determination of parameters like hardness and chloride content in water.
2. Estimation of rate constant of a reaction from concentration 鈥 鈥 鈥 time relationships.
3. Determination of physical properties like surface tension and viscosity.
4. Calculation of R_f values of some organic molecules by TLC technique.
5. Estimation of amount by conductometry, potentiometry and colorimetry.

List of Experiments:

1. Determination of total hardness of water by complexometric method using EDTA.
2. Determination of chloride content of water by Argentometry.
3. Estimation of HCl by Conductometric titrations.
4. Estimation of Acetic acid by Conductometric titrations.
5. Estimation of HCl by Potentiometric titrations.
6. Estimation of Fe²⁺ by Potentiometry using KMnO₄.
7. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.
8. Synthesis of Aspirin.
9. Thin layer chromatography calculation of R_f values. Ex; ortho and para-nitro phenols.
10. Determination of acid value of coconut oil.
11. Estimation of ferrous iron in cement by colorimetric method.
12. Determination of viscosity of given solvent by using Ostwald's viscometer.
13. Determination of partition coefficient of acetic acid between n-butanol and water.
14. Determination of surface tension of a give liquid using stalagmometer.

Note: Any 12 experiments are to be performed References

1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi).
2. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi).
3. Vogel's text book of practical organic chemistry 5th edition.
4. Text book on experiments and calculations in engineering chemistry–S.S. Dara.

20EN207HS: English Language and Communication Skills Lab**B.Tech. II SEM**

| L | T | P | C |
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| 0 | 0 | 3 | 1.5 |

Course Objectives:

The course will help students to-

1. Use computer-assisted multi-media instruction enabling individualized and independent language learning.
2. Articulate the nuances of English speech sounds distinctly.
3. Modify their accent aiming for intelligibility of speech.
4. Avoid mother tongue interference in their speech.
5. Present a topic individually and in a group in various formal situations.

Course Outcomes:

Students will be able to-

1. Imitate native accent through audio- visual experience and practice.
2. Pronounce English sounds according to standard pronunciation (RP of England).
3. Speak fluently and clearly.
4. Neutralize their accent thus refining their speech.
5. Participate in discussions and presentations effectively and confidently.

Learning Outcomes: Students will be able to attain

- Better understanding of nuances of English language through audio- visual experience and group activities.
- Neutralization of accent for intelligibility.
- Speaking skills with clarity and confidence which in turn enhances their employability skills.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

- Computer Assisted Language Learning (CALL) Lab
- Interactive Communication Skills (ICS) Lab

Listening Skills

Objectives:

1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.
 - Listening for general content
 - Listening to fill up information
 - Intensive listening
 - Listening for specific information

Speaking Skills

Objectives:

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
 - Oral practice: Just A Minute (JAM) Sessions
 - Role play – Individual/Group activities
 - Group discussions and Mock interviews

Exercise – I**CALL Lab:**

Understand: Listening Skill-Its Importance- Purpose-Process-Types-Barriers of Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Communication at Work Place- Spoken vs. Written language.

Practice: Ice-Breaking Activity and JAM Session- Greetings - Introducing Oneself and Others - Taking Leave.

Exercise – II**CALL Lab:**

Understand: Minimal Pairs- Consonant Clusters- Past Tense Markers and Plural Markers.

Practice: Differences in British and American Pronunciation.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.

Practice: Situational Dialogues – Role-Play (face-to-face & telephonic) - Expressions in Various Situations.

Exercise – III**CALL Lab:**

Understand: Structure of Syllables – Word Stress - Weak Forms and Strong Forms in Context – Rhythm

Practice: Basic Rules of Word Accent – Stress Shift.

ICS Lab:

Understand: Exposure to structured talks - How to make Formal Presentations.

Practice: Power Point Presentations.

Exercise – IV**CALL Lab:**

Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Practice: Rising Tones and Falling Tones- Neutralization of accent.

ICS Lab:

Understand: Importance of Team work as a team leader and a team player

Practice: Group Discussion

Exercise - V**CALL Lab:**

Understand: Listening for general & specific details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Interview Skills.

Practice: Mock Interviews

1. Minimum Requirement of infrastructural facilities for ELCS Lab:

- **Computer Assisted Language Learning (CALL) Lab:** The Computer Assisted Language Learning Lab has to accommodate 30 students with 30 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

- Computer network with LAN facility (minimum 30 systems with multimedia) with the following specifications:
 - i) Computers with Suitable Configuration
 - ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

- The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public-Address System, an LCD and a Projector.

20CS208ES: Programming For Problem Solving Lab**B.Tech. II SEM**

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*[Note: The programs may be executed using any available Open Source/ Freely available IDE
Some of the Tools available are:*

CodeLite: <https://codelite.org/>

Code::Blocks: <http://www.codeblocks.org/>

DevCpp : <http://www.bloodshed.net/devcpp.html>

Eclipse: <http://www.eclipse.org> This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:

- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
- To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
- To Write programs using the Dynamic Memory Allocation concept.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

- formulate the algorithms for simple problems
- translate given algorithms to a working and correct program
- correct syntax errors as reported by the compilers
- identify and correct logical errors encountered during execution
- represent and manipulate data with arrays, strings and structures
- use pointers of different types
- create, read and write to and from simple text and binary files
- modularize the code with functions so that they can be reused

Practice sessions:

- Write a simple program that prints the results of all the operators available in C (including pre/ post increment, bitwise and/or/not , etc.). Read required operand values from standard input.
- Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

Simple numeric problems:

- Write a program for fiend the max and min from the three numbers.
- Write the program for the simple, compound interest.
- Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
- Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
 - 5 x 1 = 5
 - 5 x 2 = 10
 - 5 x 3 = 15

- h. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

- A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula $s = ut + (1/2)at^2$ where u and a are the initial velocity in m/sec ($= 0$) and acceleration in m/sec^2 ($= 9.8 m/s^2$)).
- Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators $+$, $-$, $*$, $/$, $\%$ and use Switch Statement)
- Write a program that finds if a given number is a prime number
- Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
- A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
- Write a C program to generate all the prime numbers between 1 and n , where n is a value supplied by the user.
- Write a C program to find the roots of a Quadratic equation.
- Write a C program to calculate the following, where x is a fractional value.
 - $1 - x/2 + x^2/4 - x^3/6$
- Write a C program to read in two numbers, x and n , and then compute the sum of this geometric progression: $1 + x + x^2 + x^3 + \dots + x^n$. For example: if n is 3 and x is 5, then the program computes $1 + 5 + 25 + 125$.

Arrays and Pointers and Functions:

- Write a C program to find the minimum, maximum and average in an array of integers.
- Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.
- Write a C program that uses functions to perform the following:
 - Addition of Two Matrices
 - Multiplication of Two Matrices
 - Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be same.
- Write C programs that use both recursive and non-recursive functions
- To find the factorial of a given integer.
 - To find the GCD (greatest common divisor) of two given integers.
 - To find x^n
- Write a program for reading elements using pointer into array and display the values using array.
- Write a program for display values reverse order from array using pointer.
- Write a program through pointer variable to sum of n elements from array.

Files:

- Write a C program to display the contents of a file to standard output device.
- Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
- Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.
- Write a C program that does the following:
It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the

program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function) The program should then read all 10 values and print them back.

- e. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings:

- a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
- b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
- c. Write a C program that uses functions to perform the following operations:
- d. To insert a sub-string in to a given main string from a given position.
- e. ii. To delete n Characters from a given position in a given string.
- f. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
- g. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.
- h. Write a C program to count the lines, words and characters in a given text.

Miscellaneous:

- a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
- b. Write a C program to construct a pyramid of numbers as follows:

```

1          *          1          1          *
1 2        * *        2 3          2 2        * *
1 2 3      * * *      4 5 6        3 3 3        * * *
                                     4 4 4 4        * *
                                                         *
```

Sorting and Searching:

- a. Write a C program that uses non recursive function to search for a Key value in a given List of integers using linear search method.
- b. Write a C program that uses non recursive function to search for a Key value in a given Sorted list of integers using binary search method.
- c. Write a C program that implements the Bubble sort method to sort a given list of Integers in ascending order.
- d. Write a C program that sorts the given array of integers using selection sort in descending order
- e. Write a C program that sorts the given array of integers using insertion sort in ascending order
- f. Write a C program that sorts a given array of names

Suggested Reference Books for solving the problems:

- i. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- ii. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
- iii. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
- iv. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
- v. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
- vi. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.

20ME301ES: ENGINEERING MECHANICS**B.Tech III SEM**

| | | | |
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| L | T | P | C |
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Course Objectives:

1. To Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
2. To analyze the types of friction for moving bodies and problems related to friction.
3. To determine the centroid of an area and center of gravity of body.
4. To understand the concept of area moment and mass moment about any axes.

Course Outcomes:

After completion of the course the student is able to:

1. Determine the resultant of coplanar concurrent and special force systems and analyse the bodies for equilibrium to find the unknown forces.
2. Analyze the bodies on rough horizontal and inclined planes and connected bodies
3. Determine the centroid of composite areas, centre of gravity of composite bodies
4. Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.

UNIT-I:**10 L**

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II:**09 L**

Friction: Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions -Motion of Bodies -Wedge Screw, Screw-jack and differential screw – jack

UNIT-III:**11 L**

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

UNIT-IV:**10 L**

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-V:**10 L**

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

TEXT BOOKS:

1. Singer's "Engineering Mechanics Statics and Dynamics", K. Vijaya Kumar Reddy, j.Suresh Kumar/ BSP
2. Engineering Mechanics/ Irving Shames, G.Krishna Mohan Rao / Prentice Hall

REFERENCE BOOKS:

1. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGrawHill International Edition,1983.
2. Andrew Pytel, JaanKiusalaas, "Engineering Mechanics", Cengage Learning,2014.
3. Beer F.P & Johnston E.R Jr. Vector, "Mechanics for Engineers", TMH,2004.
4. Hibbeler R.C & Ashok Gupta, "Engineering Mechanics", Pearson Education,2010.
5. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
7. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008.

20ME302PC: METALLURGY AND MATERIAL SCIENCE**B.Tech III SEM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Course Objectives:

1. Develop concept of crystal structure and its defects.
2. Describe phase diagram and heat treatment processes.
3. Classify different ferrous and non ferrous materials.
4. Classify different engineering material (metals, ceramics, polymers, Semi-conductor).
5. Develop concepts in composites with their construction, properties and uses.
6. Summarize significance of material science and its role in manufacturing.

Course Outcomes:

1. To have an idea of different crystal lattice structure and to develop the knowledge of crystal structures in various materials.
2. To have the knowledge of construction of phase diagrams and to implement the same in the different alloying systems.
3. To have a knowledge in different materials their alloys in ferrous and non-ferrous materials and to know their properties applications in daily use.
4. To have an ability to enhance knowledge in various materials, their properties and applications in engineering applications.
5. Applications of composites have become a new trend in the space applications which can withstand high temperatures. So student can analyze the various properties and can come to an conclusion of various applications of composites.
6. Ability to understand the application and use of various metals and materials in manufacturing processes to get a better component or a machine which can withstand high stresses and loads.

UNIT – I**10 L**

Structure of Metals: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods, Imperfection in solids

Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

UNIT – II**09 L**

Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT –III**11 L**

Engineering Materials: Classification of Engineering Materials and its properties: Steels: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe₃C phase diagram.

Construction of TTT diagrams: Annealing, Normalizing, Hardening, and Tempering of steels, Hardenability. Alloy steels.

UNIT – IV**10 L**

Cast Irons: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.
Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V**10L**

Ceramics, Polymers and Composites: Crystalline ceramics, glasses, cermets. Structure, properties and applications. Classification, properties, and applications of Polymers and composites.

TEXT BOOKS:

1. Material science & Metallurgy / Kodgire
2. Introduction to Physical Metallurgy / Sidney H. Avener
3. Materials Science and Engineering-An Introduction”, W. D. Callister,

REFERENCE BOOKS:

1. Material Science and Engineering, V. Raghavan, “, Prentice Hall of India Private Limited, 1999.
2. Engineering Materials, Kenneth G. Budinski and Michael K. Budinski, “, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. Engineering Materials and Metallurgy, U. C. Jindal, “”, Pearson, 2011.
4. Material science & material / C.D. Yesudian & Harris Samuel
5. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
6. Callister's Materials Science and Engineering adopted by R. Balasubramaniam.

20ME303PC: THERMODYNAMICS**B.Tech III SEM**

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Pre-requisite: Engineering Chemistry and Physics**Course Objective:**

1. To get the basic concepts of thermodynamics, temperature measurement, first law and also ability to determine the heat, work in various flow & non-flow processes.
2. To gain the knowledge about the second law of thermodynamics and determine the change in entropy, availability in various processes.
3. To get the knowledge of various phases of a pure substance and calculate the properties using steam tables and to determine properties of perfect gases in various processes.
4. To learn the concepts of a mixture of gasses and to calculate the property values during any process.
5. To get the knowledge about the working of different types of thermodynamic cycles and their performance.
6. To apply the knowledge of thermodynamics in real life applications.
7. To Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

Course Outcomes:

1. At the end of the course, the student should be able to Understand and differentiate between different thermodynamic systems and processes.
2. Understand the basic laws of Thermodynamics.
3. Apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis.
4. Understand and analyze the Thermodynamic cycles and evaluate performance parameters.
5. Understand the concepts of a mixture of gasses and to calculate the property values during any process.
6. Able to use modern engineering tools and equipment to analyze energy transfer in required applications.

Tables: Steam Tables and Mollier Chart, Refrigeration Tables and Psychometric Charts**UNIT – I****09L**

Introduction: Basic Concepts: System, Surrounding, Boundaries, Universe, Control Volume, Control Surface, Types of Systems, Macroscopic and Microscopic Approaches, Concept of Continuum, Thermodynamic Equilibrium, State, path, Process, Property, Exact and Inexact Differentials, Cycle – Reversibility – Quasi-static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement and Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Types of Thermometers – Scales of Temperature, Ideal Gas Scale.

UNIT – II**11L**

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow Process – Steady Flow Energy Equation. PMM-I - Limitations of the First Law of Thermodynamics. Thermal Reservoir, Heat Engine, Refrigerator, Heat pump, Parameters of performance.

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their

Equivalence / Corollaries, PMM II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Gibbs and Helmholtz Functions, Elementary Treatment of the Third Law of Thermodynamics.

Unit – III**10L**

Pure Substances: P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction, Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, Heat and Work Transfer, changes in Internal Energy – Change in Entropy, Throttling and Free Expansion Processes. Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts.

UNIT – IV**10L**

Mixtures of perfect Gases: Mole Fraction, Mass Fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy.

Psychrometric Properties: Atmospheric air, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Psychometric chart.

UNIT - V**10L**

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles. Joules and Rankine Cycles

Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle - Performance Evaluation.

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag / McGrawHill
2. Thermodynamics / C.P.Arora.

REFERENCES:

1. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles / TMH
2. Fundamentals of Classical Thermodynamics – G. Van Wylen & R.E. Sonntag – John Wiley Pub.
3. Thermodynamics – J.P.Holman / McGrawHill
4. Engineering Thermodynamics – Jones & Dugan
5. An introduction to Thermodynamics / YVC Rao / New Age
6. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.
7. Thermodynamics – Achutan – PHI.
8. Thermodynamics – G.C. Gupta – Pearson Publications.

20ME304PC: COMPUTER AIDED MACHINE DRAWING**B.Tech III SEM**

| L | T | P | C |
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| 2 | 0 | 4 | 4 |

Pre-requisites: Engineering graphics

Course objectives: To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

Course Outcomes:

- Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
- Title boxes, their size, location and details - common abbreviations and their liberal usage
- Types of Drawings – working drawings for machine parts using CAD.

Question Paper Pattern:

Question paper will consist of Part-A and Part-B. Part one has five questions out of which answer three (each 10 marks). Part two has one question (assembly with three views) and it is to be answered compulsorily (it carries 50 marks)

PART-A:

Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

Title boxes, their size, location and details - common abbreviations and their liberal usage

Types of Drawings – working drawings for machine parts.

Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, setscrews.
2. Keys, cottered joints and knuckle joint.

3. Rivetted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

PART-B:**Assembly Drawings:**

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts- Screwsjacks, Petrol engine connecting rod, Plummer block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS:

1. Machine Drawing by K.L.Narayana, Wiley Eastern.
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson

REFERENCE BOOKS:

1. Machine Drawing by / Bhattacharyya / Oxford
2. Machine Drawing / Ajeet Singh / Mc GrawHill
3. Machine Drawing / N.D. Bhatt / Charotar

20ME305PC: FLUID MECHANICS AND HYDRAULIC MACHINES**B.Tech III SEM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Course Objectives: The objectives of the course are to enable the student;

- To understand the basic principles of fluid mechanics
- To identify various types of flows
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

Course Outcomes:

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts.

UNIT – I**10 L**

Fluid statics: Physical properties of fluids-density, specific weight, specific gravity, specific volume, viscosity, surface tension, Capillarity, vapor pressure and their influence on fluid motion. Pressure-Pascal's law, Hydrostatic law, atmospheric, gauge and vacuum pressures – measurement of pressure- Piezo meter, U-tube and differential manometers.

UNIT – II**10 L**

Fluid kinematics: Streamline, pathline and streaklines and stream tube, classification of flows-steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

UNIT – III**10 L**

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equation for flow along a stream line, momentum equation and its applications - forces on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes-pipes in series and pipes in parallel-total energy line-hydraulic gradient line. Measurement of flow: Venturimeter, and orifice meter, Pitot tube.

UNIT – IV**10 L**

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine- working proportions, work done, Efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT – V**10L**

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics by RK Bansal.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

20ME306PC: FUELS AND LUBRICANTS LAB**B.Tech III SEM**

| L | T | P | C |
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Prerequisite: Chemistry**Course Objectives:** To Understand the fuel and lubricants properties.**List of Experiments:**

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky Martens Apparatus
3. Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer
6. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using: Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
9. Drop point and Penetration Apparatus for Grease.
10. ASTM Distillation Test Apparatus.
11. Cloud and Pour point Apparatus.

(Note : Any ten of the above experiments are to be covered)

20ME307PC: FLUID MECHANICS AND HYDRAULI MACHINES LAB**B.Tech III SEM**

| L | T | P | C |
|----------|----------|----------|------------|
| 0 | 0 | 3 | 1.5 |

Course Objectives:

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps.

Course Outcomes:

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturi meter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems.

(**Note** : Any ten of the above experiments are to be covered)

20ME308PC: METALLURGY AND MATERIAL SCIENCE LAB**B.Tech III SEM**

| L | T | P | C |
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| 0 | 0 | 3 | 1.5 |

Course Objective: The purpose of this course is to make the students learn the concepts of Metallurgy and Material Science role in all manufacturing processes which convert raw materials into useful products adapted to human needs.

Course Outcomes: The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application. Upon graduation, students would have acquired and developed the necessary back ground and skills for successful careers in the materials-related industries. Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree.

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Grain size measurement by different methods.
4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high –C Steels.
5. Study of the Microstructures of Cast Irons.
6. Study of Microstructures of different alloy steels.
7. Study of the Microstructures of Non-Ferrous alloys.
8. Study of the Microstructures of Heat treated steels.
9. Harden ability of steels by Jominy End Quench Test.
10. To find out the hardness of various heat treated and untreated plain carbon steels.

20MC309CI: CONSTITUTION OF INDIA**B.Tech. III SEM**

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The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”.

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India.
9. Amendment of the Constitutional Powers and Procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency.
12. Local Self Government – Constitutional Scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain Freedom under Article 19.
15. Scope of the Right to Life and Personal Liberty under Article.

20MA401BS: Statistical and Numerical Methods**B.Tech. IV SEM**

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Course Objectives: To learn

1. Random variables that describe randomness or an uncertainty in certain realistic situation.
2. Sampling distribution of mean, variance, point estimation and interval estimation.
3. Non-parametric test such as the Chi-Square test for independence as well as Goodness of fit and provide learner the opportunity to expand their knowledge and skills of the statistical concepts and a personal development experience towards the needs of statistical data analysis.
4. Various methods to find roots of an equation and to fit a desired curve by the method of least squares for the given data
5. Solving ordinary differential equations and integrals using numerical techniques
6. Concepts of probability distributions, statistical inferences and testing of hypothesis and Numerical methods.

Course Outcomes: After learning the contents of this course the student will be able to

1. Differentiate among random variables involved in the probability models which are useful for all branches of engineering.
2. Calculate mean, proportions and variances of sampling distributions and to make important decisions for few samples which are taken from a large data.
3. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two samples .Understand the concept of proportions.
4. Solution of a system of equations and to fit a curve for a given data.
5. Find the numerical solutions for a given first order initial value problem and integrals.
6. Achieve the knowledge to test the hypothesis and form the probability distributions And numerical methods to make inferences.

UNIT- I**10****Probability, Random variables and Distributions:**

Random variables, Discrete random variable, Continuous random variable, Probability distribution function, Probability density function, Expectation.

Binomial, Poisson distributions and Continuous distribution: Normal distributions.

UNIT – II**10 L****Sampling Theory and Test of hypothesis:**

Sampling Theory: Introduction, Population and samples, Sampling distribution of means and variances, Point estimation, Maximum error of estimate, Interval estimation.

Test of Hypothesis For Large Samples : Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, One tail and two-tail tests, Tests concerning one mean and proportion, two means-proportions and their differences.

UNIT – III**10 L****Test of Hypothesis For small Samples:**

Test concerning small samples- t- Test, F-Test and χ^2 - Test for goodness of fit and independence of attribute.

UNIT-IV**10 L****Numerical Methods-I**

Finding roots of Algebraic and transcendental Equations : Introduction, Bisection Method, Method of False position, Iteration methods: fixed point iteration and Newton Raphson methods.
CurveFitting: Fitting a linear, second degree, exponential, power curve by method of least squares.

UNIT-V**8 L****Numerical Methods-II****Numerical Integration and Solution of Ordinary Differential equations**

Trapezoidal rule-Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rule, Solution of ordinary differential equations by Taylor's series, Picard's method of successive approximations, Euler's method, Runge-Kuttamethod (second and fourth order).

TEXT BOOKS:

1. Probability and statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E.Freund, New Delhi, Prentice Hall.
2. Probability and Statistics for Engineers and Sciences by Jay L. Devore, Cengage Learning.
3. Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publishers.

REFERENCES:

1. Fundamentals Of Mathematical Statistics by S.C.Guptha& V.K.Kapoor, S.Chand.
2. Introductory Methods of Numerical Analysis by S.S.Satry, PHI Learning Pvt. Ltd.
3. Mathematics for engineers and scientists by Alan Jeffery , 6^{th} edition ,CRC press.

20ME402PC: APPLIED THERMODYNAMICS**B.Tech IV SEM**

| L | T | P | C |
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Pre-requisite: Thermodynamics

Course Objective: To apply the laws of Thermodynamics to analyze air standard cycles and to understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

Course Outcomes: At the end of the course, the student should be able to evaluate the performance of IC engines and compressors under the given operating conditions. Apply the laws of Thermo dynamics to evaluate the performance of Refrigeration and air-conditioning cycles. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance

UNIT – I**I.C. Engines:****9L**

Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles and their analysis-fuels

UNIT – II**10L**

Engine systems-Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT – III**11L**

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT – IV**10L****Measurements, Testing and Performance:**

Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart

UNIT – V**10L**

Air Compressors-Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor,

Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan / Mc GrawHill
2. Thermal Engineering / Mahesh M Rathore / Mc GrawHill
3. Thermal Engineering by Rajput, Lakshmi Publications.
4. Thermal Engineering by P.K.Nag

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists / Eastop /Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / WileyEastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw HillEd.

20ME403PC: MECHANICS OF SOLIDS**B.Tech IV SEM**

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Course Objectives: The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force- deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course.

This course will advance the students' development of the following broad capabilities:

- Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
- Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
- Students will understand how to calculate normal and shear stresses

Course Outcomes:

- Analyze the behavior of the solid bodies subjected to various types of loading;
- Apply knowledge of materials and structural elements to the analysis of simple structures;
- Undertake problem identification, formulation and solution using appropriate analytical methods;
- Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
- Expectation and capacity to undertake lifelong learning

UNIT – I**10L**

Simple Stresses & Strains: Properties of Solids, Types of stresses & strains–Hooke's law– stress– strain diagram for ductile (mild steel) and brittle materials, Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain–Elastic moduli and relationship between elastic constants–Bars of varying section–composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT –II**10L**

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment–SFD and B. M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III**10L**

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.
Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV**10L**

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading–compound stresses–Normal and tangential stresses on an inclined plane for biaxial stress Two perpendicular normal stresses accompanied by a state of simple shear – Mohr’s circle of stresses-Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V**10L**

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS:

1. Mechanics of Materials, By Dr.B.C.Punmia,Ashok Kumar Jain,ArunKumar Jain, Lakshmi Publications.
2. Solid Mechanics, by Popov
3. Strength of Materials by S Ramamrutham and R.Narayana, Dhanpatrai Publications..

REFERENCES:

1. Strength of Materials -By Jindal, UmeshPublications.
2. Analysis of structures by Vazirani andRatwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt.Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt.Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt.Ltd.
6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt.Ltd
7. Strength of Materials by R.K Rajput, S. Chand &Company Ltd.

20ME404PC: MANUFACTURING PROCESS**B.Tech IV SEM**

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Pre-requisites: None**Course Objectives:**

- To teach the process-level dependence of manufacturing systems through tolerances
- To expose the students to a variety of manufacturing processes including their suitability and capabilities.
- To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
- To teach the thermal and mechanical aspects, such as force, stress, strain and temperature of the most common processes.
- To provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances
- To provide a technical understanding of common processes to aid in appropriate material selection for a predetermined process.

Course Outcomes: Student will be able to:

- Understand the idea for selecting materials for patterns.
- Know Types and allowances of patterns used in casting and analyze the components of moulds.
- Design core, core print and gating system in metal casting processes
- Understand the arc, gas, solid state and resistance welding processes.
- Develop process-maps for metal forming processes using plasticity principles.
- Identify the effect of process variables to manufacture defect free products.

UNIT – I**10L**

Introduction to manufacturing process: Casting: Steps involved in making a casting – Advantage of casting and its applications; **Patterns** - Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating– Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Casting processes–Types–Sand moulding, Centrifugal casting, die-casting, Investment casting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

UNIT – II**10L**

Welding: Classification of welding Process, Types of welds and welded joints; Welding Positions - Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

UNIT – III**10L**

Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, induction welding, explosive welding, Laser Welding.

Soldering and Brazing: Heat affected zone in welding. Welding defects – causes and remedies, destructive and non- destructive testing of welds.

UNIT – IV**10L**

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing – Types of presses and press tools.

UNIT – V**10L**

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion- Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao Vol.1 & 2 / Mc GrawHill
2. Manufacturing Engineering & Technology / SeropeKalpakjian / Steven R. Schmid /Pearson

REFERENCE BOOKS:

1. Metal Casting / T.V Ramana Rao / NewAge
2. Production Technology / G. Thirupathi Reddy /Scitech
3. Manufacturing Processes/ J.P. Kaushish / PHIPublications

20ME405PC: KINEMATICS OF MACHINERY**B.Tech IV SEM**

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Prerequisites: Basic principles of mechanics

Course Objectives:

1. To understand the different methods of obtaining a mechanism.
2. To efficiently implement the solutions for practical problems
3. To study the mechanism, machine and the geometric aspects of motion
4. To provide in-depth analysis of Velocity and Acceleration of mechanisms
5. To develop skills for designing and analyzing linkages, about the Driving Mechanisms used in daily life such as Gear-Trains, Cams, Belts, Chains & Rope drives and other mechanisms
6. To understand the working of automobile transmission mechanisms

Course Outcomes:

1. An ability to apply knowledge of computing, mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer – based systems to real-world problems.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design, implement, and evaluate a computer based system, process, component, or program to meet desired needs, within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability, and sustainability.
4. An ability to analyze a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
5. An understanding of professional, ethical, legal, security and social issues and responsibilities.
6. The broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.

UNIT – I**10L**

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT – II**10L**

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Planemotion of body: Instantaneous center of rotation-centrodes and axodes–Three centers

inline theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

10L

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier Hart - Scott Russel– Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs

Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application –problems.

UNIT –IV

10L

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

10L

Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding Forms of teeth, cycloidal and involutes profiles–phenomena of interferences–Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path ofcontactofPinion&GearandPinion&RackArrangements–IntroductiontoHelical–Bevelandworm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines / S. S. Rattan / Mc Graw Hill Publishers.
2. Theory of Machines / Sadhu Singh / Pearson.

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford
2. Theory of Machines / Thomas Bevan/CBS.

20ME406PC: MECHANICS OF SOLIDS LAB**B.Tech IV SEM**

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Pre-requisites: Physics & Mechanics**Course Objectives:** The students will advance the students' development of the following broad capabilities:

1. Understanding the basic strength of materials principles by conducting experiments.
2. Learn to determine mechanical properties of materials.
3. Learn to determine stiffness and rigidity modulus of spring.
4. Learn to determine the hardness of materials.
5. Learn to analyze and synthesize test results, write individual and group reports incorporating experimental data, graphs, assessment of results, and conclusions.
6. To give more understand in basic of structural field.

Course Outcomes:

1. Ability to design and conduct experiments, acquires data, analyze and interpret data.
2. Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes.
3. Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results, present conclusions.
4. Determine the stiffness and rigidity modulus of spring.
5. Determine hardness of materials.
6. Determine toughness of materials

List of Experiments: (Any 10 Experiments to be performed)

1. Direct tension test
2. Bending test on Simple supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Izod Impact test
10. Charpy Impact test
11. Punch shear test

(Note : Any ten of the above experiments are to be covered)

20ME407PC: APPLIED THERMODYNAMICS LAB**B.Tech IV SEM**

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Pre-Requisite: Thermodynamics & Thermal Engineering - I**Objective:** To understand the working principles of IC Engines, Compressors.**List of Experiments**

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

(Note : Any ten of the above experiments are to be covered)

20ME408PC: MANUFACTURING PROCESS LAB**B.Tech IV SEM**

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Pre-requisites: Production Technology**Course Objectives:**

- Know about the basic Physical, Chemical Properties of materials
- Explain why some material(s) are better to be used in a product for given design requirements
- Learn the basic operation of various manufacturing processes
- Learn how various products are made using traditional, non-traditional, or Electronics manufacturing processes
- Design simple process plans for parts and products
- Understand how process conditions are set for optimization of production
- Learn how CNC machines work
- Write and execute CNC machining programs to cut parts on a milling machine
- Measure a given manufactured part to evaluate its size, tolerances and surface finish
- Design and fabricate a simple product

Course Outcomes: Understanding the properties of moulding sands and pattern making. Fabricate joints using gas welding and arc welding. Evaluate the quality of welded joints. Basic idea of press working tools and performs moulding studies on plastics.

Minimum of 12 Exercises need to be performed**I. Metal Casting Lab:**

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

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2Exercises
2. Spot Welding - 1Exercise
3. TIG Welding - 1Exercise
4. Plasma welding and Brazing - 2Exercises (Water Plasma Device)

III. Mechanical Press Working:

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

IV. Processing Of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

20ME409GS: GENDER SENSITIZATION LAB**B.Tech. IV SEM**

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Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT-I**UNDERSTANDING GENDER****Gender:** Why Should We Study It? (*Towards a World of Equals: Unit -1*)**Socialization:** Making Women, Making Men (*Towards a World of Equals: Unit -2*)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II**GENDER AND BIOLOGY****Missing Women:** Sex Selection and Its Consequences (*Towards a World of Equals: Unit -4*)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals: Unit -10*)

Two or Many? Struggles with Discrimination.

UNIT-III**GENDER AND LABOUR****Housework:** the Invisible Labour (*Towards a World of Equals: Unit -3*)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals: Unit -7*)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV**ISSUES OF VIOLENCE**

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11) Blaming the Victim-“I Fought for my Life....” - Additional Reading: The Caste Face of Violence.

UNIT-V**GENDER: CO - EXISTENCE**

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK

All the five Units in the Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A. Suneetha, Uma Bhugubanda, Duggirala Vasanta, Rama Melkote, VasudhaNagaraj, Asma Rasheed, GoguShyamala, DeepaSreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**, Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. “*I Fought For My Life...and Won.*” Available online at:
<http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/>

20ME501PC: INSTRUMENTATION AND CONTROL SYSTEMS**B. Tech. V Sem.**

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Prerequisite: Mathematics-I, Thermodynamics, Basic of Electrical and electronic Engineering.

Course Objectives: Understanding the basic characteristic of a typical instrument. Identifying errors and their types that would occur in a instrument. Identifying properties used for evaluating the thermal systems. The concept of transducer and Various types and their characters.

Course Outcome: To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments. Analysis of errors so as to determine correction factors for each an instrument. To understand static and dynamic characteristics of instrument and should be able to determine loading response time. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors.

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

UNIT – II

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals.

Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge. Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators – Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed : Mechanical Tachometers, Electrical tachometers, Non- contact type-Stroboscope

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV

Stress-Strain measurements: Various types of stress and strain measurements – Selection and installation of metallic strain gauges- electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems:

Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation and Control Systems /Alavala / Cengage
2. Instrumentation, Measurement and Analysis/ B.C.Nakra and K.K.Choudhary/ Mc Graw Hill.

REFERENCE BOOKS:

1. Process Control Instrumentation Technology/ Curtis D. Johnson / Person
2. Mechanical Measurements / Sirohi and Radhakrishna / New Age International

20ME502PC: THERMAL ENGINEERING**B. Tech. V Sem.**

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Note: Steam Table book Permitted.**Pre-requisite:** Thermodynamics

Course Objective: To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

Course Outcomes: At the end of the course, the student should be able to

- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermodynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

UNIT – I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Boilers – Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification – Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney.

UNIT – II

Steam Nozzles : Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

UNIT – III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed- Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction – Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency.

UNIT - IV

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating – Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT – V

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

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill
2. Gas Turbines – V.Ganesan /Mc Graw Hill

REFERENCE BOOKS:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI

20ME503PC: DESIGN OF MACHINE MEMBERS - I**B. Tech. V Sem.**

| L | T | P | C |
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Note: Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

Pre-requisites: Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy and material science.

Course Objectives:

- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.
- To learn the design procedure of different fasteners, joints, shafts and couplings.

Course Outcomes:

- The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
- Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
- Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerances and fits – BIS codes of steels.

Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II

Design for Fatigue Strength: Stress concentration–Theoretical stress Concentration factor– Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber’s curve– Modified Goodman’s line– Soderberg’s line.

UNIT – III

Riveted, Welded and Bolted Joints: Riveted joints- methods of failure of riveted joints- strength equations-efficiency of riveted joints-eccentrically loaded riveted joints. Welded joints - Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading.

Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices – bolts of uniform strength.

UNIT – IV

Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints- spigot and socket, sleeve and cotter, jib and cotter Joints-Knuckle joints.

UNIT – V

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Use of internal and external circlips, Gaskets and seals (stationary & rotary)

Shaft Couplings: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Flange coupling (Modified).

TEXT BOOKS:

1. Design of Machine Elements / V. Bhandari / Mc Graw Hill
2. Machine Design / Jindal / Pearson

REFERENCE BOOKS:

1. Design of Machine Elements / V. M. Faires / Macmillan
2. Design of Machine Elements-I / Annaiah, M.H / New Age

20ME504PC: METROLOGY AND MACHINE TOOLS**B. Tech. V Sem.**

| L | T | P | C |
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Pre-requisites: None**Course Objectives:** The course content enables students to:

- Acquire the knowledge of Engineering metrology and its practice which is having increasing importance in industry.
- Specifically makes the student to improve applications aspect in the measurements and control of process of manufacture
- Impart the fundamental aspects of the metal cutting principles and their application in studying the behavior of various machining processes.
- Train in knowing the fundamental parts of various machine tools and their kinematic schemes.
- Discuss various principles of jigs and fixtures which will be used hold the work pieces in various machine tools

Course Outcome: At the end of the course, the student would be able to

- Identify techniques to minimize the errors in measurement.
- Identify methods and devices for measurement of length, angle, gear & thread parameters, surface roughness and geometric features of parts.
- Understand working of lathe, shaper, planer, drilling, milling and grinding machines.
- Comprehend speed and feed mechanisms of machine tools.
- Estimate machining times for machining operations on machine tools

UNIT – I

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – Principle of working, types of lathe, specifications. Taper turning,– Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – II

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines –Principles of working – machining time calculations.

UNIT – III

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing. Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

UNIT – IV

Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges: Taylor's principle, Design of GO and NO GO gauges Measurement of angles, Bevel protractor, and Sine bar. Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.

UNIT – V

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines. Coordinate Measuring Machines: Types and Applications of CMM.

TEXT BOOKS:

1. Machine Tool Practices/ Kibbe, John. Neely, T. White, Rolando O. Meyer/
Pearson
2. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd /
McGraw Hill.

REFERENCE BOOKS:

1. Principles of Machine Tools, Bhattacharyya A and Sen.G.C / New Central Book
Agency.
2. Fundamentals of Dimensional Metrology / Connie Dotson / Thomson

20ME505PC: DYNAMICS OF MACHINERY

B. Tech. V Sem.

L T P C
3 0 0 3

Pre-requisite: Kinematics of Machinery

Course Objectives: The objective is to introduce some of the components mainly used in IC Engines and make analysis of various forces involved. Subjects deals with topics like inertia forces in slider crank mechanism; IC Engine components & the analysis like governors is introduced. It also deals with balancing of rotating & reciprocating parts. Studies are made about balancing of multi cylinder engines, Radial engines etc. study of primary & secondary forces are considered while balancing. Finally they are introduced to the topic of vibrations. The study deals with linear, longitudinal, & torsional vibrations. The idea is to introduce the concept of natural frequency and the importance of resonance and critical speeds.

Course Outcome: the study of KOM & DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.

UNIT – I

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram and Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches. **Brakes and Dynamometers:** Types of brakes: Simple block brake, band and block brake- internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – IV

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

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

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly’s method – Raleigh’s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines /S.S.Rattan / Mc Graw Hill.
2. Theory of Machines /Sadhu Singh/ Pearson

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford
2. Theory of Machines / Rao,J.S & R.V. Duggipati/ New Age

20ME506PC: MACHINE TOOLS AND METROLOGY LAB

B. Tech. V Sem.

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Objectives:

- To import practical exposure to the Machine tools
- To conduct experiments and understand the working of the same.

List of Experiments:

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper,
2. Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine
4. Thread cutting and knurling on -lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles.

Objectives:

- To import practical exposure to the metrology equipment
- To conduct experiments and understand the working of the same.

Prerequisites: Theoretical exposure to Metrology and machine tools.

1. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
2. Machine tool alignment of test on the lathe.
3. Tool makers microscope and its application
4. Angle and taper measurements by bevel protractor and sine bars.
5. Use of spirit level and optical flats in finding the flatness of surface plate.
6. Thread measurement by 2-wire and 3-wire methods.

20ME507PC: INSTRUMENTATION AND CONTROL SYSTEMS LAB

B. Tech. V Sem.

L T P C
0 0 3 1.5

Pre-requisites: Basic principles of Instrumentation and control systems

Course Outcomes: At the end of the course, the student will be able to Characterize and calibrate measuring devices. Identify and analyze errors in measurement. Analyze measured data using regression analysis. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

LIST OF EXPERIMENTS:

1. Calibration of Pressure Gauges.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure.
12. Measurement and control of Pressure of a process using SCADA system.
13. Measurement and control of level in a tank using capacitive transducer with SCADA.
14. Measurement and control of temperature of a process using resistance temperature detector with SCADA

20ME508PC: KINEMATICS AND DYNAMICS LAB

B. Tech. V Sem.

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Pre-requisites: Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration, Gyroscopic Effect, Cams, Bearings.

Course Objectives: The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.

Course Outcomes:

Upon successful completion of this lab, students should be able to:

- Understand types of motion
- Analyze forces and torques of components in linkages
- Understand static and dynamic balance
- Understand forward and inverse kinematics of open-loop mechanisms

Experiments: (A Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces
2. 2. To determine the frequency of torsional vibration of a given rod
3. 3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4. Find the motion of the follower if the given profile of the cam
5. The balance masses statically and dynamically for single rotating mass systems
6. Determine the critical speed of a given shaft for different n-conditions
7. For a simple pendulum determine time period and its natural frequency
8. For a compound pendulum determine time period and its natural frequency
9. Determine the effect of gyroscope for different motions
10. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11. 11. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12. 12. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems.

20MC509IP: INTELLECTUAL PROPERTY RIGHTS**B. Tech. V Sem.****L T P C**
3 0 0 0**UNIT – I:**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II:

Trademarks: Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademark, trademark registration processes.

UNIT – III:

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV:

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, and protection for submission, trade secret litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V:

New development of intellectual property: new developments in trademark law; copyright law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

TEXT BOOKS:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company Ltd.

20MC510CS: CYBER SECURITY**B. Tech. V SEM****L T P C****3 0 0 0****Prerequisites: NIL****Course objectives:**

To familiarize various types of cyber-attacks and cyber-crimes

To give an overview of the cyber laws

To study the defensive techniques against these attacks

Course Outcomes: The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government

Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.

20ME601PC: CAD/CAM

B. Tech. VI Sem.

L T P C
3 0 0 3

Pre-requisites: To learn the importance and use of computer in design and manufacture

Course objectives: To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM

Course Outcomes: Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces. Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT – I

Fundamentals of CAD, CAM, Automation, design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD, Design workstation, Graphic terminal, CAD software- definition of system software and application software, CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT - II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non- contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM Concepts and Applications / Alavala / PHI
2. CAD/CAM Principles and Applications / P.N.Rao / Mc Graw Hill

REFERENCE BOOKS:

1. CAD/CAM/ Groover M.P/ Pearson
2. CAD/CAM/CIM/ Radhakrishnan and Subramanian / New Age

20ME602PC:DESIGN OF MACHINE MEMBERS - II

B. Tech. VI Sem.

L T P C
3 0 0 3

Note: Design Data Book is permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

Pre-requisites: Study of engineering mechanics, design of machine Members-I and theory of machines.

Course objectives:

- To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs, belts, gears etc.
- To design the components using the data available in design data books.

Course Outcomes:

- Knowledge about journal bearing design using different empirical relations.
- Estimation of life of rolling element bearings and their selection for given service conditions.
- Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry.

UNIT – I

Sliding contact bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

UNIT – II

Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

UNIT – III

Engine Parts: Connecting Rod : Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT – IV

Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Design of co-axial springs, Design of leaf springs.

Belts & Pulleys: Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

UNIT – V

Gears: Spur gears & Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

TEXT BOOKS:

1. Design of Machine Elements / Spotts/ Pearson
2. Machine tool design / V. Bhandari / Mc Graw Hill

REFERENCE BOOKS:

1. Design of Machine Elements-II / Annaiah / New Age
2. Design of Machine Elements / Sharma and Purohit/PHI

20ME603PC: HEAT TRANSFER

B. Tech. VI Sem.

L T P C
3 1 0 4

Note: Heat Transfer Data Book is permitted.

Pre-requisite: Thermodynamics

Course Objectives: To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

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

- Understand the basic modes of heat transfer
- Compute one dimensional steady state heat transfer with and without heat generation
- Understand and analyze heat transfer through extended surfaces
- Understand one dimensional transient conduction heat transfer
- Understand concepts of continuity, momentum and energy equations
- Interpret and analyze forced and free convective heat transfer
- Understand the principles of boiling, condensation and radiation heat transfer
- Design of heat exchangers using LMTD and NTU methods

UNIT – I

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

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady, and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders, and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat Generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Π Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer –

Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations – Integral Method as approximate method -Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

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

UNIT – IV

Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

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

UNIT - V

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling. **Condensation:** Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

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

TEXT BOOKS:

1. Heat and Mass Transfer – Dixit /Mc Graw Hill
2. Heat and Mass Transfer / Altamush Siddiqui/ Cengage

REFERENCE BOOKS:

1. Essential Heat Transfer - Christopher A Long / Pearson
2. Heat Transfer –Ghoshdastida / Oxford

20ME604PC: HEAT TRANSFER LAB

B. Tech. VI Sem.

L T P C
0 0 3 1.5

Pre-requisite: Thermodynamics

Course Objectives: To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications

Course Outcome: At the end of the lab sessions, the student will be able to

- Perform steady state conduction experiments to estimate thermal conductivity of different materials
- Perform transient heat conduction experiment
- Estimate heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values
- Obtain variation of temperature along the length of the pin fin under forced and free convection
- Perform radiation experiments: Determine surface emissivity of a test plate and Stefan- Boltzmann's constant and compare with theoretical value

Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

20ME605PC : CAD/CAM LAB

B. Tech. VI Sem.

L T P C
0 0 3 1.5

Pre-requisites: To give the exposure to usage of software tools for design and manufacturing. To acquire the skills needed to analyze and simulate engineering systems.

Course Objectives: To be able to understand and handle design problems in a systematic manner. To be able to apply CAD in real life applications. To be understand the basic principles of different types of analysis.

Course Outcomes: To understand the analysis of various aspects in of manufacturing design

Note: conduct any TEN excercises from the list gien below:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

20EN607HS: ADVANCED COMMUNICATION SKILLS LAB**B. Tech. V Sem.****L T P C
0 0 2 1****1. INTRODUCTION:**

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals-Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective goggling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/e- mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group

discussion,
 intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM – 512 MB Minimum, Speed – 2.8GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw Hill, 2009.

20MC609AI: ARTIFICIAL INTELLIGENCE**B. Tech. VI SEM****L T P C**
3 0 0 0

Course Objectives: To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents

Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving,

Pearson Education, 6th ed., 2009.

20ME611PE: UNCONVENTIONAL MACHINING PROCESSES

(Professional Elective - I)

B. Tech. VI Sem.

L T P C

3 0 0 3

Course Overview: The objective of this course is to introduce the student to more advanced topics in the machining processes. To bring out the need for Unconventional Machining Processes which will overcome the difficulties associated with Traditional Machining.

Course Objectives:

- To teach the modeling technique for machining processes
- To teach interpretation of data for process selection
- To teach the mechanics and thermal issues associated with chip formation
- To teach the effects of tool geometry on machining force components and surface finish
- To teach the machining surface finish and material removal rate

Course Outcomes:

- Understand the basic techniques of Unconventional Machining processes modeling
- Estimate the material removal rate and cutting force, in an industrially useful manner, for Unconventional Machining processes.

UNIT – I

Introduction – Need for non-traditional machining Methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

UNIT - II

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

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

UNIT – III

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

UNIT – IV

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT - V

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining – principle - mask ants - applications.

Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

TEXT BOOKS:

1. Advanced Machining Processes / VK Jain / Allied publishers
2. Modern Machining Processes - P. C. Pandey, H. S. Shan/ Mc Graw Hill

REFERENCE BOOKS:

1. Unconventional Manufacturing Processes/ Singh M.K/ New Age Publishers
2. Advanced Methods of Machining/ J.A. McGeough/ Springer International
3. Non-Traditional Manufacturing Processes/ Benedict G.F./ CRC Press

20ME612PE: ADDITIVE MANUFACTURING TECHNOLOGY
(Professional Elective – I)

B. Tech. VI Sem.

L T/P/D C
3 0/0/0 3

Pre-requisites: Manufacturing process, Engineering Materials

Course Objectives:

- To understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.
- To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

Course Outcomes:

- Describe various CAD issues for 3D printing and rapid prototyping and related operations for STL model manipulation.
- Formulate and solve typical problems on reverse engineering for surface reconstruction from physical prototype models through digitizing and spline-based surface fitting.
- Formulate and solve typical problems on reverse engineering for surface reconstruction from digitized mesh models through topological modelling and subdivision surface fitting.
- Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
- Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts.

UNIT - I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

UNIT - II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid

Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT - III

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP

UNIT - IV

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT - V

RP Applications: Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

TEXT BOOKS:

1. Rapid prototyping; Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications
2. Rapid Manufacturing /D.T. Pham and S.S. Dimov/Springer

REFERENCE BOOKS:

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates
2. Rapid Prototyping and Manufacturing /PaulF.Jacobs/ASME

**20ME613PE: ENGINEERING TRIBOLOGY
(Professional Elective - I)**

B. Tech. VI Sem.

**L T/P/D C
3 0/0/0 3**

Pre-requisites: Fluid mechanics, Design of machine members-II

Course objectives:

- To expose the student to different types of bearings, bearing materials,
- To understand friction characteristics and power losses in journal bearings.
- To learn theory and concepts about different types of lubrication.

Course Outcomes:

- Understanding friction characteristics in journal bearings.
- Knowledge about different theories of lubrication to reduce friction and wear.

UNIT – I

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature variation, viscosity index, determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT – II

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

UNIT – III

Friction and power losses in journal bearings: Calibration of friction loss, friction in concentric bearings, bearing modulus, Sommer-field number, heat balance, practical consideration of journal bearing design considerations.

UNIT – IV

Air lubricated bearing: Advantages and disadvantages, application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction.

UNIT - V

Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.

Bearing materials: General requirements of bearing materials, types of bearing materials.

TEXT BOOKS:

1. Fundamentals of Tribology, Basu, Sen Gupta and Ahuja /PHI
2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand & Co.

REFERENCE BOOK:

1. Introduction to Tribology of Bearings – B.C. Majumdar/ S. Chan

20MB701HS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B. Tech. VII Sem.

L T P C

3 0 0 3

Course Objective: To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II: Demand and Supply Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT – III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT – IV: Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT – V: Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGrawHill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

20ME702PC: REFRIGERATION AND AIR CONDITIONING

B. Tech. VII Sem.

L T P C
3 0 0 3

Pre-requisite: Thermodynamics

Course Objective: To apply the principles of Thermodynamics to analyze different types of refrigeration and air conditioning systems and to understand the functionality of the major components.

Course Outcomes: At the end of the course, the student should be able to Differentiate between different types of refrigeration systems with respect to application as well as conventional and unconventional refrigeration systems. Thermodynamically analyse refrigeration and air conditioning systems and evaluate performance parameters. Apply the principles of Psychometrics to design the air conditioning loads for the industrial applications.

UNIT – I

Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Air systems – Application of Air Refrigeration, Justification – Types of systems – Problems.

UNIT – II

Vapour compression refrigeration – working principle and essential components of the plant – Simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Problems.

UNIT - III

System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles. Evaporators – classification – Working Principles. Expansion devices – Types – Working Principles. Refrigerants – Desirable properties – common refrigerants used – Nomenclature – Ozone Depletion – Global Warming – Azeotropes and Zeotropes.

UNIT - IV

Vapor Absorption System – Calculation of max COP – description and working of NH₃ – water system – Li – Br system. Principle of operation Three Fluid absorption system, salient features. Steam Jet Refrigeration System – Working Principle and Basic Components Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – V

Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

Concept of human comfort and effective temperature – Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers.

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

TEXT BOOKS:

1. Refrigeration and Air conditioning / CP Arora / Mc Graw Hill
2. Refrigeration and Air-Conditioning / RC Aora / PHI

REFERENCE BOOKS:

1. Principles of Refrigeration - Dossat / Pearson
2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / Mc Graw Hill

20ME721PE: POWER PLANT ENGINEERING
(Professional Elective – II)

B. Tech. VII Sem.

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Pre-Requisites: None

Course Objective: The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

- Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
- A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
- Awareness of the economic, environmental, and regulatory issues related to power generation.

Course Outcomes: At the end of the course students are able to:

- Understand the concept of Rankine cycle.
- Understand working of boilers including water tube, fire tube and high pressure boilers and determine efficiencies.
- Analyze the flow of steam through nozzles
- Evaluate the performance of condensers and steam turbines
- Evaluate the performance of gas turbines

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II

Internal Combustion Engine Plant:

Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging. **Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. **Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways. **Hydro Projects and Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants. **Power from Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. **Types of Reactors:** Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS:

1. Power Plant Engineering/ P. K. Nag / Mc Graw Hill
2. Power Plant Engineering / Hegde / Pearson.

REFERENCES BOOKS:

1. Power Plant Engineering / Gupta / PHI
2. Power Plant Engineering / A K Raja / New age

20ME722PC: FINITE ELEMENT METHODS
(Professional Elective – II)

B. Tech. VII Sem.

L T P C
3 0 0 3

Pre-requisites: Mechanics of Solids

Course Objective: The aim of the course is to provide the participants an overview on Finite Element Method, Material models, and Applications in Civil Engineering. At the end of the course, the participants are expected to have fair understanding of:

- Basics of Finite Element Analysis.
- Available material models for structural materials, soils and interfaces/joints.
- Modeling of engineering systems and Soil–Structure Interaction (SSI).
- Importance of interfaces and joints on the behavior of engineering systems.
- Implementation of material model in finite element method and applications

Course Outcomes: At the end of the course, the student will be able to, Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer. Formulate and solve problems in one dimensional structures including trusses, beams and frames. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi- symmetric and plate bending problems. ANSYS, ABAQUS, NASTRAN, etc.

UNIT – I

Introduction to Finite Element Methods: General Procedure – Engineering Applications – Stress and Equilibrium, Strain – Displacement relations. Stress – strain relations: Finite Elements: 1-Dimensional, 2 – Dimensional, 3-Dimensional & Interpolation Elements

One Dimensional Problems: 1-D Linear and 1-D Quadratic Elements - Finite element modeling, Coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II

Analysis of Trusses: Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection.

UNIT – III

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four noded Isoparametric elements and numerical integration.

UNIT – IV

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two-dimensional analysis of thin plate.

UNIT – V

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss and beam.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation. techniques such as semi-automatic and fully Automatic use of softwares such as ANSYS, ABAQUS, NASTRAN using Hexahedral and Tetrahedral Elements.

TEXT BOOKS:

1. Finite Element Methods: Basic Concepts and applications/Alavala/PHI
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu /Pearson

REFERENCE BOOKS:

1. An Introduction to the Finite Element Method / J. N. Reddy/ Mc Graw Hill
2. Finite Element Analysis / SS Bhavikatti / New Age
3. Finite Element Method/ Dixit/Cengage

20ME723PE: INDUSTRIAL MANAGEMENT

(PROFESSIONAL ELECTIVE - II)

B. Tech. VII Sem.

L T P C
3 0 0 3

UNIT I:

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT II:

Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:

Operations Management: Objectives- product design process- Process Selection-Types of production system (Job, batch and Mass Production), -Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts-Design of product layout- Line balancing (RPW method)

Value Analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT IV:

Work Study: Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.

Statistical Quality Control: variables-attributes, Shewart control charts for variables- \bar{X} chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:

Job Evaluation: methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method – benefits of job evaluation and limitations.

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path,

Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers

REFERENCE BOOKS:

1. Motion and Time Study by Ralph M Barnes/ John Willey & Sons Work Study by ILO
2. Human factors in Engineering & Design/Ernest J McCormick / TMH
3. Production & Operation Management /Paneer Selvam /PHI
4. Industrial Engineering Management/NVS Raju/Cengage Learning
5. Industrial Engineering Hand Book /Maynard
6. Industrial Engineering Management / RaviShankar/ Galgotia

20ME731PE: OPERATIONS RESEARCH
(Professional Elective – III)

B. Tech. VII Sem.

L T P C
3 0 0 3

Course Objectives: Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

Course Outcome: Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization Tech

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT – III

Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines-graphical model. **Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

Inventory: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V

Waiting Lines: Introduction–Terminology-Single Channel–Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Dynamic Programming: Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

TEXT BOOKS:

1. Operations Research / N.V.S. Raju / SMS
2. Operations Research / ACS Kumar / Yes Dee

REFERENCE BOOKS:

1. Operations Research /J. K. Sharma / MacMilan.
2. Operations Research /A. M. Natarajan, P. Balasubramaniam, A. Tamilarasi / Pearson.

20ME732PE : COMPUTATIONAL FLUID DYNAMICS
(Professional Elective – III)

B. Tech. VII Sem.

L T P C
3 0 0 3

UNIT - I:

Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering

Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions

Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm

Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion

UNIT - II:

Finite Difference Method: Basic aspects of Discretization – Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvelinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates

UNIT - III:

FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition –Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems

UNIT - IV:

Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – Maccormack’s Technique

Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid

Driven Cavity Problem - Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – Obtaining Elliptic Equations

UNIT - V:

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity
Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer – K Muralidharan and TSudarajan, Narosa Publishers
2. Computational Fluid Dynamics : The basics with applications – John DAnderson, McGraw Hill Publications

20ME733PE: ROBOTICS
(Professional Elective - III)

B. Tech. VII Sem.

L T P C
3 0 0 3

Pre-requisites: Basic principles of Kinematics and mechanics

Course Objectives: The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

Course Outcomes: At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.

UNIT – I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.

Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.

UNIT IV

Robot actuators and Feedback components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V

Robot Application in Manufacturing:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada , Slotine / Wiley Inter-Science

20ME841PE: RENEWABLE ENERGY SOURCES
(Professional Elective -IV)

B. Tech. VIII Sem.

L T P C
3 0 0 3

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

- Understanding of renewable energy sources
- Knowledge of working principle of various energy systems
- Capability to carry out basic design of renewable energy systems

UNIT-I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-Renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO₂ reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

1. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
2. **Geothermal Energy:** Geothermal power plants, various types, hot springs and steam ejection.

REFERENCE BOOKS:

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

20ME842PE-IC ENGINES AND GAS TURBINES
(Professional Elective - IV)

B. Tech. VIII Sem.

L T P C
3 0 0 3

Pre-requisites - Basic Thermodynamics

Course Objectives:

- Acquire knowledge about the IC engine cycles, classification and working Principles.
- Describe the testing and performance parameters along with heat balance Sheet.
- Explain different alternate fuels, gas turbines and about jet propulsion

Course Out Comes:

- Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of IC engines along with its working principles.
- Describe the combustion phenomenon in SI and CI engines.
- Evaluate the performance of IC engines and the importance of alternate fuels.
- Classify the essential components of gas turbine along with its performance Improving methods.
- Illustrate the working principle of different types of Jet propulsive engines and Rockets.

UNIT - I

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram.

Fuels: Fossil fuels, Chemical structure of Petroleum, Properties of SI and CI Engine Fuels, Fuel Ratings; Octane Number, Cetane Number.

UNIT - II

Carburetors & Fuel Injection: Air Fuel Mixture Requirements, Construction and Working of Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor. Requirement of Injection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps, Working principles of Governors, Nozzles and Fuel Injector, Injection in SI and CI Engines.

Combustion and Ignition Systems in SI and CI Engines: Normal and Abnormal Combustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.

UNIT - III

Performance parameters for IC Engines: Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance.

Modern Automotive Engines: Changes in Fuel Injection Methods in S.I and C.I engines, Common Rail Direct Injection System, Gasoline Direct Injection, Variable Valve Technology, a brief review of Design changes to achieve high efficiency.

UNIT - IV

Gas Turbine: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle, and Cogeneration.

UNIT - V

Gas Turbine Cycles for Aircraft Propulsion: Criteria of performance, Intake, and propelling nozzle efficiencies, Simple Turbojet Cycle, the turboprop engine, Thrust augmentation, Gas turbine combustion systems, Combustion chamber designs, Gas Turbine Emissions.

TEXT BOOKS:

1. I.C. Engines/ Gas Turbines / V. Ganesan- Mc Graw Hill
2. Internal Combustion Engines /Colin R. Ferguson /Wiley

REFERENCE BOOKS:

1. Fundamentals of Internal Combustion Engines / H.N Gupta / PHI
2. Gas Turbine Theory/ HIH Saravanamuttoo, Cohen, Rogers/ Pearson

20ME843PE:CNC TECHNOLOGY
(Professional Elective – IV)

B. Tech. VIII Sem.

L T P C
3 0 0 3

Course objectives: Importance of CNC machines. Understand the fundamentals of it. Learning various methods of tooling the CNC machines. Various controlling methods, Learning the part programming

Course outcomes: At the end course, one should be able to select tooling method, control mechanism and do part programming for a given product.

UNIT - I

Features of NC machines: fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC Machine tools, design consideration of NC machine tool, methods of improving machine accuracy.

CNC Machine elements: machine structures - Guide ways - feed drives-spindles- spindle bearings-measuring systems- tool mentoring systems.

UNIT - II

Tooling for CNC machines: interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, and quick change tooling system, automatic head changers.

NC part programming: manual Programming-Basic concepts, point to point contour programming, canned cycles, parametric programming.

UNIT - III

Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors. Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT - IV

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

UNIT - V

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory, counters, timers and serial data I/O interrupts selection of Micro Controllers, Embedded Controllers, Applications and Programming of Micro Controllers.

Programming Logic Controllers (PLC'S): Introduction, Hardware components of PLC, system, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC'S in CNC Machines.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems/ Yoram Koren/ Mc Graw Hill
2. CNC Programming: Principles and Applications /Mattson/ Cengage

REFERENCE BOOKS:

1. Machining Tools Hand Book Vol 3/ Manfred Weck , John Wiley Mechatronics-HMT/ Mc Graw Hill .
2. Machining and CNC Technology / Michael Fitzpatrick / Mc Graw Hill

20ME851PE: PRODUCTION PLANNING AND CONTROL
(Professional Elective – V)

B. Tech. VIII Sem.

L T P C
3 0 0 3

Pre-requisites: Management Science & Productivity.

Course Objectives: Understand the importance of Production planning & control. Learning way of carrying out various functions it so as to produce right product, right quantity at right time with minimum cost.

Course Outcomes: At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

UNIT – I

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

UNIT – II

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only. **Aggregate planning** – Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT – III

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling – job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT – V

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

Follow up: definition – types of follow up – expediting – definition – expediting procedures- Applications of computers in planning and control.

TEXT BOOKS:

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

REFERENCE BOOKS:

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control- Jain & Jain – Khanna publications

20ME852PE: FLUID POWER SYSTEM
(Professional Elective - V)

B. Tech. VIII Sem.

L T P C
3 0 0 3

Pre-requisites: Fluid Mechanics and Hydraulics Machinery

Course outcomes: After doing this, student should be able to

- Understand the Properties of fluids, Fluids for hydraulic systems, governing laws. distribution of fluid power, Design and analysis of typical hydraulic circuits.
- Know accessories used in fluid power system, Filtration systems and maintenance of system.

UNIT-I

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performan curves and parameters.

UNIT-II

Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

UNIT-III

Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

UNIT-IV

Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

UNIT-V

Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time dependent control, combined control, Program Control, Electro pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

TEXT BOOKS:

1. John Watton: Fundamentals of Fluid Power Control. 1 st Ed. Cambridge University Press, 2009
2. Blackburn, J. F., G. Reethof, and J. L. Shearer, Fluid Power Control, New York: Technology Press of M. I.T. and Wiley.
3. Anthony Esposito, "Fluid Power with applications", Pearson Education.
4. Ernst, W., Oil Hydraulic Power and its Industrial Applications, New York: McGraw Hill.
5. Lewis, E.E., and H. Stern, Design of Hydraulic Control Systems, New York: McGraw Hill.
6. Morse, A. C., Electro hydraulic Servomechanism, New York: McGraw Hill.
7. Pippenger, J.J., and R. M. Koff, Fluid Power Control systems, New York: McGraw Hill.
8. Fitch, Jr., E.C., Fluid Power Control Systems, New York: McGraw Hill.
9. Khaimovitch, "Hydraulic and Pneumatic Control of Machine Tools"
10. John Watton, "Fluid Power Systems: modeling, simulation and microcomputer control", Prentice Hall International.
11. Herbert E. Merritt: Hydraulic control systems, John Wiley and Sons Inc.

REFERENCES:

1. Ian Mencal, Hydraulic operation and control of Machine tools Ronald Press
2. Sterwart Hydraulic and Pneumatic power for production-Industrial Press.
3. Hasebrink J.P., and Kobler R., "Fundamentals of Pneumatics/electropneumatics", FESTO Didactic publication No. 7301, Esslingen Germany, 1979.
4. Werner Deppert and Kurt Stoll, "Pneumatic Control-An introduction to the principles", Vogel-Verlag.
5. Blaine W. Andersen, "The analysis and Design of Pneumatic Systems", John Wiley

20ME853PE: AUTOMATION IN MANUFACTURING
(Professional Elective - V)

B.Tech. VIII Sem.

L T P C
3 0 0 3

UNIT – I

Introduction Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automaton.

UNIT – II

Automated flow lines: Methods of work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

UNIT - IV

Automated storage systems, automated storage and retrieval systems, work in process storage, interfacing handling and storage with manufacturing.

Adaptive control systems: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

UNIT – V

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of Rapid Prototyping.

TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing/M.P. Groover. / Pearson
2. Computer control of Manufacturing Systems by Yoram Coreom / Mc Graw Hill

REFERENCE BOOKS:

1. CAD / CAM/ CIM / Radhakrishnan / New Age
2. Advanced Manufacturing Technology/ K Vara Prasada Rao / Kanna Publications

B.TECH. CIVIL ENGINEERING DISASTER MANAGEMENT
(Open Elective - I)

B. Tech. V SEM

Course Code: CE511OE

L T/P/D C

3 0/0/0 3

Course Objectives: The subject provides different disasters, tools and methods for disaster management

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

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential of natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster Management Act and Policy in India – Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (<http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf>)

B.TECH. CIVIL ENGINEERING
REMOTE SENSING AND GIS
(Open Elective - II)

B.Tech.VIII SEM.

Course Code: CE621OE

L T/P/D C

3 0/0/0 3

Pre Requisites: Surveying

Course Objectives: This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

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

- Retrieve the information content of remotely sensed data
- Analyze the energy interactions in the atmosphere and earth surface features
- Interpret the images for preparation of thematic maps
- Apply problem specific remote sensing data for engineering applications
- Analyze spatial and attribute data for solving spatial problems
- Create GIS and cartographic outputs for presentation

UNIT – I

Introduction to Photogrammetry: Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II

Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro-magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

UNIT – III

Geographic Information Systems: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters- Commonly used Map Projections - Projected coordinate Systems

UNIT – IV

Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules

UNIT – V

Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

TEXT BOOKS:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

REFERENCES:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yongg, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

**B. TECH CIVIL ENGINEERING
GEOINFORMATICS
(Open Elective - II)**

B. Tech. VI SEM

Course Code: CE622OE

L T/P/D C

3 0/0/0 3

Course Objectives:

- To introduce the concepts of remote sensing, satellite image characteristics and its components.
- To expose the various remote sensing platforms and sensors and to introduce the concepts of GIS, GPS and GNSS.

Course Outcomes: At the end of the course the student will be able to understand

- The characteristics of Aerial photographic images, Remote sensing satellites and Applications of remote sensing.
- The GIS and its Data models.
- The Global Navigation Satellite System.

UNIT – I

Aerial Photographs- Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation, Introduction to Digital Photogrammetry.

UNIT - II

Remote Sensing: Physics of remote sensing, Remote sensing satellites, and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

UNIT – III

Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

UNIT - IV

Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications

UNIT - V

Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications

TEXT BOOKS:

1. Remote Sensing & GIS , BS Publications
2. Higher Surveying by A M Chandra New Age International Publisher
3. Remote Sensing & GIS by B. Bhatta Oxford University Press
4. Introduction to GPS by A. E Rabbany Library of congress cataloging in Publication data

REFERENCES:

1. T M Lillesand et al: Remote Sensing & Image Interpretation
2. Higher Surveying by B C Punmia Ashok kr. Jain Laxmi Publications
3. N K Agarwal : Essentials of GPS , Spatial Networks: Hyderabad

B.TECH. CIVIL ENGINEERING
INTELLECTUAL PROPERTY RIGHTS
(Open Elective - II)

B. Tech. VI SEM
Course Code: CE623OE

L T/P/D C
3 0/0/0 3

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddhaganguli, Tate McGraw Hill Publishing company ltd.,

B.TECH CIVIL ENGINEERING
ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective - III)

B.Tech. IV Year II Sem
Course Code: CE831OE

L T/P/D C
3 0/0/0 3

Pre Requisites: Environmental Engineering

Course Objectives: This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

Course Outcomes:

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the suitable methodology and prepare Rapid EIA.
- Identify and incorporate mitigation measures.

UNIT – I

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

UNIT- II

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

UNIT- III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

UNIT – IV

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

UNIT - V

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

REFERENCES:

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

B.TECH. CIVIL ENGINEERING
OPTIMIZATION TECHNIQUES IN ENGINEERING
(Open Elective - III)

B. Tech. VIII SEM

Course Code: CE832OE

L T/P/D C

3 0/0/0 3

Prerequisites: Operations Research

Course Objectives: After doing this subject student should know

- The various optimization techniques for single variable optimization problem
- Direct search methods and Gradient methods for multi variable un constraint Optimization problems
- Formulate a Geometric Programming model and solve it by using Arithmetic Geometric in equality theorem
- Simulate the system
- Thorough of state of art optimization techniques like Genetic Algorithms, simulated Annealing

Course Outcomes: For a given system, as per customer requirement it is required to

- Formulate optimization problem.
- Solve the problem by using a appropriate optimization techniques.

UNIT - I

Single Variable Non-Linear Unconstrained Optimization: Elimination methods: Uni-Model function-its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

UNIT - II

Multi variable non-linear unconstrained optimization: Direct search methods – Univariate method, Pattern search methods – Powell’s, Hook - Jeeves, Rosen brock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

UNIT - III

Linear Programming – Formulation, Simplex method, & artificial variable optimization techniques: Big M & Two phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition and deletion of variables, constraints. Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

UNIT - IV

Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method

Stochastic Programming: Basic concepts of probability theory, random variables-distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

UNIT - V

Geometric Programming: Polynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (\leq type only)

Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities, and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO)(very brief)

TEXT BOOKS:

1. Optimization theory & Applications / S. S. Rao / New Age International.
2. Optimization for Engineering Design, Kalyanmoy Deb, PHI

REFERENCES:

1. Operations Research by S. D. Sharma Kedarnath & Ramnath Publisher
2. Operation Research by Hamdy A Taha Pearson Educations
3. Optimization in operations research by Ronald L. Rardin Pearson Publisher
4. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
5. Optimization Techniques theory and practice by M. C. Joshi, K. M. Moudgalya Narosa Publications

B.TECH. CIVIL ENGINEERING
ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective - III)

B. Tech. VIII SEM

Course Code: CE833OE

L T/P/D C

3 0/0/0 3

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

UNIT – 1: Entrepreneurial Perspectives:

Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.

Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

UNIT – 2: New Venture Creation:

Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

UNIT – 3: Management of MSMEs and Sick Enterprises

Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

UNITS – 4: Managing Marketing and Growth of Enterprises:

Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

UNITS – 5: Strategic perspectives in Entrepreneurship:

Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

TEXT BOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V.Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing