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Kongunadu

College of Engineering & Technology

[Autonomous]

Namakkal-Trichy Main Road, Thottiam, Tiruchirappalli-621215

Affiliated to Anna University, Chennai

Regulations: R2024
Common to all B.E / B.Tech Full- Time Programmes
(Choice Based Credit System)
(For the candidates admitted from the academic year 2024-2025 onwards)

Vision

"To become Internationally Renowned Institution in Technical Education, Research and Development by Transforming the Students into Competent Professionals with Leadership Skills and Ethical Values"

Mission

- Providing the Best Resources and Infrastructure
- Creating Learner-Centric Environment and Continuous Learning
- Promoting Effective Links with Intellectuals and Industries
- Enriching Employability and Entrepreneurial Skills
- Adapting to Changes for Sustainable Development

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DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY

This Regulation is applicable to the students admitted to B.E /B.Tech programmes from the academic year 2024-2025 onwards.

1. Preliminary Definitions and Nomenclature

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means Degree Programme that is, B.E. / B.Tech. Degree Programme.

ii) **"Discipline"** means Branch or specialization of B.E./ B.Tech. Degree Programme, like Civil Engineering, Information Technology, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Circuit Theory etc.,

iv) **"Principal"** means the Chairman, Academic Council, authority of the Autonomous Institution who is responsible for all academic activities of the Institute for implementation of relevant Rules and Regulations.

v) **"Controller of Examinations"** means the authority of the Autonomous Institute who is responsible for all activities of the End semester Examinations of the college.

vi) **"Head of the Institution"** means the Principal of the college.

vii) **"Chairman, BoS"** means Chairman of Board of Studies of each department.

viii) **"Head of the Department"** means Head of the Department concerned.

ix) **"Credit"** means a numerical value allocated for each course to describe the student's workload required per week.

x) **"Grade"** means the letter grade assigned to each course based on the range of marks specified.

xi) **"Grade Point"** means a numerical value (0 to 10) allocated based on the grade assigned to each course.

xii) **"University"** means Anna University, Chennai.

xiii) **"LE"** means Lateral Entry Scheme.

2 Admission Procedure

2.1 Candidates seeking admission to the first semester of the eight semesters B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamilnadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamilnadu.

2.2 Lateral Entry admission

The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamil Nadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech., as per the rules fixed by Government of Tamil Nadu.

(OR)

The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. In addition any other conditions as notified by the Government of Tamil Nadu will be followed.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Syndicate of the University from time to time.

3. Programmes Offered

A candidate may be offered admission to any one of the programme / discipline of study approved by the Academic Council of institution.

- B. E. Biomedical Engineering
- B. E. Civil Engineering
- B. E. Computer Science and Engineering
- B. E. Electronics and Communication Engineering
- B. E. Electrical and Electronics Engineering
- B. E. Mechanical Engineering
- B.Tech. Agricultural Engineering
- B.Tech. Artificial Intelligence and Data Science
- B. Tech. Information Technology

4 Structure of Programmes

4.1 Categorization of Courses

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of the theory and practical courses such as:

i. **Humanities, Social Sciences and Management Courses (HSMC)** courses include Technical English, Communication skills, Professional Ethics & Human Values and Management Courses.

ii. **Basic Sciences Courses (BSC)** include Mathematics, Physics, Chemistry, Environmental Sciences, etc.,

iii. **Engineering Sciences Courses (ESC)** includes Engineering Practices, Engineering Graphics, Basics of Civil / Electrical / Electronics / Mechanical / Computer Engineering, etc.,

iv. **Professional Core Courses (PCC)** relevant to the chosen specialization / branch.

v. **Professional Elective Courses (PEC)** include the verticals with elective courses and elective courses relevant to the chosen specialization / branch.

vi. **Open Elective Courses (OEC)** multidisciplinary courses and include the courses from Humanities and other disciplinary of Engineering and Technology. Students can choose those courses from the list of open elective courses specified in the respective curriculum.

vii. **Employability Enhancement Courses (EEC)** includes Project Work and / or Internship, Seminar, Professional Practices, Case Study and Industrial / Practical Training, Soft Skill Training etc,..

viii. **Value Added Course (VAC)** means a course that will be offered by the department, to bridge the gap between the curriculum and the requirements of the Industry, which could be selected by any student in the college.

ix. **Mandatory Courses (MC)** is to be studied compulsorily by all the students irrespective of the programme which includes Induction Program, UHV – II and Constitution of India, Heritage of Tamil, Tamils and Technologies.

4.2 Induction Programme

- Induction Programme is mandatory for the students pursuing the Undergraduate Programme which comprising of physical activity, creative arts, universal human values, proficiency modules, lectures by eminent people, visits to local areas and familiarization to department/branch immediately after admission.

- List of students who have successfully completed the Induction Programme shall be certified by the Principal.
- The completion of the Induction Programme shall be printed in the Grade Sheet as **"COMPLETED"**.

In the case of students who have got admitted later and those who have not attended the Induction Programme at the time of joining the degree programme, it shall be conducted later and on completion, it shall be recorded in the grade sheet.

4.3 Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC/NSS/YRC/Sports/Yoga) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first aid. Alternately, activities of science club, literature club and arts club also help for personality and character development. So, students shall conduct and participate actively in Science club/Literary Forum/Fine Arts activities for 80 hours and participate in at least ONE event.

National Cadet Corps (NCC) will have about 20 parades.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

Youth Red Cross (YRC) will have activities related to social services in and around college/institutions.

Sports will have Games, Drills and Physical exercises.

Yoga will have physical activity, breathing techniques, meditation, etc to develop harmony in the body and environment.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

Science Club shall organise activities of popularisation of science and scientific temper through activities related to astronomy, works of great scientists from India and abroad, observing National Science Day, etc.

Literary Club like 'Tamil Ilakkiya Mandram' shall be formed, which shall organise colourful literary events to propagate good humanist values, morals and ethics reflected in the literature.

Fine Arts Club like music, painting and documentary films with social themes shall be encouraged.

Students who enroll and take active participation in anyone of the above activities for 80 hours and participate at least one event/programme will be given a certificate by the Head of the Institution and the copy of the same shall be forwarded to the Controller of Examinations for the purpose of record and scrutiny.

4.3.1 Number of courses per semester

Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 Theory courses and Laboratory integrated theory courses and 4 Employability Enhancement Course(s) and Laboratory Courses. However, the total number of courses per semester shall not exceed 10. Each Course shall have credits assigned as per clause 4.4.

4.4 Credit Assignment

Each course is assigned certain number of credits based on the following:

Contact period per week	Credits
1 Lecture Period	1
1 Tutorial Period	1
1 Laboratory Period (also for EEC courses like Seminar / Mini Project / Project Work / Soft Skills / etc.)	0.5

4.5 Industrial Training/ Internship

4.5.1 The students may undergo Industrial training for a period as specified in the Curriculum during the summer / winter vacation. In this case, the training has to be undergone continuously for a period of at least two weeks in an organization.

The students may undergo Internship at a Research organization / University / Industry (after due approval from the Head of the Institution) for the period prescribed in the curriculum during the summer / winter vacation, in lieu of Industrial training. Attendance Certificate mentioning the period of Industrial Training / Internship and signed by the competent authority of the industry, as per the format provided by the Controller of Examinations shall be submitted to the Head of the Institution. The attendance certificate

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shall be forwarded to the COE, through the Head of the Institution for processing results.

4.5.2 If Industrial Training / Internship is not prescribed in the curriculum, the student may undergo Industrial Training / Internship optionally and the credits earned will be indicated in the Grade Sheet. If the student earns three credits in Industrial Training / Internship, the student may drop one Professional Elective (only one professional elective can be dropped). In such cases, Industrial Training / Internship need to be undergone continuously from one organization or with a combination one two week and one four week from one/two organizations. However, if the number of credits earned is 1 or 2, then these credits shall not be considered for classification of the degree. Students shall get permission from the Head of the Institution for taking Industrial Training/Internship and the Certificate of completion of Industrial Training / Internship shall be forwarded to the COE.

Duration of Training/Internship	Credits
2 Weeks*	1
4 Weeks	2
6 Weeks	3

***1 Week = 40 Internship Hours**

4.5.3 The minimum of two weeks of Industrial Training / Internship during summer/winter vacation in the entire duration of study is compulsory for the award of the degree.

4.6 Industrial Visit

Every student is required to go for two Industrial Visits in second and third year of the programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

4.6.1 Semester Long Project Work / Industrial Project / Internship

- In the final semester students shall undertake a semester long project work in their own discipline to obtain hands-on experience.
- Project work may be assigned to a single student or to a group of students, not exceeding 3 per group with a guide from the same department. However, if the project is of interdisciplinary nature then students from different programmes are permitted to form a group and the guide can be from other department also.
- Students are permitted to undertake a semester long industrial project or semester long internship in an industry / research organization in lieu of the final semester

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project work, provided the domain of such projects or internships come under the same discipline and approved by Department Consultative Committee (DCC) and the industry has no objection in submitting the work carried out as a report. This industrial project or internship is apart from the summer industrial training or summer internship, if any.

- If the outcome of the project work is the development of a finished product then it may lead to a start-up activity.
- The students have to submit a project report or internship report or start-up report on or before the last working day of the semester and the assessment of the same is detailed in clause 12.4.7.

4.7.a Every student shall be required to opt for 10 elective courses from the list of electives. Students should study seven Professional Elective courses from his / her own discipline courses, during V to VIII Semesters, if he/she satisfies the prerequisite for that particular course. The choices of professional elective courses are detailed in clause 6.3.

However, every student shall be required to study three courses as open electives from the list of electives of the branch / branches other than his / her branch of specialization, if he/she satisfies the prerequisite for that particular course. The course / content should not be covered in their own curriculum and syllabi.

4.7.b Certificate Course

Students can undergo the globally acclaimed technical certificate course facilitated by the Institution. This certification establishes an industry standard by which students are evaluated through a fair, comprehensive test of their knowledge in the areas related to their disciplines. Being certified makes the student, a highly competent professional. After attending the Course, students can appear for the respective international certification examinations. For example, certificate courses like, Cisco Certified Network Associate (CCNA), Certified SOLIDWORKS Associate (CSWA and other relevant courses as suggested and approved by HoD and BoS may be offered. Exemption will be given from the value added courses equal to the no. of certificate courses completed.

4.7 Value Added Courses

In order to prepare the students to meet the challenges of the global work environment, value added courses are offered to bridge the gap between the curriculum and the requirements of the industry. Each value added course shall have minimum duration of 40 hours. Value added courses are designed and offered by each department for the benefit of the students. All the students have to undergo at least two value added courses of their entire study. Students can choose any two value added courses offered by the various departments, based on their areas of interest. The students have to register for the value added courses by the value added course registration form through their concerned HoD to the HoD of the department offering the course, before the commencement of the semester.

4.7.1 One / Two Credit Courses / Self Study Courses

The candidates may optionally undergo One / Two Credit Courses / Online Courses / Self Study Courses as elective courses.

4.7.1.1 One / Two Credit Courses: One / Two credit courses shall be offered by the college with the prior approval from respective Board of Studies. A candidate can earn a maximum of six credits through one / two credit courses during the entire duration of the programme.

4.7.1.2 Self Study Courses: The Department may offer an elective course as a self study course. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following due approval procedure.

A student can register for Self-Study Elective(s), the electives from any branch of Engineering / Technology at the rate of one per semester starting from V semester onwards provided he/she maintains a Cumulative Grade Point Average (CGPA) of 8.50 or above till the previous semesters with no current arrears.

4.7.1.3 The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.7.1.1 and 4.7.1.2 by registering the required number of courses in advance. Course exemption is permitted for a student to a maximum of two courses per semester in the final year of BE / BTech.

4.7.1.5 A Candidate can earn a maximum of 30 credits through all one/two credit courses, online courses and self-study courses.

4.8 Off Campus courses and Transfer of Credits

Students are permitted to optionally enroll and study a maximum of three off campus courses in physical/online/hybrid mode with the approval of Head of the Institution as per the regulations. The successful completion of these courses through any of the following modes shall be considered in lieu of professional elective / open elective courses of curriculum as approved by the Head of the Institution.

4.8.1 Students are permitted to optionally enroll and study these courses through SWAYAM / NPTEL platforms and credit transfer is to be done based on the marks and certificate provided by the NPTEL. The number of credits, transfers of credits are based on the procedure explained in Table 3 and the Mapping of the marks with the grades is explained in Table 4. The mapping of marks with grades is applicable, only if the students passes the courses as per the guidelines of NPTEL.

Table 3: Duration of the course and Number of credits

Sl. No	No. of Weeks	No. of Credits
1	4	1
2	8	2
3	12	3
4	16	4

Table 4: Mapping of Marks scored in NPTEL course and Credits earned

Letter Grade	Marks
O	90-100
A+	80-89
A	70-79
B+	60-69
B	50-59
C	40-49

4.8.2 Students are permitted to optionally enroll and study the courses in physical / hybrid / online modes offered by reputed Central / State funded Universities / Institutions which are in the top 20 positions in the latest NIRF ranking and also conducting examination towards award of marks and grades. (NIRF Ranking of any of the last three years with respect to the year in which course is to be registered. NIRF ranking is based on respective stream for professional elective courses and based on any stream for open elective courses).

Students are also permitted to enroll and undergo such courses in online mode at Universities abroad in top 500 in QS ranking in the last three years.

Students are also permitted to study courses of a particular semester in a University / Institution abroad based on MoU. A learning agreement shall be evolved to map all the courses offered in University abroad as per the procedure outlined by the Acadmic Counicil and Board of Studies. The credits earned by the students in the University abroad shall be transferred as per the learning agreement.

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In the case of 4.8.2. the students can enroll for the courses with the approval of the Head of the Institution only if the course is offered directly by Institution/University and not with the edutech platforms.

The marks/credits earned by the student shall be transferred based on the decision of a committee constituted by Head of the Institution.

4.8.3 Students are also permitted to enroll and study the courses in physical/hybrid mode (not less than 50% in physical mode) that are offered by (i) National /State funded research institutions/laboratories and (ii) (a) reputed companies (manufacturing or software) related to the programme, and (b) reputed companies involved in transfer of knowledge provided the knowledge transferring company is a spinoff from an Engineering/Technology practicing Industry and sharing the work experience of the respective industry. The companies mentioned in 4.8.3 (ii) (a) and the company with which the knowledge transfer company associated in the case of 4.8.3 (ii) (b) should have average annual turnover of more than 200 crores over a period of 5 years. However, the academic content and delivery shall be in consonance with the University academic standards and norms.

The minimum qualification of the course instructor from the company as mentioned in 4.8.3 (ii) shall be B.E. / B.Tech with 10 years of research / industrial experience. Such courses shall be offered through MOU / MOA with such institutions / Organizations / Companies. The design of the courses with regard to the syllabus content. Duration of each course and number of credits offered for each course shall be discussed and recommended by Head of the Institution and approved by Academic Council as per the Regulations.

For the offer of each course under 4.8.3, a course coordinator shall be nominated from the Department who shall also attend such course and shall coordinate the question paper setting and answer script evaluation with the course instructor from research institution / laboratories / industry / company for the continuous assessment and end semester examination conducted. The passing requirements are as per regulations.

4.9.a Mini Project

Two Mini Project courses of one Credit each are included in every UG programme, the choice of semesters may be five, six and seven in order to enhance the employability skills of the students. Through this course, students will gain premier knowledge on various domains and adapt to industry needs.

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4.9 Mandatory courses

Mandatory Courses (MC) should be studied compulsorily by all the students irrespective of the programme, like Constitution of India, Universal Human Values, Heritage of Tamil and Tamils and Technology as mentioned in the curriculum. Mandatory Courses may or may not have credits. These courses shall carry a maximum of 100 marks each and shall be evaluated through internal mode only. The evaluation will be made as per the regulations. The mandatory courses will be mentioned in the Grade Sheet.

4.10 B.E. / B. Tech. (Hons) and B.E. / B. Tech. minor with specialisation in another discipline.

(i). B.E / B.Tech. (Hons.)

a. The students should have taken additional courses from a specified group of Professional Electives (vertical) or from any of the verticals of the same programme and earned a minimum of 18 credits.

b. Should have passed all the courses prescribed in the curriculum and additional courses in the first attempt.

c. Should have earned a minimum of 7.50 CGPA taking into account of all the courses prescribed in the curriculum and additional courses.

(ii). B.E./B.Tech.Minor with specialisation in another discipline

The student should have earned additionally a minimum of 18 credits in any one of the verticals offered from Engineering Disciplines / Science and Humanities / Management

1. For these 18 credits students can optionally enroll and study a maximum of 6 credits in online mode from SWAYAM NPTEL platform (in addition to the three online courses permitted for courses of curriculum), as approved by the Academic Council.
2. B.E / B.Tech. (Hons.) and B.E./B.Tech. minor with specialisation in another discipline will be optional for students and the students shall be permitted to select any one of them only.
3. For the categories 4.10 (i), the students, including Lateral Entry, shall be permitted to register for the courses from Semester V onwards provided the students have earned a minimum CGPA of 7.50 until Semester III and have

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cleared all the courses in the first attempt.

4. For the category 4.10 (ii), the students, including Lateral Entry, will be permitted to register the courses from Semester *V* onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
5. B.E/B.Tech. (Hons.) or B.E./ B.Tech. Minor shall be offered by the Department irrespective of the number of students enrolled.
6. If a student decides not to opt for Honours, after completing certain number of additional courses, such additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the grade sheet however, they will not be considered for calculation of CGPA and the same shall be indicated in a foot note appropriately.

   If the student has failed in the additional courses or faced shortage of attendance, they will not be printed in the grade sheet and will not be considered for CGPA calculation and classification of degree.
7. If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum.

   If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the grade sheet, however, they will not be considered for calculation of CGPA and the same shall be indicated in a foot note appropriately.

   If the student has failed in the additional courses or faced shortage of attendance, they will not be printed in the grade sheet and will not be considered for CGPA calculation and classification of degree.

   The student has to enroll for these additional courses separately and pay a tuition fee for studying these six additional courses and pay additional exam fee.

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4.11 Soft Skills and Aptitude Skills

In order to enhance the employability of students, one credit Employability Enhancement courses are included in the curriculum from semester I to VI, they are given soft skills training areas like Communication, Leadership, Teamwork, Creativity, etc,. and Aptitude training on significant areas like Verbal ability, Logical Reasoning and Quantitative aptitude, etc,.

4.12 Conduct Lectures / Training by Adjunct Faculty

The classes delivered by adjunct faculty may be conducted through offline mode / online mode for students. The respective departments shall obtain the approval from the Principal before conducting such classes.

4.13 Medium of Instruction

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports.

5 Duration of the Programme

5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (for HSC students) and six semesters (for Lateral Entry students) but in any case not more than 14 Semesters for HSC (or equivalent) students and not more than 12 semesters for Lateral Entry students.

5.2 Each semester shall normally consist of 75 working days or 540 periods of 50 minutes each. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

5.3 The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{\underset{\text{taken together for all courses of the semester}}{(\text{No. of periods per week as prescribed in the curriculum}) \times 15}} \times 100$$

The End Semester Examination will normally follow immediately after the last working day of the semester as per the academic schedule prescribed from time to time.

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5.4 The total period for completion of the programme reckoned from the commencement of the first semester (third semester in case of LE) to which the candidate was admitted shall not be exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18) in order that he/she may be eligible for the award of the degree (vide clause 16).

6 Course Registration

6.1 Each student has to register for all the courses to be undergone in the curriculum of a particular semester. The student can also register for courses for which the student has failed in the earlier semesters (with the facility to drop courses to a maximum of 6 credits (vide clause 6.2)). In such cases the student shall do reappearance registration for those courses for which the attendance requirement is not compulsory. This registration is for undergoing the course as well as for writing the End Semester Examinations. No Elective course shall be offered by any department unless a minimum 10 students register for the course. However, if the students admitted in the associated Branch and Semester is less than 10, this minimum will not be applicable. The courses dropped in earlier semesters can be registered in the subsequent semesters when offered.

The courses that a student registers in a particular semester may include

i. Courses of the current semester.

ii. Courses dropped in the lower semesters

The maximum number of credits that can be registered in a semester is 36. However, this does not include the number of Re-appearance (U) and Withdrawal (WD) courses registered by the student for the appearance of Examination.

6.2 Flexibility to Drop courses

6.2.1 A student has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree.

6.2.2 From the second to final semesters, the student has the option of dropping existing courses in a semester during registration. Total number of credits of such courses shall not exceed 6 per semester. The student is permitted to drop the course(s) within 30 days of the commencement of the academic schedule.

6.2.3 From the V to VIII semesters, the student has the option of registering for additional courses in a semester. With regard to enrolling for B.E. / B. Tech. (Hons) or B.E. / B. Tech. Minor.

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The total number of credits that a student can add in a semester is limited to 6, subject to a maximum of 2 courses. Maximum number of credits enrolled in a semester (Honours and Minor) shall not exceed 36. The online courses registered for B.E. / B. Tech. (Hons.) and B.E. / B. Tech. minor shall be over and above this 36 credits.

6.3 Choice of Professional Elective Courses

The professional Elective Courses are listed in the Curriculum in Table format as verticals (Specialisation groups). A student can choose all the Professional Elective Courses either from one of the verticals or a combination of courses from all verticals in a semester. However, students irrespective of enrolling for additional courses for B.E. / B. Tech. (Hons.) are not permitted to choose more than one course from a row. Students are permitted to enroll more than one elective course from the same vertical in a semester. In the subsequent semesters students are permitted to enroll one more course in a row, provided if he/she has cleared the earlier course of the same row. For a professional elective course and open elective course, minimum number of students enrolment permitted shall be 10. However, the minimum number is not applicable for students enrolling B.E. / B. Tech. (Hons) and B.E. / B. Tech. Minor.

7 Attendance Requirements for Completion of a Semester

7.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend at le ast 75% of the classes.

Therefore, he/she **shall secure not less than 75%** (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.

7.2 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness / Participation in Sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution.

7.3 Candidates who **secure less than 65% overall attendance and candidates who do not satisfy the clause 7.1 and 7.2** shall not be permitted to write the End Semester

Examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

8. Class Advisor

There shall be a class advisor for each class. The class advisor will be one among the faculty members of the class. He / She will be appointed by the Head of the Department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of the students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students welfare activities like awards, medals, scholarships and industrial visits.

9. Class Committee

9.1 Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching learning process. The functions of the class committee include:

- Solving the problems experienced by the students in the classroom and in the laboratories. Clarifying the Regulations of the degree programme and the details of rules therein.
- Informing the student representatives the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to all the students.
- Analyzing the performance of the students of the class after each test and finding

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ways and means of solving problems if any.

- Identifying the slow learners, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such students.

9.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches) the class committee is to be constituted by the Head of the Institution.

9.3 The class committee shall be constituted within the first week of each semester.

9.4 Maximum of 6 student representatives shall be included in the class committee.

9.5 The Chairperson of the class committee may invite the Class Advisor(s) and the Head of the Department to the class committee meeting.

9.6 The Head of the Institution may participate in any class committee meeting of the Institution.

9.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the Management, the same shall be brought to the notice of the Management by the Head of the Institution.

9.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. The Class Committee Chairperson shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

10. Course Committee for Common Courses

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course Committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the Course Committee may also prepare a common question paper for the internal assessment test(s).

10.1 Departmental Consultative Committee

All departments shall constitute a Departmental Consultative Committee (DCC) consisting of the HOD as Chairperson and Three senior faculties. The responsibilities of DCC are:

1. To review and approve industries or other organizations identified for industrial training, internship or project work of students.
2. To review and approve online/NPTEL/Self-study courses selected by students for their content and quality.
3. To review the courses offered by industries and to send the recommendations to COE.

11. System of Examination

11.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) end semester examination at the end of the semester.

11.2 Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.

11.2.1 For all theory courses, the continuous internal assessment will carry **40 marks** while the End Semester University Examination will carry **60 marks**.

11.2.2 For all theory courses with laboratory component, the continuous internal assessment will carry **50 marks** while the End Semester examination will carry **50 marks**.

11.2.3 For all laboratory courses, the continuous internal assessment will carry **60 marks** while the End Semester examination will carry **40 Marks**.

11.2.4 The continuous internal assessment for the project work will carry **60 marks** while the End Semester Examination will carry **40 marks**.

11.3 Industrial Training and Seminar shall carry 100 marks and shall be evaluated through internal assessment only.

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11.4 The end semester examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

11.5 The end semester examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 3 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

11.6 For the end semester examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

12. Procedures for Awarding Marks for Internal Assessment (IA)

For all theory, laboratory courses, theory courses with laboratory component and project work the continuous assessment shall be awarded as per the procedure given below:

12.1 Internal Assessment for Theory Courses

Two assessments each carrying 100 marks shall be conducted during the semester by the Department concerned. The total marks obtained in all assessments put together out of 200, shall be proportionately reduced for 40 marks and rounded to the nearest integer (This also implies equal weightage to the two assessments).

Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total** Internal Assessment
Individual Assignment / Case Study / Seminar / Mini Project / any other experiential Learning	Written Test	Individual Assignment / Case Study/ Seminar / Mini Project / any other experiential Learning	Written Test	
40	60	40	60	200*

**The weighted average shall be converted into 40 marks for internal Assessment.*

A minimum of two internal assessments will be conducted as a part of continuous assessment. Each internal assessment is to be conducted for 100 marks and will have to be distributed in two parts viz., Individual Assignment / Case study / Seminar / Mini project / any other experimental learning and Test with each having a weightage of 40% and 60% respectively. The tests shall be in written mode. The total internal assessment marks of 200 shall be converted into a maximum of 40 marks and rounded to the nearest integer.

12.2 Internal Assessment for Laboratory Courses

The maximum marks for Internal Assessment shall be 60 marks in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records are to be maintained. There shall be atleast one test. The criteria for arriving at the Internal Assessment marks of 60 is as follows : 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be converted into a maximum of 60 marks and rounded to the nearest integer.

Internal Assessment (100 Marks)*	
Evaluation of Laboratory Observation, Record	Test
75	25

*Internal Assessment marks shall be converted into 60 marks

12.3 Theory Courses with Laboratory component / Laboratory Courses with Theory Component

Weightage of internal assessment and end semester examination marks will be 50% each. The distribution of marks for the theory and laboratory components in the internal assessments and end semester examination for different types of courses are provided in the table.

L	T	P	C	Internal		End Semester Examination
				Assessment 1	Assessment 2	
1	0	4	3	Laboratory(25%)	Theory(25%)	Laboratory only (50%)
1	0	2	2	Laboratory 25%)	Theory(25%)	Laboratory only (50%)
2	0	2	3	Theory (25%)	Laboratory(25%)	Theory(25%) Laboratory(25%)
3	0	2	4	Theory (25%)	Laboratory(25%)	Theory (35%) Laboratory(15%)
2	0	4	4	Theory (25%)	Laboratory 25%)	Theory (15%) Laboratory(35%)

The procedure for the conduct of internal assessments for theory and laboratory components shall be as per the clause 12.1 and 12.2 respectively.

The weighted average shall be converted into 50 marks for internal Assessment.

12.4 Project Work/Internship

The student shall register for Project Work in final semester. Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The student is also permitted to undergo a semester long internship in an industry / academic / research institution.

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12.4.1 Project Work shall be carried out under the supervision of a "qualified teacher" in the Department concerned. In this context "qualified teacher" means the faculty member possessing (i) PG degree or (ii) Ph.D. degree.

12.4.2 The Project Work carried out in industry / academic / research institution shall be jointly supervised. The Project Work shall be jointly supervised by a supervisor of the department and an expert from the organization as a joint supervisor and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress. The review meetings, if necessary, may also be arranged in online mode with prior approval from the Head of the Institution and suitable record of the meetings shall be maintained.

12.4.3 The Head of the Institutions shall constitute a review committee for Project Work for each programme. The review committee consists of supervisor, an expert from the Department and a project coordinator from the Department. If the project coordinator/expert member happens to be the supervisor, then an alternate member shall be nominated. In the case of Industrial Project / Internship, the review committee shall consist of the supervisor, the coordinator from industry and the project coordinator from the Department.

There shall be three reviews conducted by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be reduced for 60 marks and rounded to the nearest integer (as per the scheme given in 12.4.4).

12.4.4 The project report shall carry a maximum of 10 marks. The project report shall be submitted as per the approved guidelines as given by the Controller of Examinations. Same marks shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 30 marks. Marks awarded to each student of the project group is based on the individual performance in the viva-voce examination.

Continuous Assessment (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report	Viva-Voce Examination		
			External	Internal	External	Supervisor
20	20	20	10	10	10	10

In the case of industrial projects, the marks allotted for supervisor will be shared equally by the supervisor from the Department and coordinator from Industry.

All the project batches of VIII semester students are expected to present their project outcomes in one International / National Conference / Copyright / Patent Rights.

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12.4.5 The last date for submission of the project report is on the last working day of the semester. If a student fails to submit the project report on or before the specified deadline, it will be considered as fail in the Project Work and the student shall re-register for the same in the subsequent semester.

12.4.6 Students shall also undertake a start-up activity for the development of products as part of project work. If the outcome of a start-up is a fully developed product and whose concept is tested and validated, then it shall be considered in lieu of the project work. Such students shall submit a start up report, which includes the concepts and process flow of the developed product, publications and patents, if any. The evaluation of the start-up report is as per the clause12.4.4.

12.4.7 Assessment of Semester Long Industrial Project / Internship:

The Viva-Voce examination for semester long industrial project or internship shall be based on the report submitted by the student with regard to the work carried out in the industrial project or internship. The students have to produce attendance certificate at the time of reviews. The report shall be certified by mentor from industry, supervisor and HOD.

Projects/internship undertaken externally should have an internal guide and an external guide. Both guides are expected to interact regularly monitoring the progress of the student. For the reviews the external guide should be present atleast in online mode to assess and award marks to the student. In the beginning of the project, the internal guide should ensure that the work to be carried out is upto the standard as well as not attracting any IPR issues with the external organization, so that the work could be published. The reviews may be conducted in online mode, if the student cannot travel to attend the reviews and this shall be approved by HOD and such reviews have to be recorded. However, the end semester examination has to be conducted in physical mode with the mentor from company present physically or through online.

In the final report, the bonafide certificate shall be signed by both the guides mandatorily. However, if any difficulty is encountered in fulfilling this norm then the HoD can initiate remedial action and complete the evaluation requirement with justification and approval of the Head of the Institution for the same.

The Bonafide certificate of the project report shall have the date of viva voce examination and the signatures of the internal and external guides.

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12.5 Other Employability Enhancement Courses

(a). The Seminar / Case Study / Mini Project course is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by the Head of the Institution, consisting of the course coordinator and two experts from the Department, will evaluate the seminar and at the end of the semester, the marks shall be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

(b). The performances of the students in Employability Enhancement Courses in the category of soft skill courses, are evaluated through continuous internal assessments only for 100 marks. Every exercise shall be evaluated based on conduct of exercise and records are to be maintained. There shall be atleast one test. The criteria for arriving the marks is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments and 25 marks for the test. The total marks obtained shall be reduced to 100 marks and rounded to the nearest integer.

(c). The Industrial Training, in plant training and Summer / winter Internship shall carry 100 marks and shall be evaluated through internal assessment only.

The following is the assessment methodology to be followed:

1. Students shall submit a report on the work done during the course duration which consists of the following:
    - Description of the work
    - Feedback from the respective Industry mentor
    - Photographs of the students in the industry if the work is undertaken there
    - Completion certificate from the Industry / faculty mentor
2. The final viva-voce shall be conducted by a committee duly appointed by the office of COE which consists of a person from the related industry, two faculty members –
    1. From the same department;
    2. From another related department

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12.6 Assessment for Value Added Course

The value added course shall carry 100 marks and shall be evaluated through continuous assessments only. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior faculty member nominated by the Head of the Institution shall do the evaluation process. The list of students along with the marks and the grades earned shall be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations. The grades earned by the students for Value Added Courses will be recorded in the Grade Sheet, however the same shall not be considered for the computation of CGPA. Students who failed in value added course have to appear for the supplementary internal examination. Securing a pass in the two value added courses registered, before the commencement of VIII Semester is necessary for the award of degree.

12.6.1 Assessment for Mini Project

The Mini Project shall carry 100 marks and shall be evaluated through three reviews as continuous assessments. The first and second reviews are to be evaluated by a three member committee constituted by the HOD which includes the supervisor, coordinator and an expert from the Department. At the end of the semester the student shall submit a brief report on the Mini Project. The third review will be conducted based on the report and Viva-Voce Examination conducted by the same committee and the evaluation report shall be sent to Controller of Examinations by the Head of the Department.

The breakup of marks is given in the Table :

Continuous Assessment for Mini Project

<table>
<tr><th rowspan="3">Mini Project</th><th colspan="4">Continuous Assessment Evaluation</th></tr>
<tr><th rowspan="2">Review I</th><th rowspan="2">Review II</th><th colspan="2">Review III (50 marks)</th></tr>
<tr><th>Report</th><th>Viva-Voce Examination</th></tr>
<tr><td>Marks</td><td>25</td><td>25</td><td>20</td><td>30</td></tr>
</table>

12.7 Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

12.8 Attendance and Assessment Record

Every teacher is required to maintain an **'Attendance and Assessment Record'** which consists of attendance marked in each lecture or practical or project work class, the test marks, assignment marks, and the record of class work (Topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks, assignment marks and attendance. The Head of the department will put his/her signature with date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years).

12.9 Conduct of Academic Audit

The internal assessments are conducted for better performance of the students' as mentioned in Clause 12.

In order to ensure the above, Academic Audit is to be done for every course taught during the semester. For the internal assessments conducted for each course as per details provided in Clause 12, the academic records shall be maintained in the form of documentation for the individual assignments / case study report / report of mini project submitted by each student and assessment test question paper and answer script. Report of industrial training / internship shall also be maintained, if applicable. For laboratory courses students' record shall be maintained. Further, the attendance of all students shall be maintained as a record. Also, The academic audit shall include verification of CO, PO attainment records, student's and course coordinators feedback of the courses, and the overall teaching-learning process based on Bloom's taxonomy. Action shall be taken by HOD based on audit report for continuous improvement. Academic documents of UG degree programmes should be available with the department/faculty for 5 years.

The Head of the Institution shall arrange to conduct the Academic Audit for every course in a semester by forming the respective committees with an external course expert as one of the members drawn from a Technical institution of repute near the institute.

The inspection team appointed by the University may verify the records of Academic Audit report of the courses of both current and previous semesters, as and when required.

12.10 The following will be the weightage for different courses.

i). Theory Courses

Internal Assessment	: 40 Marks
End-Semester Exams	: 60 Marks

ii). Theory Courses with Laboratory Component

Internal Assessment	: 50 Marks
End-Semester Exams	: 50 Marks

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iii). Practical Courses

Internal Assessment : 60 Marks

End-Semester Exams : 40 Marks

iv) Project Work

Internal Assessment : 60 marks

End semester

(Project work report Evaluation

and viva-voce examination) : 40 marks

13. Requirements for Appearing for End Semester Examination

A candidate shall normally be permitted to appear for the end semester examinations for all the courses registered in the current semester (vide clause 6) if he/she has satisfied the semester completion requirements (subject to Clause 7).

Further, examination registration by a student is mandatory for all the courses in the current semester and all arrear(s) course(s) for the End Semester examinations failing which, the student will not be permitted to move to the higher semester.

A candidate who has already appeared for any course in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

14. Passing Requirements

14.1 A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End Semester Examinations] with a minimum of 45% of the marks prescribed for the end-semester Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

14.2 If a student fails to secure a pass in a theory course / laboratory course (except electives), the student shall register and appear only for the end semester examination in the subsequent semester. In such case, the internal assessment marks obtained by the student in the first appearance shall be retained and considered valid for all subsequent attempts till the student secures a pass. However, from the third attempt onwards if a student fails to obtain pass marks (IA + End Semester Examination) as per clause 14.1, then the student shall be declared to have passed the examination if he/she secures a minimum of 50% marks prescribed for the end semester examinations alone.

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14.3 If the course, in which the student has failed, is a Professional Elective or an Open Elective course, the student may be permitted to complete the same course. In such case, the internal assessment marks obtained by the student in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secures a pass. However, from the third attempt onwards if a candidate fails to obtain pass marks (IA + End Semester Examination) as per clause 14.1, then the candidate shall be declared to have passed the examination if he/she secures a minimum of 50% marks prescribed for the end semester examinations alone.

If any other Professional Elective or Open Elective course is opted by the student, the previous registration is cancelled and henceforth it is to be considered as a new Professional Elective or Open Elective course. The student has to register and attend the classes, earn the continuous assessment marks, fulfil the attendance requirements as per clause 7 and appear for the end semester examination.

14.4 If a student has submitted the project report but absent in the end semester examination of project work, the student is deemed to be failed. In this case and also if a student attends and fails in the End semester examination of Project work of B.E. / B.Tech, he/she shall attend end semester examination again within 60 days from the date of declaration of the results. The subsequent viva-voce examination will be considered as reappearance with payment of exam fee. In case, the student fails in the subsequent viva-voce examination also, the student shall redo the course again, when offered next.

14.5 The passing requirement for the courses which are assessed through purely internal mode only (Mandatory Courses, EEC courses except Project work & Laboratory), is 50% marks only.

14.5.1 Student Migration and Credit Transfer: Normalization of the credits will be carried out in consultation with the Board of Studies of the programme concerned and approved by the Head of the Institution, if a student migrates from other affiliated institutions to Kongunadu College of Engineering and Technology or rejoins from previous regulation to this regulation.

14.6 In order to complete the programme within 4 years, if a student has to reappear for ONE / TWO courses of final semester only after the announcement of the end semester examination results, the student will be permitted to appear for supplementary examination. The supplementary examination will be conducted within a month after the announcement of the end semester examination results. For supplementary examination the continuous assessment marks of the last attempt will be considered.

15. Award of Letter Grades

15.1 The award of letter grades will be decided using relative grading principle except Laboratory Courses and Project Work. The performance of a student will be reported using letter grades, each carrying certain points as detailed below:

Letter Grade	Grade Points*
O (Outstanding)	10
A + (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Average)	6
C (Satisfactory)	5
U (Re-appearance)	0
SA (Shortage of Attendance)	0
WD (Withdrawal)	0

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+","B", "C".

'SA' denotes shortage of attendance (as per clause 7.3) and hence prevented from writing the end semester examinations. 'SA' will appear only in the result sheet.

" *U* " denotes that the student has failed to pass in that course. "WD" denotes withdrawal from the exam for the particular course. The grades *U* and W will figure both in the Grade Sheet as well as in the Result Sheet. In both cases, the student has to appear for the End Semester Examinations as per the Regulations.

If the grade U is given to Theory Courses/ Laboratory Courses it is not required to satisfy the attendance requirements (vide clause 7), but has to appear for the end semester examination and fulfil the norms specified in clause 14 to earn a pass in the respective courses.

If the grade U is given to EEC course (except, Project Work), which are evaluated only

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through internal assessment, the student shall register for the course again in the subsequent semester, fulfil the norms as specified in clause 14 to earn pass in the course. However, attendance requirement need not be satisfied.

15.1.1 Relative Grading

For those students who have passed the course (theory course / laboratory integrated courses / theory integrated courses / all other EEC except laboratory course / Project Work Courses), the relative grading shall be done. The marks of those students who have passed only shall be inputted in the software developed for relative grading. The evolved relative grading method normalizes the results data using the BOX-COX transformation method and computes the grade range for each course separately and awards the grade to each student. (theory course / laboratory integrated courses / theory integrated courses and all other EEC Courses). If the students' strength is greater than 30 , the relative grading method shall be adopted

15.1.2 Absolute Grading

- In all the courses, if the number of students who have passed the course is less than or equal to 30 then absolute grading shall be followed with the grade range as specified in the Table.
- For the Project Work / Internship and Laboratory Courses, absolute grading procedure shall be followed as given in the Table below irrespective of the number of students who have passed the course.

Table - Grade range for absolute grading

O	A+	A	B+	B	C	U
91 – 100	81 – 90	71 – 80	61 – 70	56 – 60	50 – 55	< 50

15.2 For the Co-curricular activities such as National Cadet Corps (NCC)/ National Service Scheme (NSS) / NSO / YRC / Women Development Cell / Science club / Literary Club/ Fine Arts Club, a **'completed'** remark will appear in the Grade Sheet on successful completion of the same. Every student shall put in a minimum of 75% attendance in the training and attend the camp or events of the clubs compulsorily. The training and camp or club events shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the subsequent years. **Successful completion of any one of the above co-curricular activities is compulsory for the award of degree.**

15.3 For the Induction Program a **"Completed"** grading will appear in the Grade sheet. **A Completed grade in the Induction Program is compulsory for the award of degree.**

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15.4 For the Mandatory Courses a **"Passed"** grading will appear in the Mark Sheet. The Courses for which the grades are RA, SA will not figure in the mark sheet. **A Passed grade in the Mandatory Courses is compulsory for the award of degree.**

15.4.1 The grades earned for **Value Added Courses** as any of the following grades: "O", "A+", "A", "B+","B", "C", will be recorded in the Grade Sheet. However the same shall not be considered for computation of CGPA. The completion of two value added courses with above said grades are compulsory for the award of the degree.

15.5 Grade Sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- List of courses studied for Hons., Minor and any other additional courses in which the student has passed with the grades under the title additional courses.
- The Grade Point Average (GPA) for the semester considering only the courses of curriculum (not the additional courses) and
- The Cumulative Grade Point Average (CGPA) of all courses registered from first semester onwards considering only the courses of curriculum (not the additional courses). However, for the students who have successfully completed the requirements of B.E. / B. Tech.(Hons) and B.E. / B.Tech. Minor vide Clause 4.10, grades scored in the six additional courses shall be taken into account for the computation of CGPA.

During each semester, the list of curricular courses (not the additional courses) registered and the grades scored in each course are used to compute the Grade Point Average (GPA). GPA is the ratio of the sum of the products of the number of credits of curricular courses (not the additional courses) registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester. U grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\Sigma}{\Sigma}$$

Where,

C is the number of Credits assigned to the course

GPi is the point corresponding to the grade obtained for each course

n is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

15.5.1 If a student studies more number of professional and open electives than required as per the student's programme curriculum, the calculation of final CGPA shall be as per 4·10.6 and 4·10.7.

15.5.2 If a student successfully completes all the requirements of the programme and also meets the requirements of B.E. / B. Tech. (Hons) or B.E. / B. Tech. Minor but desires not to opt for the additional qualification, then he/she has to submit a declaration with regard to the same 30 days before the completion of semester VIII.

15.5.3 In the consolidated grade sheet the CGPA earned shall be converted into percentage of marks as follows:

$$\text{Percentage of Marks} = \text{CGPA} \times 10.$$

16. Eligibility for the Award of Degree

16.1 A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided,

i) The student has successfully gained the required number of total credits as specified in the curriculum corresponding to student's programme within the stipulated time.

ii) The student has successfully completed the course requirements, appeared for the End - Semester examinations and passed all the subjects within the period as prescribed in clause 5.1.

iii) The student has successfully completed any additional courses prescribed by the Chairperson, Academic Council whenever, any candidate is readmitted under regulations other than R2024 (vide clause 18.2)

iv) Successfully completed the NCC / NSS / YRC / Sports / Yoga / Women Development Cell / Science Club / Literature Club / Fine Arts Club requirements requirements.

v) Successfully completed the Value Added Courses requirements.

vi) Successfully completed the Industrial Visits and Internship.

vii) Successfully completed the Mandatory Courses requirements

viii) The student has no disciplinary action pending against him/her.

ix) The award of Degree must have been approved by the Syndicate of the University.

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16.2 Classification of the Degree Awarded

16.2.1 First Class with Distinction

A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters and 6 semesters in the case of Lateral Entry in the student's First Appearance within five years and Four years in the case of Lateral Entry. Withdrawal from examination (vide Clause 17) will not be considered as an appearance. Should have secured a CGPA of not less than **8. 50**.
- One year authorized break of study (if availed of) is included in the five years and four years in the case of lateral entry for award of First class with Distinction.
- Should not have been prevented from writing end semester examination in any of the courses of the Curriculum making up the total credit requirement.

A student who satisfies norms given in clause 4.10 becomes eligible for classification of the degree with B.E./B.Tech. (Hons) and B.E./B.Tech. minor.

Details are provided in Table

Degree (i)	Duration of programme (ii)	Duration permitted (iii)	Additional credits above the requirement of curriculum (iv)	CGPA (v)	Pass in (vi)	Break of study (vii)	Prevention to write end semester examination (viii)	Withdrawal from writing end semester examination (ix)
B.E./B.Tech. (Regular)	4 years	5 years	-	8.50	First attempt	One year authorised break of study included in the Duration permitted(iii)	Not permitted	Will not be considered as an attempt
B.E./B.Tech. Lateral Entry	3 years	4 years	-	8.50	First attempt	One year authorised break of study included in the Duration permitted(iii)	Not permitted	Will not be considered as an attempt
B.E./B.Tech. (Honours)	3/4 years (Lateral entry and Regular, respectively)	4/5 Years (Lateral entry and Regular, respectively)	18 credits from more than one verticals of the same programme	8.50	First attempt	One year authorised break of study included in the Duration permitted (iii)	Not permitted	Will not be considered as an attempt
B.E./B.Tech. minor	3/4 Years (Lateral entry and Regular, respectively)	4/5 Years (Lateral entry and Regular, respectively)	18 credits from any one vertical of the other programme	8.50	First attempt	One year authorised break of study included in the Duration permitted (iii)	Not permitted	Will not be considered as an attempt

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16.2.2 First Class:

A student who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all eight semesters and 6 semesters in the case of Lateral Entry within five years and Four years in the case of Lateral Entry.
- One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of five years and four years in the case of Lateral Entry for award of First class.
- Should have secured a CGPA of not less than 6.50.
- A student who satisfies norms given in clause 4.10 becomes eligible for classification of the degree with B.E./B.Tech. (Honours) and B.E./B.Tech. minor.

Details are provided in Table.

Degree (i)	Duration of programme (ii)	Duration permitted (iii)	Additional credits (iv)	CGPA (v)	Pass in (vi)	Break of study (vii)	Prevention to write end semester examination (viii)	Withdrawal from writing end semester examination (ix)
B.E./B.Tech. (Regular)	4 years	5 years	-	6.50	-	One year authorised break of study included in the Duration permitted(iii)	Included in the Duration permitted (iii)	-
B.E./B.Tech. Lateral Entry	3 years	4 years	-	6.50	-	One year authorised break of study included in the Duration permitted(iii)	Included in the Duration permitted (iii)	-
B.E./B.Tech. (Honours)	3/4 Years (Lateral entry and Regular, respectively)	4/5 Years (Lateral entry and Regular, respectively)	18 credits from more than one verticals of the same programme	7.50	First attempt	One year authorised break of study included in the Duration permitted (iii)	Not permitted	Will not be considered as an attempt
B.E./B.Tech. minor	3/4 Years (Lateral entry and Regular, respectively)	4/5 Years (Lateral entry and Regular, respectively)	18 credits from any one vertical of the other programme	6.50	-	One year authorised break of study included in the Duration permitted (iii)	Included in the Duration permitted (iii)	-

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16.2.3 **Second Class:**

Students who pursue B.E./B.Tech. in Regular mode or lateral entry mode or B.E./B.Tech. minor in specialisation of another discipline and who are not covered in clauses 16.2.1 and 16.2.2 and who qualify for the award of the degree (vide Clause 16.1) shall be declared to have passed the examination in Second Class.

16.2.4 A student who is absent in the End Semester Examination in a course / project work after having registered for the same shall be considered to have appeared in that examination (except approved withdrawal from end semester examinations as per clause 15) for the purpose classification.

16.2.5 Student earned additional 18 credits as per Clause 4.10 (i) and (ii) but does not satisfy the conditions mentioned in 16.2 .1 or 16.2 .2 shall not be awarded B.E./B.Tech.(Hons.) In such case if the student becomes eligible for First Class, while computing CGPA with the Professional Elective / Open Elective courses with higher grades the student shall be awarded B.E. / B. Tech. in First Class only.

16.3 A student who is absent in end semester examination in a course / project workafter having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17).

16.4 Photocopy / Revaluation

A candidate can apply for photocopy of his/her end semester examinations answer paper in a theory course, within two weeks from the declarations of results on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with the breakup of marks for each question. Based on the recommendation, candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidates concerned through the Head of the Department. Revaluation is not permitted for practical courses and for EEC courses.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

16.5 Review

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the

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Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

16.6 Ranks Awarded to Students

Ranks are awarded for each programme based on the following criteria.

- The number of ranks awarded for each programme is 5% of the student's intake in that programme.
- The rank of a student is determined from CGPA. However, students who have scored less than 7.5 CGPA will not be eligible for a rank.
- Students should have passed the End Semester Examination in all the courses of all the eight semesters (six semesters in case of LE) in his/her First Appearance without any break of study.

17. Provision for Withdrawal from End Semester Examination

17.1 A student may, for valid reasons, (medically unfit / unexpected family situations / sports approved by Chairman, sports board / Head of the Institution) be granted permission to withdraw from appearing for the end semester examination in any course or courses in ANY ONE of the semester examinations during the entire duration of the degree programme.

17.2 Withdrawal application is valid if the student is otherwise eligible to write the examination (Clause 7) and if it is made within TEN days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution with intimation to the Controller of Examinations.

17.2.1 Notwithstanding the requirement of mandatory 10 days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

17.3 In case of withdrawal from course/courses, it will figure both in Marks Sheet as well as in Result Sheet. However, withdrawal shall not be considerd as an appearance for the eligibility of a candidate for First Class with Distinction.

17.4 If a student withdraws from writing end semester examinations for a course or courses, he/she shall register for the same in the subsequent semester and write the end semester examination(s).

17.5 If a student applies for withdrawal from Project Work, he/she will be permitted for the withdrawal only if the student has submitted the project report before the deadline.

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However, the student may appear for the viva-voce examination within 60 days after the declaration of results for Project Work and the same shall not be considered as reappearance.

17.6 Withdrawal is permitted for the end semester examinations in the final semester, as per clause 16.2.1.

18. Provision for Authorized Break of Study from a Programme

18.1 A student is permitted to avail authorised break of study for a maximum period of one year in a single spell.

18.2 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the student may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a student intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she shall apply to Head of the Institution in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Department stating the reasons therefore and the probable date of rejoining the programme.

18.3 The students permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself. The students rejoining in new regulations shall register for additional courses, if any, as recommended by the Board of Studies under change of regulations. These courses may be from any of the semesters of the curriculum in force, so as to bridge the curriculum in force and the old curriculum. In such cases, the total number of credits to be earned by the student may be more than or equal to the total number of credits prescribed in the curriculum in force.

18.4 The authorized break of study of maximum of one year is included in the duration specified for passing all the courses for the purpose of classification (vide Clause 16.1).

18.5 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

18.6 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

18.7 If a student in Full Time mode wants to take up job / start-up / entrepreneurship during the period of study he/she shall apply for authorised break of study for one year. The student shall undertake the job / start-up / entrepreneurship only after getting approval with due proof to that effect.

18.8 No fee is applicable to students during the Break of Study period.

19. Discipline

19.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the Institution. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be students department, to enquire into acts of indiscipline.

19.2 If a student indulges in malpractice in any of the End semester examination / internal examination, he / she shall be liable for punitive action as prescribed by the Institution from time to time.

19.3 Ragging is not at all allowed. Punitive actions will be taken against the students involved in ragging as per the government norms.

20 Pro - Internship Scheme

Pro-Internship scheme is designed specifically for students with good academic credentials. It presents a unique opportunity for the students to complete the theory courses of the program in seven semesters. Pro - Internship allows students to take up the VIII semester theory courses in VI and VII semesters itself. Students can go for internship during the VIII semester and complete the VIII semester Project Work in well reputed Industries / organizations / R & D organizations / Premier Institutions, as part of their internship.

20.1 Internship Benefits to Students

During the Internship Students can apply their theoretical knowledge they have studied to practical problems in an engineering / technology environment. They will have the opportunity to screen career choices. It provides experience often required for future, full-time job searches. Experience through internship facilitates sound judgment,

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confidence, teamwork, self-discipline, and communication skills among the students. They have the possibility to establish contact with practicing professionals and to get full-time job offers at graduation. It provides an opportunity to earn while learning.

20.2 Eligibility

The guidelines presented below will be used to select the students for Pro-Internship

i. Students who are in the VI semester with a minimum CGPA of 7.5 up to V semester.
ii. Those who have completed all the courses up to V semester.
iii. However only students who complete all the courses up to VII semester will be allowed to proceed with the Internship cum Project.

20.3 Application to the Pro - Internship Scheme

Students eligible for Pro-Internship scheme should apply for the scheme to their HoD within 7 days from the date of publication of V semester results in the VI semester of their study.

20.4 Guidelines to be followed

a. Pro-Internship students should take at least one VIII semester theory course in VI semester. The rest of the VIII semester theory courses can be completed in VII semester.
b. The Pro-Internship option requires students to attend two evening classes of 4 period's duration per week for the VIII semester courses during their VI and VII semesters of their study. If required, students need to attend additional classes during holidays to meet the curriculum requirement.
c. Students will be permitted to start the internship only after the seventh semester end terminal examinations
d. Students doing the internship should attend the Project Reviews in the scheduled dates. After completion of the internship cum project, the final summative evaluation will be conducted with a view to assign the final score.

20.5 Terms and conditions for Internship

a. The Internship should be carried out at a single organization.
b. It should be completed within one semester.
c. All arrangements should be specified in the internship agreement.
d. During long leave period and closure of Industries / R&D organization/Premier Institutions for any reason, during the internship period, the students concerned should continue the work only in the college.

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e. Students should adhere to the rules and regulations of the college and Industries/ R&D organization / Premier Institutions during the Internship cum Project period.

20.6 Termination of the Internship

a. In the event of prolonged absence of student during the internship (or)

b. If the student has to discontinue the internship due to unforeseen circumstances during that period (or)

c. If the performance of the work done by the student in the Industries/ R&D organization/Premier Institutions is not satisfactory during the Project Review (or)

d. If the student violates the college rules and regulations during the Internship cum Project period,

Then the Internship cum Project will be terminated for these students, after due intimation to the company. In such a situation, the VIII Semester Project will be in jeopardy, i.e. these students have to repeat their VIII Semester project in the next academic year.

21 Revision of Regulations and Curriculum

The Institution may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations with the approval of Academic Council if found necessary.

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Kongunadu College of Engineering and Technology (Autonomous)

Affiliated to Anna University, Chennai

B.E. Mechanical Engineering

Regulations: R2024

Choice Based Credit System

I to VIII Semesters Curricula & Syllabi

Semester I

S. No	Course Code	Course Title	Course Category	No of Periods/Week L	T	P	Credits
1	24MC001	Induction Programme	MC	-	-	-	0
Theory							
2	24EN101	Communicative English	HSMC	3	0	0	3
3	24MA101	Matrices and Calculus	BSC	3	1	0	4
4	24PH101	Engineering Physics	BSC	3	0	2	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	4
6	24GE102	Engineering Graphics	ESC	3	0	2	4
7	24TA101	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1
Practicals							
8	24GE104L	Engineering Practices Laboratory	ESC	0	0	4	2
9	24EEC101L	Interpersonal Communication Laboratory	EEC	0	0	2	1
			Total	**16**	**1**	**12**	**23**

Semester II

S. No	Course Code	Course Title	Course Category	No of Periods/Week L	T	P	Credits
Theory							
1	24EN201	Technical English	HSMC	3	0	0	3
2	24MA203	Vector Calculus and Statistics	BSC	3	1	0	4
3	24MC002	Universal Human Values – 2 Understanding Harmony	MC	2	1	0	3
4	24CY201	Environmental Sciences	BSC	3	0	0	3
5	24GE101	Computer Fundamentals and C Programming	ESC	3	0	0	3
6	24CE201	Engineering Mechanics	PCC	3	1	0	4
7	24TA201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1
Practicals							
8	24GE103L	C Programming Laboratory	ESC	0	0	3	1.5
9	24ME201L	Computer Aided Drafting Laboratory	PCC	0	0	3	1.5
10	24EEC201L	Professional Communication Laboratory	EEC	0	0	2	1
			Total	**18**	**3**	**8**	**25**

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Semester III							
S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
				L	T	P	
Theory							
1	24MA303	Transforms and Partial Differential Equations	BSC	3	1	0	4
2	24ME301	Fluid Mechanics and Machinery	PCC	3	0	0	3
3	24ME302	Engineering Thermodynamics	PCC	3	1	0	4
4	24ME303	Manufacturing Process	PCC	3	0	0	3
5	24EE304	Electrical Machines and Drives	ESC	3	0	2	4
Practicals							
6	24ME304L	Fluid Mechanics and Machinery Laboratory	PCC	0	0	2	1
7	24ME305L	Manufacturing Process Laboratory	PCC	0	0	2	1
8	24EEC301L	Soft Skills Development	EEC	0	0	2	1
			Total	**15**	**2**	**8**	**21**

Semester IV							
S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
				L	T	P	
Theory							
1	24MA401	Numerical Methods	BSC	3	1	0	4
2	24ME401	Mechanics of Materials	PCC	3	1	0	4
3	24ME402	Engineering Materials and Metallurgy	PCC	3	0	0	3
4	24ME403	Kinematics of Machinery	PCC	3	0	0	3
5	24ME404	Conventional and Modern Machining Process	PCC	3	0	0	3
6	24MC003	Constitution of India	MC	2	0	0	0
Practicals							
7	24ME405L	Mechanics of Materials and Metallurgy Laboratory	PCC	0	0	2	1
8	24ME406L	Manufacturing Technology Laboratory	PCC	0	0	2	1
9	24EEC401L	Life Skills and Personality Development	EEC	0	0	2	1
			Total	**17**	**2**	**6**	**20**

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S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
Semester V							
				L	T	P	
Theory							
1	24ME501	Dynamics of Machines	PCC	3	0	0	3
2	24ME502	Design of Machine Elements	PCC	3	0	0	3
3	24ME503	Thermal Engineering	PCC	3	0	0	3
4	24ME504	Automobile Engineering	PCC	3	0	0	3
5	24ME505	CAD/CAM	PCC	3	0	2	4
6		Professional Elective - I	PEC	3	0	0	3
Practicals							
7	24ME506L	Dynamics Laboratory	PCC	0	0	2	1
8	24ME507L	Thermal Engineering Laboratory	PCC	0	0	2	1
9	24EEC501L	Professional Skills Development	EEC	0	0	2	1
			Total	**18**	**0**	**8**	**22**

S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
Semester VI							
				L	T	P	
Theory							
1	24ME601	Heat and Mass Transfer	PCC	3	0	0	3
2	24ME602	Design of Transmission Systems	PCC	3	0	0	3
3	24ME603	Finite Element Analysis	PCC	3	1	0	4
4	24ME604	Metrology and Measurements	PCC	3	0	2	4
5		Professional Elective - II	PEC	3	0	0	3
6		Open Elective - I	OEC	3	0	0	3
Practicals							
7	24ME605L	Heat Transfer Laboratory	PCC	0	0	2	1
8	24ME606L	Mini Project - I	EEC	0	0	2	1
9	24EEC601L	Employability Skills	EEC	0	0	2	1
			Total	**18**	**1**	**8**	**23**

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Semester VII							
S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
				L	T	P	
Theory							
1	24ME701	Mechatronics	PCC	3	0	0	3
2		Professional Elective - III	PEC	3	0	0	3
3		Professional Elective - IV	PEC	3	0	0	3
4		Professional Elective - V	PEC	3	0	0	3
5		Open Elective - II	OEC	3	0	0	3
Practicals							
6	24ME702L	Mechatronics Laboratory	PCC	0	0	2	1
7	24ME703L	Simulation and Analysis Laboratory	PCC	0	0	2	1
8	24ME704L	Mini Project - II	EEC	0	0	2	1
			Total	**15**	**0**	**6**	**18**

Semester VIII							
S. No	Course Code	Course Title	Course Category	No of Periods/Week			Credits
				L	T	P	
Theory							
1		Professional Elective - VI	PEC	3	0	0	3
2		Professional Elective - VII	PEC	3	0	0	3
Practical							
3	24ME801L	Project Work	EEC	0	0	20	10
				6	**0**	**20**	**16**

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6	Vertical 7	Vertical 8
Thermal Power Engineering	**Design Systems and Development**	**Advanced Manufacturing**	**Materials Engineering**	**Industrial Engineering**	**Robotics and Automation**	**Management and Administrations**	**Diversified Courses**
Refrigeration and Air Conditioning	New Product Development	Metal Additive Manufacturing	Composite Materials	Industrial safety	Automation in Manufacturing	AI in Human Resource Management	Equipment for Pollution Control
Gas Dynamics and Jet Propulsion	Product Design and Manufacturing	Applied Hydraulics and Pneumatics	Powder Metallurgy	Social Innovations in Industry 4.0	Production Planning and Control	Green Supply Chain Management	Hybrid and Electric Vehicle Technology
Energy Storage Devices	System Design for Sustainability	Product Life Cycle Management	Carbon Materials and Manufacturing	Labour Welfare and Industrial Relations	Robotics	Entrepreneurship	Vehicle Health Monitoring, Maintenance and Safety
Advanced IC Engines	Design Codes and Standards	Plant Layout and Material Handling	Bio Materials & Ceramics	Industrial Automation and Control	Automation in Production Systems and Management	Engineering Economics	Engineering Fracture Mechanics
Design of Heat Exchangers	Introduction to Aircraft Design	Rapid Manufacturing	Fundamentals of Nano Technology	Industrial Layout Design and Safety	Drone Technologies	Total Quality Management	Failure Analysis and Prevention
Solar Energy Engineering and Technology	Intelligent Mobility	Digital Manufacturing and IoT	Advanced Materials and Processes	Process Planning and Cost Estimation	Flexible Manufacturing Systems	Professional Ethics in Engineering	Bulk Material Transport and Handling Systems
Power Plant Engineering	Computational Fluid Dynamics	Mathematical Modelling of Manufacturing Processes	Micro Electro Mechanical Systems	Quality Control and Reliability Engineering	AI in Mechanical Systems	Project Management for Managers	Bioenergy Conversion Technologies
Sustainable Power Generation Systems	Pressure Vessels and Piping Design	Non Destructive Testing	Material Characterization	Applied Ergonomics	Maintenance Engineering	Principles of Management	Renewable Energy Technologies

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical 1: Thermal Power Engineering

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME101PE	Refrigeration and Air Conditioning	PEC	3	0	0	3
2.	24ME102PE	Gas Dynamics and Jet Propulsion	PEC	3	0	0	3
3.	24ME103PE	Energy Storage Devices	PEC	3	0	0	3
4.	24ME104PE	Advanced IC Engines	PEC	3	0	0	3
5.	24ME105PE	Design of Heat Exchangers	PEC	3	0	0	3
6.	24EE606PE	Solar Energy Engineering and Technology	PEC	3	0	0	3
7.	24ME106PE	Power Plant Engineering	PEC	3	0	0	3
8.	24ME107PE	Sustainable Power Generation Systems	PEC	3	0	0	3

Vertical 2: Design Systems and Development

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME201PE	New Product Development	PEC	3	0	0	3
2.	24ME202PE	Product Design and Manufacturing	PEC	3	0	0	3
3.	24ME203PE	System Design for Sustainability	PEC	3	0	0	3
4.	24ME204PE	Design Codes and Standards	PEC	3	0	0	3
5.	24ME205PE	Introduction to Aircraft Design	PEC	3	0	0	3
6.	24ME206PE	Intelligent Mobility	PEC	3	0	0	3
7.	24ME207PE	Computational Fluid Dynamics	PEC	3	0	0	3
8.	24ME208PE	Pressure Vessels and Piping Design	PEC	3	0	0	3

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VERTICAL 3: Advanced Manufacturing

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME301PE	Metal Additive Manufacturing	PEC	3	0	0	3
2.	24ME302PE	Applied Hydraulics and Pneumatics	PEC	3	0	0	3
3.	24ME303PE	Product Life Cycle Management	PEC	3	0	0	3
4.	24ME304PE	Plant Layout and Material Handling	PEC	3	0	0	3
5.	24ME305PE	Rapid Manufacturing	PEC	3	0	0	3
6.	24ME306PE	Digital Manufacturing and IoT	PEC	3	0	0	3
7.	24ME307PE	Mathematical Modelling of Manufacturing Processes	PEC	3	0	0	3
8.	24ME308PE	Non Destructive Testing	PEC	3	0	0	3

Vertical 4: Materials Engineering

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME401PE	Composite Materials	PEC	3	0	0	3
2.	24ME402PE	Powder Metallurgy	PEC	3	0	0	3
3.	24ME403PE	Carbon Materials and Manufacturing	PEC	3	0	0	3
4.	24ME404PE	Bio Materials & Ceramics	PEC	3	0	0	3
5.	24ME405PE	Fundamentals of Nano Technology	PEC	3	0	0	3
6.	24ME406PE	Advanced Materials and Processes	PEC	3	0	0	3
7.	24ME407PE	Micro Electro Mechanical Systems	PEC	3	0	0	3
8.	24ME408PE	Material Characterization	PEC	3	0	0	3

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Vertical 5: Industrial Engineering

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME501PE	Industrial safety	PEC	3	0	0	3
2.	24ME502PE	Social Innovations in Industry 4.0	PEC	3	0	0	3
3.	24ME503PE	Labour Welfare and Industrial Relations	PEC	3	0	0	3
4.	24ME504PE	Industrial Automation and Control	PEC	3	0	0	3
5.	24ME505PE	Industrial Layout Design and Safety	PEC	3	0	0	3
6.	24ME506PE	Process Planning and Cost Estimation	PEC	3	0	0	3
7.	24ME507PE	Quality Control and Reliability Engineering	PEC	3	0	0	3
8.	24ME508PE	Applied Ergonomics	PEC	3	0	0	3

Vertical 6: Robotics and Automation

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME601PE	Automation in Manufacturing	PEC	3	0	0	3
2.	24ME602PE	Production Planning and Control	PEC	3	0	0	3
3.	24ME603PE	Robotics	PEC	3	0	0	3
4.	24ME604PE	Automation in Production Systems and Management	PEC	3	0	0	3
5.	24ME605PE	Drone Technologies	PEC	3	0	0	3
6.	24ME606PE	Flexible Manufacturing Systems	PEC	3	0	0	3
7.	24ME607PE	AI in Mechanical Systems	PEC	3	0	0	3
8.	24ME608PE	Maintenance Engineering	PEC	3	0	0	3

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Vertical 7: Management and Administrations

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME701PE	AI in Human Resource Management	PEC	3	0	0	3
2.	24ME702PE	Green Supply Chain Management	PEC	3	0	0	3
3.	24ME703PE	Entrepreneurship	PEC	3	0	0	3
4.	24ME704PE	Engineering Economics	PEC	3	0	0	3
5.	24ME705PE	Total Quality Management	PEC	3	0	0	3
6.	24ME706PE	Professional Ethics in Engineering	PEC	3	0	0	3
7.	24ME707PE	Project Management for Managers	PEC	3	0	0	3
8.	24ME708PE	Principles of Management	PEC	3	0	0	3

Vertical 8: Diversified Courses

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1.	24ME801PE	Equipment for Pollution Control	PEC	3	0	0	3
2.	24ME802PE	Hybrid and Electric Vehicle Technology	PEC	3	0	0	3
3.	24ME803PE	Vehicle Health Monitoring, Maintenance and Safety	PEC	3	0	0	3
4.	24ME804PE	Engineering Fracture Mechanics	PEC	3	0	0	3
5.	24ME805PE	Failure Analysis and Prevention	PEC	3	0	0	3
6.	24ME806PE	Bulk Material Transport and Handling Systems	PEC	3	0	0	3
7.	24ME807PE	Bioenergy Conversion Technologies	PEC	3	0	0	3
8.	24EE702	Renewable Energy Technologies	PEC	3	0	0	3

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Open Elective Course (OEC)

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

Semester VI

Open Elective – I

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1	24BM101OE	Medical Instruments	OEC	3	0	0	3
2	24BM102OE	Food, Nutrition and Health	OEC	3	0	0	3
3	24CE101OE	Industrial Waste Management	OEC	3	0	0	3
4	24CE102OE	Ecological Engineering	OEC	3	0	0	3
5	24CS101OE	Python Programming for Data Science	OEC	3	0	0	3
6	24CS102OE	Programming and Data Structures	OEC	3	0	0	3
7	24EC101OE	Principles of Signal Processing	OEC	3	0	0	3
8	24EC102OE	Consumer Electronics	OEC	3	0	0	3
9	24EE101OE	Power Generation Systems	OEC	3	0	0	3
10	24EE102OE	Electrical Wiring and Lighting	OEC	3	0	0	3
11	24AD101OE	Introduction to Artificial Intelligence	OEC	3	0	0	3
12	24AD102OE	Introduction to Data Science	OEC	3	0	0	3
13	24AG101OE	Basics of Agriculture Engineering	OEC	3	0	0	3
14	24AG102OE	Farm Machinery	OEC	3	0	0	3
15	24IT101OE	Fundamentals of Software Engineering	OEC	3	0	0	3
16	24IT102OE	Wireless Sensor Networks	OEC	3	0	0	3

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Semester VII

Open Elective - II

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1	24BM201OE	Traditional Indian Foods	OEC	3	0	0	3
2	24BM202OE	Fundamentals of Cell and Molecular Biology	OEC	3	0	0	3
3	24CE201OE	Global Warming and Climate Change	OEC	3	0	0	3
4	24CE202OE	Building Services	OEC	3	0	0	3
5	24CS201OE	Fundamentals of Operating Systems	OEC	3	0	0	3
6	24CS202OE	Introduction to Database	OEC	3	0	0	3
7	24EC201OE	Basics of Virtual Instrumentation	OEC	3	0	0	3
8	24EC202OE	Telecommunication for Society	OEC	3	0	0	3
9	24EE201OE	Energy Audit and Management	OEC	3	0	0	3
10	24EE202OE	Electric Vehicles	OEC	3	0	0	3
11	24AD201OE	Basics of Visualization Tools	OEC	3	0	0	3
12	24AD202OE	Foundations of Machine Learning	OEC	3	0	0	3
13	24AG201OE	Introduction to Organic Farming	OEC	3	0	0	3
14	24AG202OE	Introduction to Green House Technology	OEC	3	0	0	3
15	24IT201OE	Introduction to Web Development	OEC	3	0	0	3
16	24IT202OE	Principles of Multimedia	OEC	3	0	0	3

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ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

- A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.
- For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.
- For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Vertical for Minor Degree
(In addition to all the verticals of other programmes)

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5
Fintech and Block Chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable Infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Elements of Public Administration	Data Mining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

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SUMMARY

S No	Course Category	Credits As Per Semester								Total Credit	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	4	4							8	4.76
2.	BSC	12	7	4	4					27	16.07
3.	ESC	6	4.5	4						14.5	8.63
4.	EEC	1	1	1	1	1	2	1	10	18	10.72
5.	PCC		5.5	12	15	18	15	5		70.5	41.96
6.	PEC					3	3	9	6	21	12.50
7.	OEC						3	3		6	3.57
8.	MC		3							3	1.79
Total		23	25	21	20	22	23	18	16	168	100

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24MC001 **INDUCTION PROGRAMME** **L T P C**

- - - 0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. " Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

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(iv) Literary Activity
Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules
This would address some lacunas that students might have, for example, English, computer familiarity etc.
(vi) Lectures by Eminent People
Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area
A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations
They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities
About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science. Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE

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24EN101 | **COMMUNICATIVE ENGLISH (Common to All Branches)** | **L T P C 3 0 0 3**

OBJECTIVES:

The students should be made to:

- Develop basic communication skills in English.
- Enhance the speaking skills for academic, professional and social purposes.
- Use of the electronic media such as internet and other online resources for their language development.
- Inculcate the habit of reading and writing for the purpose of effective communication
- Develop confidence in learners to communicate in English for all purposes

UNIT I BASICS OF COMMUNICATION 9

Listening: Basics of listening-Intensive and Extensive Listening, Barriers to Effective Listening; Speaking: Speaking about Future plans- Giving instruction to use the product, Reading: Skimming and Scanning, Writing: Writing about one's leisure time activities, hometown, everyday activities etc., Grammar: Parts of speech, Prepositions, Vocabulary: Word formation.

UNIT II CREATIVE COMMUNICATION 9

Listening: Listening to short lectures /talks, Speaking: Telephonic interview, Reading: Reading Editorial and Opinion Blogs, Writing: Biographical writing - Writing a paragraph (Cause and Effect/Compare and Contrast/Narrative/Analytical) - Grammar: Gerund and Infinitive - Present Tense, Vocabulary: Abbreviations & Acronyms.

UNIT III FUNCTIONAL COMMUNICATION 9

Listening: Listening to radio and TV and taking notes - Focused audio tracks, Speaking: Role Play - Group Interaction, Reading: Reading magazines, Writing: Letter (Informal /Formal – Industrial Visit, Internship, etc),Writing a set of instructions, Grammar: Past Tense -Subject - Verb Agreement, Vocabulary: Question Tags.

UNIT IV ANALYTICAL SKILLS 9

Listening: Listening to select talks by eminent personalities, speaking: Speaking in mock Interviews, Reading: Reading advertisements, Writing: Writing a set of recommendations, Interpreting Visual Materials (Line Graphs, Pie Charts etc.), Grammar: Sentence Pattern, Future Tense, Articles, Vocabulary: Single word substitutes.

UNIT V PROFESSIONAL COMMUNICATION 9

Listening: Understanding different Accents,Listening to TED talks, Speaking: Giving impromptu talks- Making presentations, Reading: Reading and comprehending a passage, Writing: Letter to the editor- Check list, Grammar: Direct and Indirect Speech, Vocabulary: Phrasal Verbs.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Use suitable vocabulary with confidence and express their ideas both in speech and writing.
- Write intelligibly avoiding grammatical errors, using a range of vocabulary, organizing their ideas logically on a topic.
- Speak confidently, with one or many listeners using appropriate communicative strategies.
- Read different genres of texts adopting various reading strategies.
- Understand different spoken discourses/excerpts in different accents.

TEXT BOOKS:

1. Kumar, Sanjay and Lata, Pushp, "Communication Skills", Oxford University Press. 2018.

REFERENCES:

1. DuttP. Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2007.
2. Mohan, Krishna and Banerji Meera, "Developing Communication Skills", Macmillan Publishers India Ltd., Delhi: 2009.
3. Martin Hewings "Advanced English Grammar: A self study reference and Practice book for advanced South Asian students" Cambridge University Press, Delhi: 2016.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	-	2	-	1	2	3	-	2
CO2	-	-	2	-	2	-	-	2	3	1	-
CO3	-	-	2	-	2	1	2	3	3	2	2
CO4	-	-	-	2	2	1	2	3	3	2	2
CO5	2	3	-	2	3	-	2	-	3	1	2

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24MA101 | **MATRICES AND CALCULUS** | **L T P C**
(Common to All Branches) | **3 1 0 4**

OBJECTIVES:

The students should be made to:

- Introduce the matrix techniques and to illustrate the nature of the matrix.
- Remember the basic concepts of solving algebraic and transcendental equations.
- Apply the formula for the curvature of a curve defined in Cartesian coordinates.
- Analyze the Partial differentiation, concept of total derivative, finding maxima and minima of function of two variables.
- Evaluate the techniques of integration in finding area and volume.

UNIT I MATRICES **9+3**

Eigenvalues and eigenvectors of a real matrix - Properties of eigenvalues and eigenvectors - Cayley-Hamilton theorem (Without proof) - Application of Cayley - Hamilton theorem (A^{-1},A^{n})- Nature of quadratic forms - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II SYSTEM OF LINEAR EQUATIONS **9+3**

Newton Raphson method- Bisection Method -Solution of linear system of equations by matrix method, Gauss-Jordan, Gauss- Jacobi and Gauss-Seidel methods- Eigen values of a matrix by Power method.

UNIT III DIFFERENTIAL CALCULUS **9+3**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normal.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial derivatives - Total derivative - Differentiation of implicit functions - Jacobians - Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT-V MULTIPLE INTEGRALS IN CARTESIAN COORDINATES **9+3**

Double integration- Change of order of integration- Area between two curves- Triple integration- Volume as triple integrals.

TOTAL: (45+15) PERIODS

OUTCOMES:

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

- Develop problem-solving skills using systems of equations and matrix transformations.
- Evaluate the efficiency of numerical methods based on the number of iterations required to achieve a desired level of accuracy.
- Compute the radius of curvature and interpret its significance for different types of curves.
- Expand a given function into a series and determine the maximum and minimum of multivariate functions.
- Apply the concepts of double and triple integrals in mathematical and real-world contexts.

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TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2018.

REFERENCES:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2018.
2. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 4th Edition, New Delhi, 2021.
3. Ramana B V "Higher Engineering Mathematics", New Delhi Tata McGraw- Hill Education India Private Limited., 2021
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" 7th Edition, Pearson Education India, 2017.

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	-	-	-	-	-	2
CO2	3	3	2	3	2	-	-	-	-	-	2
CO3	3	3	2	2	2	1	-	-	-	-	2
CO4	3	3	2	3	3	1	-	-	-	-	2
CO5	3	2	3	3	3	2	-	-	-	-	3

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24PH101	ENGINEERING PHYSICS (Common to All Branches)	L T P C 3 0 2 4

OBJECTIVES:

The students should be made to:

- Recall the mechanical properties of materials.
- Gain knowledge on electrical properties of materials.
- Understand the properties of magnetic and superconducting materials.
- Examine basic quantum mechanical concepts and their applications.
- Acquire the basic knowledge about nano phase materials and their properties.

UNIT I MECHANICAL PROPERTIES OF SOLIDS 9

Elasticity and Plasticity - stress-strain diagram and its uses - Hooke's law - factors affecting elastic modulus - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment – I shaped girders and its applications.

UNIT II ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory of metals - Electrical conductivity and thermal conductivity of metals - Wiedemann - Franz law - Failures of classical free electron theory - Success of Quantum free electron theory - Fermi distribution function and its variation with temperature - Density of energy states-carrier concentration of metals.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Classification of magnetic materials - Domain theory of ferromagnetism - Hysteresis - Soft and Hard magnetic materials - Superconducting materials – Meissner effect - Isotopic effect - BCS theory of superconductors - Type I & Type II superconductors - Applications of superconductors.

UNIT IV QUANTUM PHYSICS 9

Black body radiation - Planck's theory (derivation) - Deduction of Wien's displacement law and Rayleigh Jeans' Law from Planck's theory-de-Broglie wavelength - Properties of matter waves - Schrodinger's wave equations - Time independent and time dependent wave equations - Physical significance of wave function - Particle in a one dimensional potential box.

UNIT V NEW ENGINEERING MATERIALS 9

Metallic glasses - Types - Preparation - Properties and applications - Shape Memory Alloys (SMA) - Characteristics and applications - Advantages and disadvantages of shape memory alloys - Synthesis of nanomaterials - Top down approaches (Ball Milling) and Bottom up approaches (CVD and PVD).

TOTAL: 45 PERIODS

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LIST OF THE EXPERIMENTS – PHYSICS LABORATORY

1. Determination of Young's modulus of the material by Non-uniform bending method.
2. Determination of Rigidity modulus of the wire using Torsion Pendulum.
3. Determination of band gap energy of a semiconductor.
4. Determination of thickness of the thin film/wire by forming the fringe using Air wedge method.
5. Determination of velocity of ultrasonic waves in a liquid and compressibility of liquid using ultrasonic Interferometer.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Identify the mechanical properties of materials and their significance in engineering applications.
- Interpret the electrical properties of materials and their role in various technological applications.
- Illustrate the magnetic and superconducting properties of materials and their practical implications.
- Apply fundamental quantum mechanical concepts to understand material behavior at the atomic level.
- Explore the properties and applications of smart materials in modern engineering solutions.

TEXT BOOKS:

1. M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy "A Text book of Engineering Physics", S.Chand and Company Ltd, New Delhi, 11th Edition.2022.
2. Rajendran. V. "Materials Science", McGraw Hill Education (India) Private Limited, New Delhi, 2017.
3. S.O Pillai, "Solid State Physics" New Age International Publishers, New Delhi, 10th Edition, 2022.

REFERENCES:

1. R. K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai Publications, New Delhi, Reprint 2022.
2. Wahab. M.A, "Solid State Physics' Narosa Publishing House, New Delhi, 4th Edition. 2023.
3. D. Halliday, R. Resnick and J. Walker, Principles of Physics, Wiley (11th Edition), 2020.
4. Malik.K and Singh. A.K, "Engineering Physics" TMH, New Delhi 2nd Edition - 2020.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

PHYSICS LABORATORY

S.No.	Name of Equipment	Quantity Required
1	Torsional pendulum with accessories	6 Nos.
2	Non - Uniform bending with accessories	6 Nos.
3	Ultrasonic interferometer.	6 Nos.
4	Air wedge with accessories	6 Nos.
5	Band gap kit	6 Nos.

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Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	1	1	-	-	-	-	-	1
CO2	3	2	2	3	2	-	-	-	-	-	2
CO3	3	3	2	3	2	1	-	-	-	-	-
CO4	3	2	2	3	3	-	-	-	-	-	2
CO5	2	2	2	2	2	2	-	-	-	-	3

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24CY101 | ENGINEERING CHEMISTRY (Common to All Branches) | L T P C 3 0 2 4

OBJECTIVES:

The student should be made to:

- Gain knowledge on various sources of water and its industrial applications.
- Explore the essentials of electrochemistry, types of corrosion and its prevention.
- Examine the fundamentals of polymer, various engineering plastics and composites.
- Study the concept of Phase diagrams, different types of energy storage devices and emerging batteries.
- Assess the types of fuels and its quality estimation.

UNIT I WATER TECHNOLOGY 9

Sources of water - Hard and soft water - Boiler feed water-requirements - disadvantages of using hard water in boilers (Scale, Sludge, Caustic Embrittlement, Priming and Foaming) - Municipal water treatment (screening, sedimentation, coagulation, filtration and disinfection - ozonolysis, UV treatment, chlorination). Internal conditioning (Phosphate, Calgon, Colloidal and Carbonate conditioning methods) - External conditioning - Zeolite and demineralization process - desalination by reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION SCIENCE 9

Electrochemistry - Nernst equation & its Applications - Electrochemical (EMF) series - Corrosion - Types - Chemical and Electrochemical corrosions - Galvanic corrosion - Differential aeration corrosion - Pitting corrosion - Corrosion control - material selection and design - sacrificial anodic method and impressed current cathodic protection method - Organic coatings - Paint and its constituents.

UNIT III POLYMERS AND COMPOSITES 9

Introduction: Functionality - degree of polymerization. Classification of polymers (Source, Structure, Synthesis and Intermolecular forces) - Mechanism of free radical polymerization - Engineering Plastics: Polyamides, Polycarbonates and Polyurethanes.

Composites: Need, Composition of composites - Definition, examples and applications of Metal matrix composites (MMC), Ceramic matrix composites (CMC) and Polymer matrix composites (PMC)

UNIT IV PHASE RULE AND ENERGY STORAGE DEVICES 9

Phase Rule - Terms involved - One Component system (water system) - Two component system (Lead-Silver system) - Storage devices - types - primary battery (dry cell), secondary battery (lead acid, lithium-ion battery) - Emerging batteries - Aluminum air battery, batteries for automobiles and satellites - Fuel cells - Hydrogen - Oxygen fuel cell.

UNIT V FUELS AND COMBUSTION 9

Fuels – Introduction - Classification of fuels - coal - Analysis of coal (proximate and ultimate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method) - Petroleum - Manufacture of synthetic petrol (Bergius process) - Knocking - Anti knocking - Octane number - Cetane number - Gaseous fuels - LPG, CNG - Combustion: Calorific value - higher and lower calorific values - Theoretical calculation of calorific value - Flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

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LIST OF THE EXPERIMENTS - CHEMISTRY LABORATORY

1. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of Chloride content of water sample by Argentometric method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of Copper content by spectrophotometer.
6. Estimation of iron content of the given solution using potentiometer.
7. Conductometric titration of strong acid Vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Understand the various water treatment methodologies and its applications.
- Recognize corrosion protection techniques and appropriate mitigation strategies.
- Assess different types of polymers, composites and their industrial applications.
- Illustrate the concept of phase diagram, working principles of batteries, emerging energy storage technologies and their applications.
- Analyze the various fuels and their properties.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing, Company, New Delhi, 2015.
2. S. S. Dara, "A Text Book of Engineering Chemistry", S Chand & Co. Ltd., New Delhi, 2013.

REFERENCES:

1. Shika Agarwal, "Engineering Chemistry", Cambridge University Press, Delhi, 2016.
2. B. Sivashankar, "Engineering Chemistry", Tata Mc. Graw–Hill Publishing Company, Ltd., Delhi, 2012.
3. G Palanna, "Engineering Chemistry", Tata Mc. Graw Hill Education Private Limited, Delhi, 2017.
4. Prasanta Rath,"Engineering Chemistry", Cengage Learning India Pvt. Ltd., Delhi, 2018.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

CHEMISTRY LABORATORY

S.No.	Name of Equipment	Quantity Required
1	pH Meter	10 Nos.
2	Digital Conductivity Meter	10 Nos.
3	Digital Potentiometer	10 Nos.
4	Electronic Balance	5 Nos.
5	Deionizer unit	1 No.
6	Spectrophotometer	5 Nos.

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Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	2	3	2	-	-	-	-
CO2	3	2	-	-	2	3	2	-	-	-	-
CO3	3	-	2	2	3	2	-	-	-	-	-
CO4	3	2	1	-	3	2	-	-	-	-	2
CO5	3	3	1	-	2	3	2	-	-	-	2

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24GE102 **ENGINEERING GRAPHICS**

(Common to All Branches)

L	T	P	C
3	0	2	4

OBJECTIVES:

The student should be made to:

- Understand the various basic concepts like dimensioning, standards, curves and free hand sketching
- Develop the skills on projection of points, lines and plane surfaces
- Impart knowledge on projection of solids like prisms and pyramids
- Illustrate the section of solids and development of surfaces for various objects
- Acquire skills on viewing of solid objects in Isometric and Perspective projections

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **2**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and geometric dimensioning

UNIT I PLANE CURVES AND FREE HAND SKETCHING **9+6**

Curves used in engineering practices: Conics - Construction of ellipse, Parabola and hyperbola by eccentricity method - Construction of cycloid and involutes of square and circle- Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles - Representation of Three Dimensional objects - Layout of views – Free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **9+6**

Projection of points - Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true length and true inclination by rotating line method - Projection of planes inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **7+6**

Projection of simple solids like prisms, pyramids, cylinder, cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **9+6**

Sectioning of solids: prisms, pyramids, cylinder, cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids: prisms, pyramids, cylinder and cone.

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UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9+6

Principles of isometric projection - isometric scale - isometric projections of simple solids, truncated and frustum of solids: Prisms, pyramids, cylinder, cone - Perspective projection of simple solids: Prisms, pyramids and cylinder by visual ray method.

TOTAL: 75 (45+30) PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Relate the engineering knowledge on dimensioning, standards, curves and free hand sketching objects
- Identify the various views on the projection of points, straight lines and plane surfaces
- Apply the knowledge on projection of solids like prisms and pyramids
- Analyze the section of solids and development of surfaces
- Develop the isometric views and perspective projection of simple solids

TEXT BOOKS:

1. Natarajan K V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2023.
2. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2024.

REFERENCES:

1. Bhatt N D and Panchal V M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2023.
2. Basant Agarwal and Agarwal C M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2019.
3. Gopalakrishna K R., "Engineering Drawing" (Vol. I & II combined), Subhas Stores, Bangalore, 2017.

Special points applicable to End Semester Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use an appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	3	-	2
CO2	3	2	2	-	-	-	-	-	3	-	2
CO3	3	2	2	-	-	-	-	-	3	-	2
CO4	3	2	2	-	-	-	-	-	3	-	2
CO5	3	2	2	-	-	-	-	-	3	-	2

CHAIRMAN
(BoS / MECH)

24TA101	**HERITAGE OF TAMILS** **(Common to All Branches)**	**L T P C** **1 0 0 1**

OBJECTIVES:

The students should be made to:

- Learn the extensive literature of classical Tamil.
- Analyze rock art paintings to modern art.
- Understand folk and martial arts.
- Apply the concepts of Thinai in Tamils.
- Realize the contribution of Tamils in Indian freedom struggle.

UNIT I LANGUAGE AND LITERATURE **3**

Language Families in India - Dravidian Languages –Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART– SCULPTURE **3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS **3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS **3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE **3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India– Self-Respect Movement- Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

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OUTCOMES:

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

- Recognize the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Realization of Thinai concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self- esteem movement and siddha medicine.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	2	-	1
CO2	-	-	-	-	-	-	2	1	2	-	1
CO3	-	-	-	-	-	-	2	1	2	-	1
CO4	-	-	-	-	-	-	2	1	2	-	1
CO5	-	-	-	-	-	-	2	1	2	-	1

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24TA101 **தமிழர் மரபு** **L T P C**
(அனைத்து துறைகளுக்கும் பொதுவானது) **1 0 0 1**

நோக்கங்கள்:

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன:

- செம்மொழியான தமிழ் மொழியின் விரிவான இலக்கியத்தைப் பற்றி அறிதல்.
- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை உள்ள கலைகளை பகுப்பாய்வு செய்தல்.
- நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகளைப் புரிந்துகொள்ளுதல்.
- தமிழர்களின் திணைக் கோட்பாடுகளைச் செயல்படுத்துதல்.
- இந்திய விடுதலைப் போராட்டத்திற்கும் பண்பாட்டிற்கும் தமிழர்களின் பங்களிப்பை உணருதல்

அலகு 1 மொழி மற்றும் இலக்கியம் **3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் –சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம்-திருக்குறளில் மேலாண்மைக் கருத்துக்கள்- தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் -தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் -குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை , வீணை , யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள்

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போற்றிய அறக்கோட்பபாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் –சங்ககால நகரங்களும் துறை முகங்களும் -சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- தமிழ் மொழியின் செம்மொழி தன்மையையும் சங்க இலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்துகொள்வார்கள்.
- நாட்டுப்புறக் கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக் கோட்பாடுகளும் சங்ககால வர்த்தகமும் புரிந்துகொள்வார்கள்.
- இந்திய விடுதலைப் போராட்டம், சுயமரியாதை இயக்கம், சித்த மருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

உரை மற்றும் குறிப்பு புத்தகங்கள்:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
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5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)

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9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
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Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	2	-	1
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CO3	-	-	-	-	-	-	2	1	2	-	1
CO4	-	-	-	-	-	-	2	1	2	-	1
CO5	-	-	-	-	-	-	2	1	2	-	1

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24GE104L **ENGINEERING PRACTICES LABORATORY** **L T P C**

(Common to All Branches) **0 0 4 2**

OBJECTIVES:

The student should be made to:

- Acquire knowledge in calculation of area and volume of various 2D and 3D shapes and gain practical exposure in pipeline connections and carpentry
- Develop the fundamental skills in welding, machining, sheet metal and foundry works
- Illustrate the basic working principles of air conditioner, industrial robot and washing machine
- Learn the domestic, industrial wiring circuits and measure the electrical parameters
- Demonstrate the basic electronic components in PCB, assemble of smart phone, computer and LED TV

GROUP A (CIVIL & MECHANICAL)

I. CIVIL ENGINEERING PRACTICES **15**

Basic Measurements

1. Calculation of area and volume for various solid and hollow shapes, including cubical, spherical, cylindrical and conical models with different scale conversions.

Carpentry

2. Study of industrial trusses and joints in doors and windows using models.
3. Sawing and planing- Making joints: T-joint, Mortise joint, and Tenon joint.

Plumbing

4. Laying pipe connections for suction and delivery sides of the pumps and preparation of plumbing line sketches for water supply and sewage works.
5. Connecting various pipe fittings using different materials (metal, plastic, and flexible pipes) and other components which are commonly used in household appliances.

II. MECHANICAL ENGINEERING PRACTICES **15**

Welding:

a) Arc Welding
    i) Butt joint
    ii) Lap joint
b) Gas welding practice

Basic Machining:

a) Turning and Facing
b) Drilling and tapping

Sheet Metal work:

a) Making of a funnel
b) Making of a tray

Foundry work:

a) Making a mould using solid pattern
b) Making a mould using split pattern

Study Experiments

a) Study of components in Air conditioner
b) Study of components in Industrial robot
c) Study of components in Washing machine

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GROUP B (ELECTRICAL AND ELECTRONICS)

III. ELECTRICAL ENGINEERING 15

1. Residential house wiring using switches, fuse, indicator, circuit breaker, lamp and Energy meter
2. Stair case wiring
3. Industrial wiring using switches, fuse, indicator and Energy meter
4. Measurement of electrical quantities - voltage, current, power, power factor and energy in RLC circuit
5. Calculation of energy consumption for different lamps
6. Study of fan with regulator, Iron Box and Emergency Lamp

IV. ELECTRONICS ENGINEERING 15

1. Study and identification of electronic components -Resistors, Capacitors and Inductors
2. Assembling and testing electronic components in small PCB
3. Assembling and dismantling of Computer/Laptop
4. Assembling and dismantling of LED TV
5. Study of elements in smart phone

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Interpret engineering knowledge on calculation of area and volume of different geometric shapes, connecting various household fittings and making carpentry joints
- Apply engineering skills to do welding, machining, sheet metal and foundry works
- Gain knowledge on Air conditioner, Industrial robot and washing machine
- Understand the domestic, industrial wiring circuits and measure the various electrical parameters
- Analyze the basic components of electronic circuits, computer, laptop, smart phone and LED TV

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	2	2	-	2	-	-	2
CO2	3	2	2	-	2	2	-	2	-	-	2
CO3	3	2	1	-	2	2	-	2	-	-	2
CO4	3	2	1	-	2	2	-	2	-	-	2
CO5	3	2	2	-	2	2	-	2	-	-	2

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24GE104L ENGINEERING PRACTICES LABORATORY

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

GROUP A (CIVIL & MECHANICAL)

S. No	Name of Equipment	Quantity Required
	CIVIL ENGINEERING PRACTICES	
Basic Measurements		
1.	Sphere	03 Nos.
2.	Cylinder	03 Nos.
3.	Cone	03 Nos.
4.	Cube	03 Nos.
5.	Cuboid	03 Nos.
Carpentry		
6.	Industrial truss	03 Nos.
7.	Door Joint	03 Nos.
8.	Window Joint	03 Nos.
9.	Try Square	15 Nos.
10.	Hand Saw	15 Nos.
11.	Carpentry bench vice	15 Nos.
12.	Firmer Chisel	15 Nos.
13.	Motrin Chisel	15 Nos.
14.	Iron Jack	15 Nos.
15.	Mallet	15 Nos.
16.	Bench hold fastens (C Clamp)	15 Nos.
17.	Wood Cutting Machine	2 Nos.
18.	Planer machine	2 Nos.
19.	Hand drilling Machine	2 Nos.
20.	Jig Saw	2 Nos.
Plumbing		
21.	Pipe Vice	15 Nos.
22.	Die Holder with Die set	10 Nos.

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S. No	Name of Equipment	Quantity Required
MECHANICAL ENGINEERING PRACTICES		
Welding		
1.	Arc welding unit	5 Nos.
2.	Gas welding unit	2 Nos.
Basic Machining		
3.	Lathe Machines	3 Nos.
4.	Drilling Machines	2 Nos.
Sheet Metal work		
5.	Steel rule	5Nos.
6.	Bend snips	5 Nos.
7.	Straight snips	5 Nos.
8.	Scriber	5 Nos.
9.	Divider	5 Nos.
10.	Trammel	5 Nos.
11.	Prick Punches	5 Nos.
12.	Centre punches	5 Nos.
13.	Pliers	5 Nos.
14.	Ball peen hammer	5 Nos.
15.	Cross peen hammer	5 Nos.
16.	Bull wart hammer	5 Nos.
17.	Mallet	5 Nos.
18.	Anvil	3 Nos.
19.	Swage block	3 Nos.
20.	Wire gauges	2 Nos.
Foundry work		
21.	Cope and Drag Box	5 Nos.
22.	Solid pattern	5 Nos.
23.	Split pattern	5 Nos.
24.	Runner	5 Nos.
25.	Riser	5 Nos.
26.	Sprue pin	5 Nos.
27.	Sand rammer	5 Nos.
28.	Trowel	5 Nos.
Study Experiments		
29.	Air-conditioner unit	1 No.
30.	Industrial Robot	1 No.
31.	Washing Machine	1 No.

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24GE104L **ENGINEERING PRACTICES LABORATORY (GROUP – B)**

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
Part III: Electrical Engineering		
1.	Single phase house wiring setup	5
2.	Three phase house wiring setup	3
3.	Staircase wiring setup	3
4.	Fluorescent lamp and LED with wiring setup	Each 3
5.	Emergency lamp wiring setup	2
6.	Iron box wiring setup	2
7.	Fan with Regulator	2
8.	AC Voltmeter, Ammeter, Wattmeter and Energy Meter	Each 4
9.	R-Load	4
10.	Inductive and Capacitive Load	Each 1
Part IV: Electronics Engineering		
1.	Soldering Iron, Lead	10 Set
2.	Multi meter	10
3.	Continuity tester	10
4.	Used Laptop	3
5.	Used desktop computer	3
6.	Used LED TV	3
7.	Used Smart Phone	3
8.	DC Regulated power supply (0-30V)	2
9.	Resistors	200
10.	Capacitors	200
11.	Diodes	100
12.	Transistors	50

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BoS(EEE) 26/02/25

24EEC101L INTERPERSONAL COMMUNICATION LABORATORY **L T P C**
(Common to All Branches) **0 0 2 1**

OBJECTIVES:
The students should be made to:

- Improve the communicative competence of learners
- Help learners use language effectively in academic/work contexts
- Develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- Build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- Use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6
Listening for general information-specific details - conversation: Introduction to classmates (formal & informal); Telephone conversation; Speaking - Self Introduction-Introducing a friend; - politeness strategies - making polite requests, making polite offers, replying to polite requests and offers - understanding basic instructions (filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events- Talking about current and temporary situations & permanent and regular situations - describing experiences and feelings engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6
Listening - Listen to product and process descriptions, a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)- talking about precautions.

UNIT IV FUNCTIONAL COMMUNICATION 6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation.

UNIT V PROFESSIONAL SKILLS 6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic.

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Listen to and comprehend general as well as complex academic information.
- Listen to and understand different points of view in a discussion.
- Speak fluently and accurately in formal and informal communicative contexts.
- Describe products and processes and explain their uses and purposes clearly and accurately.
- Express their opinions effectively in both formal and informal discussions.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	3	-	2
CO2	-	-	-	-	-	-	2	2	3	-	2
CO3	-	-	2	-	3	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	3	2	2	3	-	-

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LIST OF EQUIPMENTS
Requirements for a batch of 30 students

Sl. No.	Description of Equipment/Software	Quantity required (Nos)
1	Computer	30
2	Headphones	30
3	**Software:** Globarena	30

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24EN201	TECHNICAL ENGLISH (Common to All Branches)	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- Improve understanding of commonly used English usage by cultivating listening skills through informal interactions.
- Enrich their speaking abilities through scenario-based conversations to understand how language functions in context.
- Develop their ability to read critically by analyzing newspaper articles.
- Use group discussion techniques to improve cooperative communication.
- Enhance your ability to write professionally by creating organized reports.

UNIT I CONVERSATION 9

Listening: Listening to informal conversations, Speaking: Short conversations in varied situations in student life, Reading: Reading Short text and longer passages for comprehension at deeper levels, Writing: Writing reviews (book / film), Grammar: Compound Nouns - Numerical Expression, Vocabulary: Cause and Effect Expressions.

UNIT II LANGUAGE IN USE 9

Listening: Listening to Situation based Dialogues, Speaking: Asking about Routine actions and giving directions, Reading: Reading a short story for appreciation and understanding, Writing: Writing Emails - Dialogue writing, Grammar: Purpose expressions - Adverbs, Vocabulary: Imperative sentences.

UNIT III ENGLISH FOR SPECIFIC PURPOSE 9

Listening: Listening strategies for deeper understanding, Speaking: Using dictionary for learning pronunciation, stress and syllable divisions, Reading: an article from Newspaper - Critical reading, Writing: Note-Making / Note-Taking - Essay writing, Grammar: Definition, Degrees of Comparison, Vocabulary: Model verbs.

UNIT IV ENGLISH FOR CAREER 9

Listening: Listening to the interviews of CEOs / entrepreneur, Speaking: Group Discussion skills, Reading: pre reading and post reading tasks, Writing - Job application - Cover letter & Resume, Grammar: Active and Passive voice, Relative Pronouns, Vocabulary: Synonyms and Antonyms.

UNIT V REPORT WRITING 9

Listening: Listening and making notes, Speaking: Discussion on problems and solutions (case studies), Reading: Reading abstracts / Journal Articles, Writing: Minutes of meeting, Reports (Feasibility / Accident / Survey Report), Grammar: If Clause, Vocabulary: Idioms and their Meanings.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Respond to informal conversations with effectiveness, exhibiting understanding.
- Appreciate and critically engage with short stories, articulating insights.
- Utilize dictionaries to comprehend syllable structures and pronounce words correctly.
- Engage in healthy group discussions by answering peers' questions and sharing ideas.
- Acquire constructive criticism in case study by describing issues.

TEXT BOOKS:

1. Bhatnagar, Nitin and Bhatnagar, Mamta, “Communicative English for Engineering and Professionals”, Pearson Education India, 2010.

REFERENCES:

1. Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press, Delhi, 2019.
2. Andrea J, Rutherford. “Basic Communication Skills for Technology”, Pearson Education, Inc., 2013.
3. Rizvi M, Ashraf. “Effective Technical Communication”, Tata McGraw Hill Education Pvt.Ltd., Delhi,2017.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	1	-	-	2	3	-	2
CO2	-	-	1	-	-	2	2	-	3	-	2
CO3	-	-	-	-	2	-	2	-	3	-	-
CO4	-	-	-	2	-	-	2	3	3	-	-
CO5	-	2	-	2	-	2	2	2	3	-	-

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24MA203	VECTOR CALCULUS AND STATISTICS (Common to Civil, Mech and AGE)	L T P C 3 1 0 4

OBJECTIVES:

The Student should be made to:

- Grasp the fundamental ideas of vectors, vector fields, and scalar fields.
- Identify the field of engineering in ODE as an effective tool for resolving practical issues.
- Interpret the geometric implications of analytic functions in terms of conformal mapping.
- Differentiate knowledge of hypothesis testing to small and large samples that play an important role in real-life problems.
- Analyze differences among group means, while controlling the Type I error rate.

UNIT I VECTOR CALCULUS **9+3**

Gradient of a Scalar point function - Divergence, Curl, Solenoidal and irrotational of a vector point function - Directional Derivative - Green's, Gauss divergence and Stoke's theorems (without proof)

UNIT II ORDINARY DIFFERENTIAL EQUATIONS **9+3**

Higher order linear differential equations with constant coefficients $(e^{ax}V, x^nV)$ - Method of variation of parameters - Cauchy's linear differential equations - Legendre's linear differential equations

UNIT III ANALYTIC FUNCTIONS **9+3**

Functions of a complex variable - Analytic functions: Necessary condition - Cauchy-Riemann equations and sufficient condition (statement only) Harmonic and orthogonal properties of analytic function - Construction of analytic functions by Milne's method - Conformal mapping $(w = z + k, 1/z, kz)$ - Bilinear transformation.

UNIT IV TESTING OF HYPOTHESIS **9+3**

Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Small sample tests based on t distributions for testing of means and F distributions for testing of variances - Chi-square - Contingency table (test for Independency) - Goodness of fit.

UNIT V ANALYSIS OF VARIANCE **9+3**

One way classifications - two way classifications - Completely randomized design -Randomized block design - Latin square design

TOTAL: (45+15) PERIODS

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BoS (S&H) 19/12/25

OUTCOMES:

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

- Understand the concepts of gradient, divergence, and curl in vector calculus.
- Apply suitable techniques for solving second and higher-order differential equations.
- Utilize conformal mapping and analytic functions to transform complex functions between different domains.
- Formulate the null and alternative hypotheses based on research questions and real-life scenarios.
- Classify the one-way and two-way ANOVA and interpret their applications in statistical analysis.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. Richard A. Johnson., "Probability and Statistics for Engineers", Pearson Education, 8th Edition, 2019.

REFERENCES:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th
2. Edition, New Delhi, 2018.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition New Delhi, 2013.
4. Devore. J.L.,"Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 8th Edition, 2021.
5. Spiegel Schiller "Probability and Statistics" Tata McGraw-Hill Publishing Company Limited, New Delhi. 3rd Edition, 2018.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	-	-	-	-	-	2
CO2	3	3	3	3	2	2	-	-	-	-	2
CO3	3	3	3	-	3	-	-	-	-	-	1
CO4	3	3	-	3	2	-	-	-	-	-	2
CO5	3	3	2	3	2	1	-	-	-	-	2

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24MC002 UNIVERSAL HUMAN VALUES 2 - UNDERSTANDING HARMONY **L T P C**
(Common to All Branches) **2 1 0 3**

OBJECTIVES:

The students should be made to:

- Demonstrate an understanding of ethical principles and human values
- Apply critical thinking to analyze ethical dilemmas and conflicts
- Communicate effectively about ethical issues and human values
- Appreciate the importance of harmony in personal, social, and environmental contexts
- Engage in practices that promote ethical behavior and societal harmony

UNIT 1 INTRODUCTION TO VALUE EDUCATION 6+3

Value Education – need and process, Self-Exploration – process, Basic Human Aspirations - Continuous Happiness and Prosperity, Basic requirement for fulfilment of Human Aspirants, Understanding Happiness and Prosperity – Continuity of Happiness from Physical Facility.

UNIT II HARMONY IN THE HUMAN BEING 6+3

Human being as a co-existence of the self and the Body - The needs of Self and Body, Body as an Instrument - The Self as the Seer- Doer-Enjoyer, Harmony in the self, Harmony of the Self with the Body –Programme for Self – regulation and health.

UNIT III HARMONY IN THE FAMILY AND SOCIETY 6+3

Family as the basic unit of human interaction , Understanding Relationship, Trust as the foundational value, Respect as the Right Evaluation, Harmony in the society – Understanding Human Goal, Harmony from Family Order to World Family Order – Universal Human Order - Scope.

UNIT IV HARMONY IN THE NATURE AND EXISTENCE 6+3

Nature - as Collections of Units, Classification of Units into Four Orders, Interconnectedness, and mutual fulfilment among the four orders of nature, self-regulation in Nature, Understanding Existence as Units in Space, Existence as Co-existence.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 6+3

Natural Acceptance of Human Values - Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Constitution, Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production System and Management Models – Typical case, Strategies for Transition towards value based life and profession.

TOTAL: (30+15) PERIODS

OUTCOMES:

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

- Understand the significance of value education and distinguish between values and skills
- Understand the concept of harmony within the self and how it relates to human values
- Analyze the role of family and society in fostering harmony
- Evaluate the relationship between human values and harmony in nature
- Develop skills to resolve conflicts and promote harmony in personal and professional life

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TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019.

REFERENCES:

1. Tripathi A N, "Human Values", New Age Intl. Publishers, New Delhi, 2009.
2. Govindarajan M, Natrajan S and Senthilkumar V S, "Engineering Ethics (Including HumanValues)" Eastern Economy, PHI, 12th Edition, 2011.
3. Govindarajan M and Natrajan S, "Professional Ethics and Human Values", PHI, 2011.
4. Banerjee B P, "Foundation of Ethics and Management", Excel Publication, 2005.
5. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co, Lucknow,Reprinted 2008.
6. Seebauer and Robert L Berry, "Fundamentals of Ethics for Scientist and Engineers", OxfordUniversity Press, 2000.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	-	-	-	3
CO2	-	-	-	-	-	3	3	-	-	-	3
CO3	-	-	-	-	-	3	3	-	2	-	3
CO4	-	-	-	-	-	3	3	-	2	-	3
CO5	-	-	-	-	-	3	3	-	2	-	3

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BoS (S&H)

24CY201 **ENVIRONMENTAL SCIENCES** **L T P C**
(Common to All Branches) **3 0 0 3**

OBJECTIVES:

The students should be made to:

- Understand the structure and function of different ecosystems and concepts of biodiversity.
- Recognize the causes and effects of environmental pollutants and disaster management.
- Explore the natural resources and their sustainability.
- Examine the principles of sustainable development and Green Chemistry.
- Analyze the impacts of population on environment and human health.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment - concept of an ecosystem - structure and function of an ecosystem - ecological succession - food chain - food web - structure and function of the (a) forest ecosystem (b) desert ecosystem (c) aquatic ecosystem - (pond and ocean) - Biodiversity: Hot spots of biodiversity - threats to biodiversity - values of biodiversity - endangered and endemic species - conservation of biodiversity: In-situ and ex-situ conservation methods.

UNIT II ENVIRONMENTAL POLLUTION AND NATURAL CALAMITIES 9

Definition - causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution (e) Nuclear hazards - solid waste and E-waste Management: role of an individual in prevention of pollution-disaster management: flood, earthquake, cyclone and landslides.

UNIT III NATURAL RESOURCES 9

Forest resources: deforestation, mining, dam and their effects on forest and tribal people - Water resources: Use and over - utilization of surface and ground water - dams-benefits and problems - Food resources: World food problems - effects of modern agriculture - fertilizer - pesticide problems, water logging, salinity - Energy resources: renewable energy sources - Solar energy, Tidal energy, Wind energy sources. Land resource: land degradation, Soil erosion and desertification - role of an individual in conservation of natural resources.

UNIT IV SOCIAL ISSUES AND SUSTAINABILITY 9

Water conservation - rain water harvesting- resettlement and rehabilitation of people; its problems and concerns - environmental ethics - acid rain, ozone layer depletion - waste land reclamation - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act – Forest conservation act. Sustainable development-Green Chemistry: Principles of green chemistry - Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transportation.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - value education - HIV / AIDS - threatening of communicable diseases for human population and its prevention - women and child welfare - role of information technology in environment and human health.

TOTAL: 45 PERIODS

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BoS (S&H) 19/02/25

OUTCOMES:

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

- Articulate the significance of ecosystems and biodiversity.
- Evaluate the preventive measures of pollution and calamities.
- Identify the strategies for the conservation of natural resources.
- Retrieve the measures of green chemistry to real-world scenarios.
- Evaluate the issues of overpopulation and communicable diseases on the environment.

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, Delhi, 2nd Edition, 2018.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 3rd Edition, 2016.

REFERENCES:

1. G. Tyler Miller, St. Andrews Preshyterian, "Introduction to Environmental Science", Cengage Learning India Pvt., Ltd., 2010.
2. Dharmendra S. Sengar, "Environmental Law", Prentice hall of India Pvt. Ltd, Delhi, 2007.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	3	2	-	-	-	-
CO2	2	2	-	-	-	3	3	-	-	-	-
CO3	-	1	3	-	2	3	-	-	-	-	-
CO4	2	-	3	-	3	-	3	-	-	-	-
CO5	1	2	-	-	-	2	-	-	2	-	-

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BoS (S&H) 19/02/25

24GE101 COMPUTER FUNDAMENTALS AND C PROGRAMMING

(Common to All Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn the fundamentals of Computer and Programming.
- Understand the basics of C programming and decision making statements.
- Learn how to construct programs using array and pointer.
- Understand the concept of string and function.
- Study the concept of structure, union and files.

UNIT I FUNDAMENTALS OF COMPUTER AND PROGRAMMING 9

Computer System - Components of Computer Hardware - Data Representation - Number System and Conversion - Program Development Life Cycle - Algorithm - Control Structures - Flowchart – Pseudo code - Programming Paradigms.

UNIT II BASICS OF C PROGRAMMING 9

Overview of C - C Character Set - Identifiers and Keywords - Variable Declaration - Data types - Type Qualifiers and Type Modifiers - Structure of a C Program - Executing a C Program - Operators and Expressions - Decision-Making and Looping Statements.

UNIT III ARRAYS AND POINTERS 9

Introduction to Arrays - Types of Array - Pointers - void Pointer - Null Pointer - Arrays of Pointers - Pointer to a Pointer - Pointer to an Array - Pointer Arithmetic.

UNIT IV STRINGS AND FUNCTIONS 9

Strings - Reading String Input - String Library Functions - Command Line Arguments - Functions: Types - Declaration - Definition - Function Call - Pass by Value - Pass by Reference - Passing arrays to functions - Recursion.

UNIT V STRUCTURE, UNION AND FILES 9

Structures - Pointers to Structures - Array of Structures - Structures within a Structure - Functions and Structures - Unions - Storage Classes - Files: Streams - File type - File operations.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals of computer and programming.
- Choose appropriate data types, variables and statements for solving simple problems.
- Construct programs using arrays and pointers for a given scenario.
- Build programs using strings and functions in C language.
- Develop programs using structure, union and files for a given scenario.

TEXT BOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Pearson India Education Services Pvt. Ltd., 2016.

REFERENCES:

1. Ajay Mital, "Programming in C - A Practical Approach", Pearson Education, 2015.
2. Dromey R G, "How to Solve it by Computer", Pearson Education, Fifteenth Impression, 2014.
3. Herbert Schildt, "C - The Complete Reference", Tata McGraw-Hill, 2013.
4. Ashok N Kamthane, "Computer Programming", Pearson Education, Second Edition, 2012.
5. Juneja B L and Anita Seth, "Programming in C", Cengage Learning India Pvt. Ltd., 2011.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	2	2	-
CO3	3	2	2	2	-	-	-	-	2	2	1
CO4	3	2	2	2	2	-	-	-	2	2	1
CO5	3	2	2	2	2	-	-	-	2	2	1

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BoS (IT) 27/11

24CE201 **ENGINEERING MECHANICS** **L T P C**

(Common to Civil and Mech) **3 1 0 4**

OBJECTIVES:

The Students should be made to:

- Understand the basic concepts of statics of particles, forces and moments.
- Evaluate the various forces involved in rigid bodies.
- Solve problems related to first and second moment of area of different sections.
- Develop knowledge to analyze the various frictional forces.
- Analyze different types of dynamics and kinematics motion in particles.

UNIT I STATICS OF PARTICLES 12 (9+3)

Introduction - Units and dimensions - Laws of mechanics - Lami's theorem, Parallelogram and triangular law of forces - Vectorial representation of forces and moments - Coplanar forces - Resolution and composition of forces -Free body diagram - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility.

UNIT II STATICS OF RIGID BODIES 12 (9+3)

Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem -Types of supports and their reactions - Moments and couples - Equilibrium of rigid bodies in two dimensions.

UNIT III PROPERTIES OF SURFACES AND MASS 12 (9+3)

First moment of area, centroid of sections –Simple, Compound sections and Hollow sections- Second moment of plane areas – Simple, compound sections and Hollow sections - Parallel axis theorem and perpendicular axis theorem – Polar moment of Inertia – Product of Inertia – Introduction to mass moment of inertia of plane area.

UNIT IV KINETICS AND KINEMATICS 12 (9+3)

Frictional force - Laws of coulomb friction –Sliding friction - Static and Kinetic friction - Belt friction - Ladder friction- Wedge friction-Rolling resistance- Displacement, velocity and relative motion.

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UNIT V DYNAMICS OF PARTICLES & KINEMATICS OF RIGID BODIES **12 (9+3)**

Rectilinear motion - Curvilinear motion - Newton's law- D'Alembert's Principle - Work energy equation of particles - Impulse and momentum –Impact of elastic bodies -Translation and rotation of rigid Bodies - General plane motion of simple rigid bodies such as cylinder and sphere.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to:

- Illustrate vectorial representation of forces and moments.
- Evaluate statics of rigid bodies in equilibrium.
- Analyze various properties of surfaces and masses.
- Determine various frictional forces applying laws of friction.
- Solve dynamic forces, kinematics of rigid bodies and its effects.

TEXT BOOKS:

1. Kottiswaran N, "Engineering Mechanics – Statics & Dynamics", Sri Balaji Publications11th Edition, 2017
2. Palanichamy, M.S., Nagan S., "Engineering Mechanics - Statics & Dynamics", Tata McGraw- Hill, 3rd Edition, 2006.

REFERENCE BOOKS:

1. Parthasarathi NS and Vela Murali, "Engineering Mechanics", Oxford University Press, 2016.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics - Statics and Dynamics", 4th Edition, Pearson Education,2006.
3. Meriam J.L. and Kraige L.G., "Engineering Mechanics" - Statics-Volume 1, Dynamics-Volume Third Edition, John Wiley & Sons, 9th Edition, 2018.
4. Beer, Jhonston, Cornwell and Sanghi, "Vector mechanics for engineers: statics and dynamics", Twelfth Edition, McGraw Hill Education,2019.

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BoS(Civil)

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	-	-	-	-	-	-	2
CO2	3	3	3	3	-	-	-	-	-	-	2
CO3	3	3	3	3	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	-	-	-	-	-	-	2

CHAIRMAN
BoS(Civil) 22/02/25

24TA201 **TAMILS AND TECHNOLOGY** **L T P C**
(Common to All Branches) **1 0 0 1**

OBJECTIVES:

Students should be made to:

- Gain knowledge about weaving and ceramic Technology
- Creating a design and construction Technology
- Analyzing manufacturing Technology
- Applying agriculture and irrigation Technology
- Remembering scientific and scientific Tamil and Tamil computing

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo -Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing Knowledge of Sea - Fisheries– Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

OUTCOMES:

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

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.

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BoS (S&H) 19/02/25

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை– (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	-	-	1
CO2	-	-	-	-	-	-	2	1	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	1
CO4	-	-	-	-	-	-	2	1	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	1

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24TA201 **தமிழரும் தொழில்நுட்பமும்** **L T P C**

(அனைத்து துறைகளுக்கும் பொதுவானது) **1 0 0 1**

நோக்கம்:

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன:

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில் நுட்பத்தை பகுப்பாய்வு செய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில் நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல் மற்றும் அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை நினைவில் கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பானை தொழில் நுட்பம் **3**

சங்க காலத்தில் நெசவுத்தொழில் - பானை தொழில் நுட்பம் - கருப்பு, சிவப்பு பாண்டங்கள் - பாண்டுகளில் கீறல் குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **3**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் &சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலதது பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் நாயக்கர் கால கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.

அலகு 3 உற்பத்தித் தொழில்நுட்பம் **3**

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடிகள் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்பு துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம் **3**

அணை, குளங்கள், மதகு - சோழர்கால குமுளி தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்து குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

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அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ் **3**

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- பீங்கான் மற்றும் நெசவு தொழில்நுட்பத்தைப் புரிந்து கொள்ளுதல்.
- புதிய வடிவமைப்பு மற்றும் கட்டுமான தொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தித் தொழில் நுட்பத்தை அடையாளம் காணுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத்தைப் புரிந்து கொள்ளுதல்.
- அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை பெறுதல்.

உரை மற்றும் குறிப்பு புத்தகங்கள்:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை– (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	-	-	1
CO2	-	-	-	-	-	-	2	1	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	1
CO4	-	-	-	-	-	-	2	1	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	1

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24GE103L

C PROGRAMMING LABORATORY
(Common to All Branches)

L	T	P	C
0	0	3	1.5

OBJECTIVES:

The Student should be made to:

- Learn how to develop C programs using conditional and looping statements
- Understand the concept of functions, arrays and strings
- Learn how to access memory using pointers
- Group different kinds of data related to a single entity
- Understand the manipulation of data in permanent storage

LIST OF EXPERIMENTS:

1. Programs using decision making statements.
2. Programs using looping statements.
3. Programs using user defined functions and recursive functions.
4. Programs using one dimensional and two dimensional arrays.
5. Solving problems using string functions.
6. Programs using pointers and dynamic memory allocation.
7. Programs using structures and unions.
8. Programs using pointers to structures and other data types.
9. Programs using text files.
10. Programs using binary files.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Implement C programs using control statements.
- Write C programs using functions, arrays and strings.
- Write C programs to access data in memory using pointers.
- Develop C programs using structures and other user defined data structures to manipulate heterogeneous data.
- Build C programs to manipulate data stored on permanent storage.

List of Equipment for a Batch of 30 Students:

- Standalone desktops with C compiler or Server with C compiler for 30 Nos.

Mapping of COs with POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	-	-	-	2	3	-	-
CO2	3	2	3	2	-	-	-	2	3	-	-
CO3	3	2	3	2	-	-	-	2	3	-	2
CO4	3	2	3	2	2	-	-	2	3	-	2
CO5	3	2	3	2	2	-	-	2	3	-	2

N. Pranfon

CHAIRMAN
BoS (IT) 27/11

24ME201L **COMPUTER AIDED DRAFTING LABORATORY**

L	T	P	C
0	0	3	1.5

OBJECTIVES:

The student should be made to:

- Acquire knowledge in engineering drawings, Standard practices with fits and tolerances
- Study the terminologies in two dimensional drawings
- Learn the importance of projection symbols and usage of title blocks
- Gain knowledge in creation of various curves and solids
- Prepare the standard layout for various machine components with Bill of Materials

DRAWING STANDARDS **3**

Code of practice for Engineering Drawing, computational dimensioning & tolerancing, paper sizes & fits, Preparation of production drawings and reading of part drawings.

2-D DRAFTING **3**

Basic Terminologies-Drawing, Editing, Dimensioning, Line, Curves and Splines, Layering, Hatching, Mirroring, Text and types, Block, Array, Coordinate systems (absolute, relative, polar, etc.), types of sectioning

CAD PRACTICE **39**

1. Drawing of a Title Block with necessary text and projection symbol.
2. Drawing of curves like parabola, ellipse, spiral, involute using B-spline or cubic spline.
3. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, and dimensioning.
4. Creation of the Sectional view of assembly for the following:

   Joints: Universal, Knuckle, Gib & Cotter

   Bearing: Bushed Bearing

   Coupling: Muff, Flange

   Engine parts: Piston, Connecting Rod

   Machine Components: Machine Vice, Plummer Block.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Infer engineering knowledge in creation of drawing with Standards
- Select the basic tooling commands of two dimensional drawings
- Create the title block with text and projection symbol
- Construct the various curves and solids in two dimensional drafting
- Develop the sectional views of various machine components with engineering knowledge

REFERENCES :

1. Bhatt N D and Panchal V M., "Machine Drawing", Charator Publishers, 51st Edition, 2022.
2. Sidheswar N, Kannaiah P and Sastry .V.V.S., "Machine Drawing", McGraw Hill Education, 2017.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	3	3	-	3	-	-	2	3	2
CO2	3	2	2	-	3	3	-	2	-	-	2	3	2
CO3	3	2	2	-	3	3	-	-	-	-	2	3	2
CO4	3	2	1	-	3	3	-	2	-	-	2	3	2
CO5	3	2	2	-	3	3	-	2	-	-	2	3	3

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(BoS / MECH)

24ME201L COMPUTER AIDED DRAFTING LABORATORY

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1	Computer System with necessary accessories	30 Nos.
2	Licensed software (AUTOCAD) for Drafting	30 License
3	Printer	1 No.

31/05

CHAIRMAN
(BoS / MECH)

24EEC201L PROFESSIONAL COMMUNICATION LABORATORY **L T P C**
(Common to All Branches) **0 0 2 1**

OBJECTIVES:
The students should be made to:

- Establish effective time management techniques and professional grooming routines.
- Make progress on their own presentations by utilizing visual aids and interacting with the audience.
- Obtain the ability to participate in group conversations effectively and comprehend group dynamics.
- Recognize the protocol required for different types of interviews.
- Develop strategies for stress management, time management, and professional networking.

UNIT I SOFT SKILLS DEVELOPMENT **6**
Introduction to Soft Skills - Hard skills & soft skills - Employability and Career Skills - Grooming as a professional with values - Time Management - General awareness of Current Affairs.

UNIT II DEVELOPING SELF ESTEEM **6**
Self-Introduction-organizing the material - Introducing oneself to the audience - introducing the topic - answering questions - individual presentation practice - presenting the visuals effectively - Five minutes presentation

UNIT III PROFESSIONAL SKILLS **6**
Introduction to Group Discussion - Participating in group discussions - understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies - activities to improve GD skills

UNIT IV COMMUNICATION ETIQUETTES **6**
Interview etiquette - dress code - body language - attending job interviews - telephonic interview - one to one interview & panel interview - FAQs related to job interviews

UNIT V MANAGEMENT SKILLS **6**
Recognizing the differences between groups and teams - managing time - managing stress-networking professionally- respecting social protocols - understanding career management-developing a long- term career plan-making career changes.

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion of the course, the students will be able to,

- Develop employability skills such as communication, teamwork, adaptability, and problem-solving.
- Enhance confidence and competence in answering questions effectively during presentations and discussions.
- Apply group discussion techniques and real-world exercises to improve debating abilities.
- Prepare for various job interviews, including panel, one-on-one, and telephone interviews.
- Formulate a comprehensive career plan, focusing on networking and career progression.

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Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	3	2	-	3
CO3	-	-	-	-	-	-	-	2	3	-	3
CO4	-	-	-	-	-	-	-	3	3	-	3
CO5	-	-	-	-	-	-	-	3	2	-	2

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LIST OF EQUIPMENTS
Requirements for a batch of 30 students

Sl. No.	Description of Equipment/Software	Quantity required (Nos)
1	Computer	30
2	Headphones	30
3	**Software:** Globarena	30

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24MA303 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS **L T P C**
(Common to BME, CIVIL, EEE, ECE and MECH) **3 1 0 4**

OBJECTIVES:
The Student should be made to:

- Understand the basic concepts of PDE for solving standard partial differential equations
- Remember the concepts of fourier series for solving problems in engineering disciplines
- Applying the standard techniques for solving boundary value problem
- Analyze Fourier transform techniques used in wide variety of situations
- Evaluate the Z transform techniques for discrete time systems

UNIT I PARTIAL DIFFERENTIAL EQUATIONS **9+3**
Formation of partial differential equations(single functions only) - Singular integrals -Solutions of standard types of first order partial differential equations(four types) - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients of homogeneous Equations.

UNIT II FOURIER SERIES **9+3**
Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Complex form of Fourier series - Parseval's identity - Harmonic analysis.

UNIT III FOURIER TRANSFORMS **9+3**
Fourier transform pair - Fourier sine and cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9+3**
Classification of PDE - Method of separation of variables - Fourier Series Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**
Z-transforms - Elementary properties - Inverse Z-transform - Partial fraction - Convolution theorem (Statement and Examples) - Initial and final value theorems - Formation of difference equations - Solution of difference equations using Z-transform.

TOTAL: (45+15) PERIODS

OUTCOMES:
On successful completion of the course, the students will be able to,

- Understand suitable concepts in solving first order and second order partial differential equations with constant coefficients
- Identify the Fourier series for standard periodic waveforms
- Apply the solutions of wave and heat equations using Fourier series
- Analyze the properties and techniques of Fourier transforms
- Evaluate the necessary Z transform techniques to solve the difference equations

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TEXT BOOKS:

1. Veerarajan T., "Transforms and Partial Differential Equations", 3rd Edition, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
2. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2017.

REFERENCES:

1. Bali N.P and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd., 9th Edition, 2016.
2. Ramana B V, "Higher Engineering Mathematics", New Delhi Tata McGraw- Hill Education India Private Limited., 2018.
3. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2011.
4. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2011.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	-	2	-	2	-	-	2
CO2	3	2	2	-	-	2	-	2	-	-	2
CO3	3	3	3	2	-	2	-	2	-	-	2
CO4	3	2	2	-	-	1	-	2	-	-	2
CO5	3	2	3	2	-	1	-	2	-	-	2

CHAIRMAN
BoS (S&H) 14/10

24ME301 **FLUID MECHANICS AND MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the properties of the fluids and flow characteristics.
- Determine the losses in a flow system, flow through pipes and boundary layer flow.
- Formulate and analyse problems related to dimensional analysis.
- Analyze the principles and working of hydraulic turbines.
- Gain the knowledge of centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Definition of Fluid - Properties of fluids – Fluid Statics - Simple Manometer - Flow characteristics - Concept of control volume - Applications of Continuity equation and Energy equation - venturi meter and orifice meter.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9

Reynold's Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of Boundary layer thickness

UNIT III DIMENSIONAL ANALYSIS 9

Fundamental dimensions - Dimensional homogeneity - Methods used for dimensional analysis: Rayleigh's method and Buckingham Pi theorem - Dimensionless parameters: Reynold`s number - Froude number – Euler number – Weber number- Cauchy number- Mach number- Newton number.

UNIT IV TURBINES 9

Hydraulic Turbines: Classifications – Working principles - Pelton Wheel Turbine - Francis Turbine - Kaplan Turbine – Work Done and Efficiencies – Draft tubes – Specific Speed - Performance curves for turbines.

UNIT V PUMPS 9

Pumps: Definition - Classification of pumps - Centrifugal pumps - Working principle - Heads and Efficiencies - Velocity triangles – Work done by the impeller- Performance curves.

Reciprocating pump: Classification - Working Principle - Indicator diagram and its variations – work saved by fitting air vessels.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Determine the fluid properties and flow characteristics in engineering problems.
- Analyze the friction losses and understand the boundary layer problems on the flat solid surface.
- Apply dimensional analysis to predict physical parameters that influence the flow of various problems.
- Examine the work done and efficiencies of various hydraulic turbines.
- Predict the performance characteristics of centrifugal and reciprocating pumps.

TEXT BOOKS:

1. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 11th Edition, Laxmi Publications, New Delhi, 2024
2. Jain A. K. "Fluid Mechanics including Hydraulic Machines", Khanna Publishers, New Delhi, 2014.

REFERENCES:

1. Subramanya K., "Fluid Mechanics and Hydraulic Machines", 2nd Edition, Mc Graw Hill Education, Chennai, 2021.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 22nd edition, 2019
3. Sukumar Pati. "Fluid Mechanics and Hydraulic Machines". 1st Edition, Mc Graw Hill Education, Chennai, Reprint, 2018.
4. Kumar, K. L., "Engineering Fluid Mechanics", S Chand, Eurasia Publishing House (P) Ltd, New Delhi, 7th Edition, 2020.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	2	3	3
CO2	3	3	2	2	2	2	-	-	-	-	2	2	3
CO3	3	3	2	2	2	-	-	-	-	-	-	2	2
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3
CO5	3	3	2	2	3	2	-	-	-	-	2	3	3

CHAIRMAN
(BoS / MECH)

24ME302 **ENGINEERING THERMODYNAMICS**

L	T	P	C
3	1	0	4

OBJECTIVES:

The student should be made to:

- Understand the basics and application of first law of thermodynamics
- Know second law of thermodynamics in analyzing the performance of thermal devices
- Recognize the significance of availability and applications of second law of thermodynamics
- Explore the various properties of steam through steam tables and Mollier chart
- Acquire knowledge on the macroscopic properties of ideal and real gases

(Use of Standard and approved Steam Table, Mollier Chart and Compressibility Chart permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW **9+3**

Basic concepts - concept of continuum - comparison of microscopic and macroscopic approach - Point and path functions - Intensive and extensive properties - total and specific quantities - System and their types - Thermodynamic Equilibrium State – path and process - Quasi-static - reversible and irreversible processes - Heat and work transfer – definition and comparison - sign convention - Displacement work and other modes of work - P-V diagram - Zeroth law of thermodynamics – concept of temperature and thermal equilibrium – concept of temperature scales - First law of thermodynamics – application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND ENTROPY PRINCIPLES **9+3**

Kelvin-Planck and Clausius statements - heat engine and heat pump – reversibility - Carnot cycle – theorem – performance - Clausius theorem - Concept of entropy - T-s diagram - entropy change for a pure substance.

UNIT III AVAILABILITY AND APPLICATIONS OF SECOND LAW **9+3**

Ideal gases undergoing different processes - principle of increase in entropy - Applications of Second Law - High and low-grade energy - Availability and Irreversibility for open and closed system processes - First and Second law Efficiency.

UNIT IV PROPERTIES OF PURE SUBSTANCES **9+3**

Thermodynamic properties in solid – liquid and vapour phases - phase rule - p-v, p-T, T-v, T-s, h-s diagrams - pvT surfaces. Steam - formation and its thermodynamic properties - Calculations of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT V GAS MIXTURES AND THERMODYNAMIC RELATIONS **9+3**

Properties of ideal gas – real gas – comparison - Equations of state for ideal and real gases - Vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states - Generalized Compressibility Chart - Maxwell relations - TdS Equations - heat capacities relations - Energy equation - Joule Thomson experiment - Clausius-Clapeyron equation.

TOTAL: 60 (45+15) PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply the problem analyzing techniques in thermodynamic processes
- Acquire knowledge to assess second law of thermodynamics and entropy principles
- Solve problems on availability and applications of second law of thermodynamics
- Analyze the properties of pure substance and develop solutions for various properties of steam
- Examine gas mixtures and thermodynamic relations to investigate the property changes

TEXT BOOKS:

1. Nag P K, "Engineering Thermodynamics", Tata McGraw Hill Publishing Company. New Delhi, 6th Edition, 2017.
2. Cengel Y and Boles M, "Thermodynamics - An Engineering Approach", Tata McGraw Hill Publishing Company, New Delhi, 9th Edition, 2019.

REFERENCES:

1. Natarajan E, "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, Chennai, 2nd Edition, 2014.
2. Chattopadhyay P, "Engineering Thermodynamics", Oxford University Press, 2nd Edition, 2016.
3. Arora C P, "Thermodynamics", McGraw Hill Education, 2017.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	2	2
CO3	3	3	3	3	-	-	-	-	-	-	1	3	2
CO4	3	3	3	1	-	1	-	-	-	-	1	3	2
CO5	3	3	3	3	-	1	-	-	-	-	1	3	2

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(BoS / MECH)

24ME303 **MANUFACTURING PROCESS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the principles and concepts of various metal casting processes
- Illustrate the working principles of metal joining processes.
- Know the principles of metal deformation and forming processes.
- Study the concepts on forming of sheet metals and plastic components.
- Learn about the metal cutting process and their operations.

UNIT I METAL CASTING PROCESSES **9**

Sand Casting – Sand Moulds – Type of patterns – Pattern materials – Pattern allowances – Moulding sand – properties– Core making – Moulding machines – Melting furnaces: Blast, Cupola and Induction Furnaces – Principle of special casting processes – Shell, investment casting, Ceramic mould, Pressure die casting, Centrifugal casting, CO_2 process –Defects in Sand casting process-remedies.

UNIT II METAL JOINING PROCESSES **9**

Fusion welding processes: Principle, equipment and applications – Gas welding – Types – Flame characteristics – Arc Welding – Manual metal arc welding – Gas Tungsten arc welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Operating principle and applications of: Resistance welding – Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding – Brazing and soldering – Weld defects: types, causes and remedies.

UNIT III BULK DEFORMATION PROCESSES **9**

Hot working and cold working of metals – Forging processes – open, impression and closed die forging – cold forging- Characteristics of the processes – Typical forging operations - Rolling of metals – Types of Rolling – Flat strip rolling – Shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types - Hot and Cold extrusion.

UNIT IV PROCESSING OF SHEET METALS AND PLASTICS **10**

Sheet metal characteristics – Typical Shearing, Bending and Drawing operations – Stretch forming operations –Principle and application of special forming processes: Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming. Plastics- Types and characteristics- Principles and typical applications of: injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding.

UNIT V METAL CUTTING PROCESS **8**

Mechanics of chip formation, forces in machining, types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting. Centre lathe, constructional features, specification, operations – Taper turning methods, Thread cutting methods, special attachments. Capstan and turret lathes.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Interpret knowledge on different metal casting processes and its principles.
- Explain the metal joining process of various components for industry needs.
- Describe various bulk deformation processes and its applications.
- Apply the various forming processes to make sheet metal and plastic components.
- Describe the constructional and operational features of the centre lathe and other lathes.

TEXTBOOKS:

1. Sharma P C, "A Textbook of Manufacturing Technology-I", S Chand and Company, 8th Edition, 2015.
2. Rao. P.N "Manufacturing Technology-Volume 2", Metal Cutting and Machine Tools, Tata McGraw-Hill, New Delhi, 2018.
3. Hajra Choudhury, "Elements of Workshop Technology", Vol. 1, Media Promotors Pvt Ltd., Mumbai, 2012

REFERENCES:

1. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
2. Serope Kalpakjian and Steven R Schmid, "Manufacturing Engineering and Technology", Pearson Education, 7th Edition, 2013.
3. Rajput R K, "A textbook of Manufacturing Technology", Laxmi Publications, 2019.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	1	-	-	-	-	2	3	2
CO2	3	2	2	1	-	1	-	-	-	-	2	3	2
CO3	3	2	2	2	-	1	-	-	-	-	2	3	2
CO4	3	2	2	2	-	1	-	-	-	-	2	3	2
CO5	3	2	1	1	-	1	-	-	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24EE304 **ELECTRICAL MACHINES AND DRIVES (FOR MECHANICAL ONLY)**

L	T	P	C
3	0	2	4

OBJECTIVES:

The students should be made to:

- Learn the basic concepts and laws used in electrical circuits
- Understand the construction and working of electric motors
- Explore various types and characteristics of electrical drives
- Examine the conventional and solid state speed control of DC drives
- Identify various methods to control the speed of AC drives

UNIT I INTRODUCTION **9**

Electric Potential, Current, Power and Energy – Solving simple DC Circuits using KVL and KCL – Single phase AC circuit fundamentals – Power and Power factor – Solving simple AC circuits – 3 phase AC circuits (Qualitative Analysis).

UNIT II ELECTRICAL MOTORS **9**

DC motors: Construction, Working, Back EMF, Torque Equation, Types and Applications – 3-Phase Induction motor: Construction, Working, Torque Equation, Types and Applications.

UNIT III ELECTRICAL DRIVES **9**

Basic elements – Types of electric drives – Factors influence the choice of electrical drives – Heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors – Speed-Torque characteristics of various types of load and drive motors.

UNIT IV DC DRIVES **9**

Speed control of DC series and shunt motors – Armature and field control, Ward Leonard control system – Using controlled rectifiers and DC choppers – Applications.

UNIT V AC DRIVES **9**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – Applications.

THEORY: 45 PERIODS

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff's law.
2. Measurement of three phase power and power factor.
3. Load test on DC shunt motor.
4. Load test on three phase induction motor.
5. Speed-Torque Characteristics of DC compound motor.
6. Study of different loading conditions and classes of duty in electrical drives.
7. Speed control of DC shunt motor (Armature, Field control).
8. Simulation of single phase fully controlled converter fed DC drive.
9. Speed control of three phase induction motor.
10. Simulation three phase AC voltage controlled fed induction motor.

PRACTICAL: 30 PERIODS
TOTAL: 75 PERIODS

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BoS (EEE) 06/05/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the fundamental concepts of electric circuits, including DC and AC systems
- Elucidate the structural design and operational mechanisms of electric motors
- Describe the characteristics and types of electrical drives
- Analyze the diverse techniques employed for regulating the speed of DC drives
- Illustrate the various approaches used to control the speed of AC drive systems

TEXT BOOKS:

1. Kothari D P, Nagrath I J, "Basic Electrical Engineering", McGraw Hill, Fourth Edition, 2019.
2. Vedam Subrahmaniam, "Electric Drives: Concepts and Applications", McGraw Hill Education (India) Pvt. Ltd., Fifth Edition, 2013.

REFERENCES:

1. Theraja B L, "Fundamentals of Electrical Engineering and Electronics" S.Chand & Co., Revised Multi Colour Edition, 2008.
2. Sukhija M S and Nagsarkar T K, "Basic Electrical and Electronic Engineering", Oxford University Press, Third Edition, 2017.
3. Singh M D and Khanchandani K B, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd., Third Edition, 2017.
4. Partab H, "Art and Science of Utilisation of Electrical Power Energy", Dhanpat Rai Publication, Third Edition, 2017.
5. Nagrath I J and Kothari D P, "Electrical Machines", McGraw Hill Education (India) Pvt. Ltd., Fifth Edition, 2018.

Mapping of COs with POs, PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	–	2	–	–	2	–	–	1	3	3
CO2	3	3	1	–	2	–	–	2	–	–	1	3	3
CO3	3	3	1	–	2	–	–	2	–	–	1	3	3
CO4	3	3	1	–	2	–	–	2	–	–	1	3	3
CO5	3	3	1	–	2	–	–	2	–	–	1	3	3

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BoS (EEE)

24EE304 **ELECTRICAL MACHINES AND DRIVES**

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	Regulated Power Supply	2
1.	DC Shunt Motor (5HP, 220V, 1500RPM) with Loading arrangement with 3 Point Starter.	2
2.	DC Compound Motor (5HP, 220V, 1500RPM) with Loading arrangement with 3 Point Starter.	1
3.	Three phase squirrel cage motor (5HP, 440V, 1500 RPM) with loading arrangement	2
4.	Three phase slip ring induction motor (5HP, 1500 RPM) with loading arrangement	1
8.	Three Phase Resistive Load	7
11.	Tachometers Digital/Analog	10
12.	Rheostat of Various ranges	As required
13.	MI/MC Voltmeter	As required
14.	MI/MC Ammeter	As required
15.	UPF/LPF Wattmeter	As required

CHAIRMAN
BoS (EEE) 11/05/25

24ME304L FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to:

- Utilize flow measuring devices for engineering applications.
- Estimate friction losses in pipeline flow.
- Determine the metacentric height of floating bodies
- Analyze the performance characteristics of turbo machines.
- Investigate the performance characteristics of Pumps

LIST OF EXPERIMENTS:

1. Determination of co-efficient of discharge for venturi meter.
2. Determination of co-efficient of discharge for orifice meter.
3. Identification of major losses in flow through Pipes.
4. Identification of minor losses in flow through Pipes.
5. Determination of metacentric height.
6. Performance characteristics of a Pelton wheel turbine.
7. Performance characteristics of a Francis turbine.
8. Performance analysis of Kaplan Turbine.
9. Characteristics of Centrifugal pump.
10. Characteristics of Reciprocating Pump.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Analyze the coefficient of discharge in flow through pipes.
- Estimate the frictional losses in flow through pipes.
- Calculate the metacentric height of floating bodies and their stability under different conditions.
- Estimate the discharge and efficiency of turbo machines.
- Determine the work done and efficiency of hydraulic pumps, and analyze their operational characteristics.

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(BoS / MECH) c8/10

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	-	-	2	1	-	2	2	2
CO2	3	3	2	2	3	-	-	2	1	-	2	2	2
CO3	3	3	2	2	3	-	-	2	1	-	-	2	2
CO4	3	3	2	2	3	-	-	2	1	-	2	3	3
CO5	3	3	2	2	3	-	-	2	1	-	2	3	3

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24ME304L FLUID MECHANICS AND MACHINERY LABORATORY

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Venturi Meter Apparatus	01 No.
2.	Orifice Meter Apparatus	01 No.
3.	Pipe Friction Setup	01 No.
4.	Pipe Fittings Setup	01 No.
5.	Metacentric Height Ship model setup	01 No.
6.	Pelton Wheel Turbine Apparatus	01 No.
7.	Francis Turbine Apparatus	01 No.
8.	Kaplan Turbine Apparatus	01 No.
9.	Centrifugal Pump Setup	01 No.
10.	Reciprocating Pump Setup	01 No.

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(BoS / MECH) 08/10

24ME305L **MANUFACTURING PROCESS LABORATORY**

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to:

- Perform welding operations using GMAW process.
- Understand the principles of turning machines and its operations.
- Gain hands-on-experience on metal spinning in lathe.
- Know the cutting force measurements on lathe.
- Prepare plastic components using injection moulding machine.

LIST OF EXPERIMENTS:

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Step turning on circular shaft.
3. Taper Turning on circular parts using lathe machine.
4. Eccentric Turning on circular shaft.
5. Knurling on circular parts using lathe machine.
6. External thread cutting.
7. Boring and internal thread cutting.
8. Metal spinning.
9. Cutting force calculation using dynamometer in lathe machine.
10. Fabricating plastic components using injection moulding.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply welding operation for various applications to meet industry needs.
- Apply machining operation to make various components in lathe.
- Develop different sheet metal components with appropriate techniques.
- Explain the cutting force measurements in lathe using tool dynamometer.
- Develop plastic components with injection moulding machines.

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(BoS / MECH) 08/10

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	2	1	-	1	-	-	2	3	2
CO2	3	-	-	-	2	1	-	1	-	-	2	3	2
CO3	3	-	-	-	2	1	-	1	-	-	2	3	2
CO4	3	-	-	-	2	1	-	1	-	-	2	3	2
CO5	3	-	-	-	2	1	-	1	-	-	2	3	2

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24ME305L **MANUFACTURING PROCESS LABORATORY**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Centre lathe	10 Nos.
2.	MIG Welding transformer with cables and holders	1 No.
3.	Gas cylinders, blow pipe and other welding outfit	1 No.
4.	Lathe with metal spinning setup	1 No.
5.	Injection moulding equipment	1 No.
6.	Lathe tool dynamometer	1 No.

CHAIRMAN
(BoS / MECH) 08/10

24EEC301L | **SOFT SKILLS DEVELOPMENT (Common to All Branches)** | **L T P C 0 0 2 1**

OBJECTIVES:

The students should be made to:

- Enhance the development of students by focusing on soft skills
- Develop skills of the students through individual and group activities
- Shape students' attitude and behaviour through activities
- Analyze the characteristics of the students for self-development
- Prepare themselves for the recruitment processes

UNIT I SOFT SKILLS ARE IMPORTANT FOR SUCCESS **6**

Importance of Soft Skills - Types - Industrial needs - Development of skills – Employees' expectation - Success of employees.

UNIT II CORPORATE COMMUNICATION **6**

Needs and Development of Communication - Customers Relationship - Improving informal communication - Formation of presentations - Public Speaking - Telephone and Email Etiquettes.

UNIT III DISCUSSIONS **6**

Introduction to Discussion - Importance and types of discussion - Spontaneous conversation - Plan for discussions - Panel discussions - Visual Aid discussions - Debate.

UNIT IV SELF ANALYSIS **6**

Who am I - Identifying or searching one's own Strength, Weakness - Opportunities and Threats (SWOT Analysis) - Benefits of SWOT Analysis - Importance of Self Confidence, Self Esteem, Self Development and Self Introspection.

UNIT V CREATIVITY AND GOAL SETTING **6**

Thinking out of the box - Lateral thinking - Positive thinking - Results of smart work - Application of creativities - Short Term and Long Term Goals - Lifetime goals.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Learners will recognize the importance of Soft skills in Professional life.
- Improve oral and Listening Skills.
- Enhance students' ability in GDs, Presentations and interviews.
- Develop one's strength in setting of goals and developing creative.
- Become a good team worker in the society.

CHAIRMAN
BoS (S&H) 14/10

TEXT BOOKS:

1. "SOFT SKILLS", Career Development Centre, Green Pearl Publications, 2015.

REFERENCES:

1. Covey Sean, "Seven Habits of Highly Effective Teens", New York, Fireside Publishers, 1998.
2. Carnegie Dale, "How to win Friends and Influence People", New York: Simon & Schuster, 1998.
3. Jeff Butterfield, "Soft Skills for Everyone", Cengage Learning, 2011.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	2	-	2	2	-	-
CO2	-	3	-	3	2	-	3	2	2	2	2
CO3	2	-	-	-	3	-	2	3	2	2	2
CO4	2	-	2	-	-	2	-	3	2	3	-
CO5	-	3	2	1	-	2	2	3	2	-	-

CHAIRMAN 14/10
BoS (S&H)

24MA401 **NUMERICAL METHODS** **L T P C**
(Common to CIVIL and MECH) **3 1 0 4**

OBJECTIVES:
The Student should be made to:

- Introduce the numerical techniques of interpolation in various intervals in real life situations
- Understanding of numerical techniques of differentiation which plays an important role in engineering and technology disciplines
- Determine the absolute and relative error in using a numerical integration technique
- Acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- Evaluate the differential equation with boundary conditions

UNIT I INTERPOLATION AND APPROXIMATION 9+3
Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Central difference interpolation: Stirling's Formula, Bessel's Formula - Cubic Splines.

UNIT II NUMERICAL DIFFERENTIATION 9+3
Interpolation with equal intervals - Newton's forward and backward difference formulae- Approximation of derivatives using interpolation polynomials - Maxima and minima of Tabulated Functions.

UNIT III NUMERICAL INTEGRATION 9+3
Numerical integration using Trapezoidal, Simpson's 1/3 rule - Romberg's method - Two point and three point Gaussian quadrature formulae - Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3
Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: (45+15) PERIODS

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OUTCOMES:

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

- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations
- Apply the numerical techniques of differentiation ration for engineering problems
- Apply numerical methods to obtain approximate solutions to mathematical problems
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations
- Obtain the solution of differential equation with boundary conditions

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt.Ltd, 4th Edition, New Delhi, 2021.

REFERENCES:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2018.
2. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill,5th Edition, New Delhi, 2007.
3. Gerald C.F., and Wheatley. P.O. "Applied Numerical Analysis" 7th Edition, Pearson Education India, 2017.
4. Burden, R.L and Faires J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2018.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	-	-	-	2	1	-	1
CO2	3	2	1	-	-	-	-	2	1	-	1
CO3	3	3	1	1	-	-	-	2	1	-	1
CO4	3	3	3	-	-	-	-	2	1	-	1
CO5	3	3	2	2	-	-	-	2	1	-	1

CHAIRMAN
BoS (S&H) 14/10

24ME401 **MECHANICS OF MATERIALS**

L	T	P	C
3	1	0	4

OBJECTIVES:

The student should be made to:

- Understand the concepts of stress structures subjected to axial and thermal loads
- Determine stresses and deformation in circular shafts and helical spring due to torsion.
- Study the principles of bi-axial stresses in cylinders and oblique planes.
- Construct shear force, and bending moment diagrams to evaluate the bending stress in beams
- Gain knowledge on slope, deflection of beams and buckling of columns

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **9+3**

Stress-Strain – Types of stresses - tension, compression and shear stresses – Deformation of simple and compound bars under axial loads – Thermal stresses – Elastic constants and their relationships - Volumetric strain.

UNIT II TORSION AND SPRINGS **9+3**

Theory of torsion – Stresses and Deformations in solid and hollow circular shafts – Power transmitted to the shaft – Shaft of varying sections – Closed and Open coiled helical springs - Springs in series and parallel.

UNIT III CYLINDERS, PRINCIPAL STRESSES AND STRAINS **9+3**

Stresses in thin and thick cylinders due to internal pressure - Circumferential and Longitudinal stresses - Deformation in thin and thick cylinders – Stresses on inclined planes - Principal stresses and Principal planes – Mohr's circle of stress.

UNIT IV TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAMS **9+3**

Beams - types - applications – Supports and loads – Shear force and Bending moment in beams - cantilever, simply supported and over hanging beams – Theory of simple bending - section modulus - bending stress distribution - shear stress distribution.

UNIT V DEFLECTION OF BEAMS AND COLUMNS **9+3**

Slope and Deflection of cantilever and simply supported beams by Double integration method and Macaulay's method - Theory of Columns – Slenderness ratio, end conditions, equivalent length, Euler and Rankine's formulae.

TOTAL: 60 (45 + 15) PERIODS

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(BoS / MECH) 07/03/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the stress and strain in simple and compound bars
- Apply torsional equation in designing of shafts and helical springs
- Calculate the compound stresses in two dimensional systems, thin and thick cylinders.
- Examine the shear force, bending moment and bending stresses in beams under transverse loading.
- Analyze the slope and deflection of beams and buckling loads of columns.

TEXT BOOKS:

1. Bansal R K, "Strength of Materials", Laxmi Publications, New Delhi, 7th Edition, 2024.
2. Rajput R K, "Strength of Materials", S Chand & Company Private Ltd, New Delhi, 7th Edition, 2022.

REFERENCES:

1. Singh. D.K., "Strength of Materials", 4th edition, Ane Books Pvt Ltd., New Delhi, 2021.
2. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
3. Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi 2019.
4. Vazirani. V.N, Ratwani. M.M, Duggal. S.K "Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1", Khanna Publishers, New Delhi 2014
5. Khurmi R S and Khurmi N, "Strength of Materials", S Chand, New Delhi, 26th Edition, 2019

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	2	-	-	-	-	-	-	3	2	3
CO4	3	3	2	2	-	-	-	-	-	-	2	2	3
CO5	3	3	3	2	-	-	-	-	-	-	2	2	2

CHAIRMAN
(BoS / MECH)

24ME402 ENGINEERING MATERIALS AND METALLURGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the concepts of phase diagram and the reaction of the iron-iron carbide phase diagram for microstructure formation.
- Explore various types of ferrous and non-ferrous alloys and their engineering applications
- Acquire knowledge on different heat treatment processes and microstructure formation.
- Know various polymers, ceramics, and composites along with their engineering applications.
- Learn different testing procedures and failure mechanisms in engineering materials.

UNIT I CONSTITUTION OF ALLOYS 9

Constitution of alloys - Solid solutions, substitutional and interstitial – Phase diagrams, lever rule, isomorphous, eutectic, eutectoid, peritectic and peritectoid reactions, Iron – Iron carbon equilibrium diagram – Classification of steels and cast irons, microstructure, properties and applications – Ferrite and Austenite stabilizers.

UNIT II FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel: Manganese (Mn), Silicon (Si), Chromium (Cr), Molybdenum (Mo), Vanadium (V), Titanium (Ti) and Tungsten (W), stainless and tool steels –HSLA, Maraging steels, Cast Iron: Grey, White, Malleable, Spheroidal – Alloy cast irons – Al and its alloys - precipitation strengthening treatment – Copper and its alloys - brass, bronze, and gold.

UNIT III HEAT TREATMENT 9

Full annealing, glass annealing, stress relief, recrystallization and spheroidizing – Normalising, quenching, hardening and tempering of steel – Isothermal transformation diagrams - cooling curves superimposed on Time Temperature Transformation (TTT) diagram - Critical Cooling Rate (CCR) – Hardenability - Jominy end quench test – Austempering, Martempering, Ausforming – Case hardening- carburizing, nitriding, cyaniding, carbonitriding – Flame and induction hardening.

UNIT IV NON-METALLIC MATERIALS 9

Polymers - types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers – Urea and Phenol formaldehyde –Nylon – Recycling of polymers for sustainability – Engineering Ceramics - properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites- Matrix and reinforcement materials - applications of composites - nanocomposites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Introduction to Mechanical Properties - Mechanisms of plastic deformation, slip and twinning – Types of fracture - fracture mechanics - Griffith's theory – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) – Impact test Izod and Charpy – Fatigue and Creep failure mechanisms.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe alloys, phase diagrams, the iron-iron carbon diagram and classifications of steel.
- Explain the impact of alloying elements on ferrous and non-ferrous metals.
- Summarize isothermal transformation, continuous cooling diagrams, and various heat treatment processes.
- Examine the various properties and applications of non-metallic materials.
- Apply different mechanical testing methods and mechanisms.

TEXT BOOKS:

1. Khanna O P, "Materials Science and Metallurgy", Dhanpat Rai Publications Pvt. Ltd., New Delhi, 11th Edition, 2015.
2. Kenneth G Budinski and Michael K Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th edition, 2018.

REFERENCES:

1. William F Smith, Javad Hashemi and Ravi Prakash, "Materials Science and Engineering", McGraw Hill, New York, 6th Edition, 2014.
2. Sydney H. Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994.
3. George E Dieter, "Mechanical Metallurgy", McGraw Hill, New York, 3rd Edition, 2013
4. Raghavan V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 6th Edition, 2021

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	2	-	-	-	-	3	3	2
CO2	3	2	2	-	-	2	-	-	-	-	3	3	2
CO3	3	2	2	-	-	2	-	-	-	-	3	3	2
CO4	3	2	2	-	-	2	-	-	-	-	3	3	2
CO5	3	2	2	-	-	-	-	-	-	-	3	3	2

CHAIRMAN
(BoS / MECH)

24ME403 **KINEMATICS OF MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the types of mechanisms, links and joint arrangements.
- Gain knowledge of velocity and acceleration analysis using different graphical methods.
- Explain the concept of cam and follower mechanism and its profile plotting methods.
- Acquire knowledge on different type of gears and gear trains arrangement and calculations.
- Relate friction in screw jack and clutches for torque and efficiency calculations.

UNIT I SIMPLE MECHANISMS **9**

Basic mechanisms and its terminologies – Degree of freedom – mobility – Kutzbach criterion – Grubler's criterion for planar mechanisms – Grashof's law – Kinematic inversions of four bar chain - single slider - double slider crank chains - quick return mechanisms - mechanical advantage – Classification of mechanisms.

UNIT II KINEMATIC ANALYSIS OF SIMPLE MECHANISMS **9**

Displacement – Velocity – Acceleration analysis –Relative velocity and acceleration method - four bars - single slider - double slider - toggle mechanisms – Instantaneous centre method - four bars - single slider.

UNIT III KINEMATICS OF CAMS **9**

Classification of cams and followers – Terminology – Types of follower motion - uniform velocity motion - simple harmonic motion - uniform acceleration and retardation motion - cycloidal motion – Graphical layouts of cam profile - knife edge - roller - flat faced followers.

UNIT IV KINEMATICS OF GEARS AND GEAR TRAINS **9**

Gear - types – Spur gear terminology – Law of toothed gearing – Basics of involute and cycloidal tooth forms, interchangeability - interference and undercutting – Gear trains calculations - speed and number of teeth - simple, compound and epicyclic gear trains.

UNIT V FRICTION **9**

Friction – types, Friction in screw jack - torque required to raise and lower the load by a screw jack - efficiency of the screw jack – Friction in clutches - single plate, multi plate, cone clutch and centrifugal clutch - considering uniform wear and pressure theory - power, torque and efficiency calculations.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize the simple mechanisms of links and joints for various applications.
- Construct the velocity and acceleration diagrams for different mechanisms.
- Draw the different cam profile for various follower motions.
- Apply gear and gear trains concepts for different gear arrangements.
- Analyze frictional based Mechanisms to perform torque and efficiency calculations.

TEXT BOOKS:

1. Khurmi R S and Gupta J K, "Theory of Machines", S Chand and Company Pvt. Ltd., 14^{th} Edition, 2020.
2. Rattan S S, "Theory of Machines", McGraw Hill Education India Private Limited, 5^{th} Edition, 2019.
3. John J Uicker, Jr., Gordon R Pennock and Joseph E Shigley, "Theory of Machines and Mechanisms - SI Edition", Oxford University Press, 4^{th} Edition, 2017.

REFERENCES:

1. Robert L Norton, "Kinematics and Dynamics of Machinery", Tata McGraw Hill, 2017.
2. Rao. J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2^{nd} edition, 2014
3. Bansal R K and Brar J S, "Theory of Machines", Laxmi Publications, 5^{th} Edition, Revised 2016.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	3	3	2
CO4	3	3	2	2	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24ME404 CONVENTIONAL AND MODERN MACHINING PROCESS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the principles and concepts of shaper, milling and gear cutting machines.
- Illustrate the working principles of abrasive and broaching processes.
- Classify non-traditional mechanical energy based machining processes.
- Differentiate chemical and electro chemical energy based processes.
- Know the concepts of thermo-electric energy based processes.

UNIT I SHAPER, MILLING AND GEAR CUTTING MACHINES **9**

Shaper - types of operations, drilling, reaming, boring, tapping – Milling operations - types of milling cutter – Gear cutting – Forming and generation principle and construction of gear milling, hobbing and gear shaping processes –Finishing of gears.

UNIT II ABRASIVE PROCESS AND BROACHING **9**

Introduction - Abrasive process - grinding wheel - specifications and selection, types of grinding process - cylindrical grinding, surface grinding, centreless grinding and internal grinding - typical applications – Concepts of surface integrity – Broaching machines: broach construction - push, pull, surface and continuous broaching machines.

UNIT III MODERN MECHANICAL MACHINING PROCESSES **9**

Introduction - need for non-traditional machining processes – Classification of non-traditional machining processes - applications - principles, equipment, effect of process parameters, applications, advantages and limitations of abrasive jet machining, water jet machining, abrasive water jet machining, abrasive flow machining, ultrasonic machining.

UNIT IV CHEMICAL ENERGY BASED PROCESSES **9**

Principles, equipment's, effect of process parameters, applications, advantages and limitations of chemical machining, electro-chemical machining, electro-chemical honing, electro-chemical grinding, electro chemical deburring.

UNIT V THERMO ELECTRIC ENERGY BASED PROCESSES **9**

Principles, equipment's, effect of process parameters, applications, advantages and limitations of electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, ion beam machining.

TOTAL: 45 PERIODS

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(BoS / MECH) 07/03/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the constructional and operational features of shaper, milling and gear cutting machines.
- Explain the types of grinding and broaching operations.
- Summarize different non-traditional mechanical machining processes and its operations.
- Relate chemical and electro chemical energy for machining processes.
- Examine the process parameters of thermo-electric machining processes.

TEXT BOOKS:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,7th Edition, 2018.
2. Rao. P.N "Manufacturing Technology-Volume 2", Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2018.
3. Anand Pandey, "Modern Machining Processes", Ane Books Pvt. Ltd., New Delhi, India, 2019

REFERENCES:

1. A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
2. Jagadeesha T., "Non-Traditional Machining Processes", I.K. International Publishing House Pvt. Ltd., New Delhi, India, 2017.
3. Vijay K. Jain, "Advanced Machining Processes", Allied Publishers, New Delhi, India, 2022

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	-	-	2	-	-	-	-	-	2	3	2
CO4	3	2	-	-	2	-	-	-	-	-	2	3	2
CO5	3	2	-	-	2	-	-	-	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24MC003	CONSTITUTION OF INDIA (Common to All Branches)	L T P C 2 0 0 0

OBJECTIVES:

The students should be made to:

- Apply the understanding of fundamental rights and duties to real life situations and legal case studies.
- Illustrate the roles and responsibilities parliamentary framework.
- Analyze the general structure of the state executive roles in the state level.
- Investigate the powers and judicial responsibilities of the higher Judiciary.
- Judge the strength and limitations of India's federal power structure in practice.

UNIT 1 INTRODUCTION **6**

Historical background - Government of India act - Indian councils act - Making of the constitution - Philosophy of the Indian constitution - Preamble.

UNIT II GOVERNMENT OF THE UNION **6**

Powers and Functions of President and Prime Minister - Council of Ministers – President in relation to his council - Legislature structure and functions of Lok Sabha and Rajya Sabha - Speaker.

UNIT III GOVERNMENTS OF THE STATES AND LOCAL GOVERNMENT **6**

The state executive: General structure - Governor - Council of ministers - State legislature. Local government - Panchayat - Municipality - Power authority and responsibilities municipalities.

UNIT IV THE JUDICATURE **6**

Organization and Composition of Judiciary – Constitution – Appointment - Qualifications - Powers and functions of the supreme court– High courts – Control over subordinate courts.

UNIT V THE FEDERAL SYSTEM **6**

Distribution of financial powers: Need, principles-Underlying distribution of tax revenues-Distribution of legislative power – Interstate relation - Emergency provisions.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Distinguish and apply constitutional principles and democratic values of the Indian constitution.
- Emphasize on the powers and interactions of the president, prime ministers in the parliamentary structure.
- Evaluate the structure, powers and functions of state and local governance.
- Demonstrate the Indian judiciary, structure and functions of courts.
- Explore the financial, legislative provisions of Indian federation.

CHAIRMAN
BoS (S&H) 20/06/25

TEXT BOOKS:

1. Basu D.D, "Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

REFERENCES:

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. The Constitution of India, 1950 (Bare Act), Government Publication.
4. Jain M P, Indian Constitution Law, 7th Edition. Lexis Nexis, 2014.
5. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	-	-	-	2
CO2	-	-	-	-	-	3	3	2	2	2	3
CO3	-	-	-	-	-	3	3	2	2	2	3
CO4	-	-	-	-	-	3	3	-	2	2	3
CO5	-	-	-	-	-	3	3	-	-	3	2

CHAIRMAN
BoS (S&H)

24ME405L	MECHANICS OF MATERIALS AND METALLURGY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student should be made to:

- Determine the mechanical properties of metal, such as ultimate tensile strength and shear strength.
- Know the material behaviour of mild steel under torsion, and impact tests.
- Compare the hardness value of untreated and hardened steel samples to evaluate the improvement.
- Identify the stiffness and young's modulus of the given materials.
- Understand the microstructural characteristics of steel and cast iron.

LIST OF EXPERIMENTS:

1. Tension test on mild steel rod.
2. Double shear test on metal.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metal using brinell hardness testing machine.
6. Effect of Hardening Improvement in Hardness of steel.
7. Compression test on helical spring.
8. Deflection test on Metal beam.
9. Microscopic Examination of low carbon, eutectoid steel.
10. Microscopic Examination of grey and spheroidal cast iron.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify tensile and shear strength of metals using standard testing machines.
- Determine material deformation and failure mechanisms under torsional, impact tests.
- Examine experimental data for hardness improvement in steel samples.
- Calculate the stiffness of the helical spring and young's modulus for the given beam.
- Inspect the microstructure formation in different grades of steel and cast irons.

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(BoS / MECH) 07/03/25

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	2	-	-	2	2	2
CO2	3	3	2	2	-	-	-	2	-	-	2	2	2
CO3	3	3	2	2	-	-	-	2	-	-	2	2	2
CO4	3	3	2	2	-	-	-	2	-	-	2	2	2
CO5	3	2	2	2	-	-	-	2	-	-	2	2	2

CHAIRMAN
(BoS / MECH)

24ME405L **MECHANICS OF MATERIALS AND METALLURGY LABORATORY**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Universal Testing Machine	1 No.
2.	Digital Torsion Testing Machine	1 No.
3.	Impact testing Machine	1 No.
4.	Brinell Hardness Testing Machine	1 No.
5.	Spring Testing Machine	1 No.
6.	Deflection Test Apparatus	1 No.
7.	Muffle Furnace	1 No.
8.	Quenching Machine	1 No.
9.	Metallurgical Microscope	2 Nos.

CHAIRMAN
(BoS / MECH) 07/03/25

24ME406L MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to:

- Learn the principle and operations in shaper and drilling machine.
- Understand the working principle of milling and hobbing process.
- Perform gear shaping and contour milling operations.
- Gain hands-on-experience on slotting and surface grinding process.
- Familiarize with the principle of cylindrical and centreless grinding process.

LIST OF EXPERIMENTS:

1. Shaping Hexagonal Heads on circular parts using Shaper Machine.
2. Drilling and Reaming using Radial Drilling Machine.
3. Cutting Spur gear using Universal Milling Machine.
4. Generating gears using Gear Hobbing Machine.
5. Generating gears using Gear Shaping Machine.
6. Milling contours on plates using Vertical Milling Machine.
7. Making a Keyway by using Slotting Machine.
8. Grinding components using Surface Grinding Machine.
9. Grinding components using Cylindrical Grinding Machine.
10. Grinding components using Centreless Grinding Machine.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply machining operations to perform drilling and make hexagonal heads using shaper.
- Make a gear with suitable material by using milling and hobbing machine.
- Develop a gear with gear shaper and contour profile using milling machine.
- Apply the machining technique to make a keyway with slotter and finish components using surface grinding machine.
- Demonstrate grinding operations on cylindrical and centreless grinding machines.

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(BoS / MECH) 07/03/25

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-	-	2	3	2
CO2	3	2	-	-	-	-	-	2	-	-	2	3	2
CO3	3	2	-	-	-	-	-	2	-	-	2	3	2
CO4	3	2	-	-	-	-	-	2	-	-	2	3	2
CO5	3	2	-	-	-	-	-	2	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24ME406L MANUFACTURING TECHNOLOGY LABORATORY

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Shaper Machine	1 No.
2.	Radial Drilling Machine	1 No.
3.	Universal Milling Machine	1 No.
4.	Gear Hobbing Machine	1 No.
5.	Gear Shaping Machine	1 No.
6.	Vertical Milling Machine	1 No.
7.	Slotting Machine	1 No.
8.	Surface Grinding Machine	1 No.
9.	Cylindrical Grinding Machine	1 No.
10.	Centreless Grinding Machine	1 No.

CHAIRMAN
(BoS / MECH) 07/03/25

24EEC401L LIFE SKILLS AND PERSONALITY DEVELOPMENT
(Common to All Branches)

L	T	P	C
0	0	2	1

OBJECTIVES:

The students should be made to:

- Create self- confident among the students by the training
- Develop good personality for mature outlook in different circumstances
- Encourage effective presentation skills
- Dramatize role play by assigning the best role
- Enhance team building and time management skills

UNIT I CAREER PLANNING **6**

Introduction - Benefits of Career Planning - Expectation and Development - Guidelines for choosing a Career - Future planning - Evaluation of planning.

UNIT II ATTITUDE **6**

Introduction - Rightness of Attitude and behaviour - Formation of Attitudes - Evolving Behaviour of a person - Creating right attitudes - Approaches of Challenges - Lessons from Attitude.

UNIT III ROLE PLAYING **6**

Introduction - settings of role plays - Principles and Purpose - importance of communication in role plays - Arrangement of points and character - Extempore Talk - Debates - Emotional Intelligence.

UNIT IV TEAM BUILDING **6**

Purpose of Creating Team - Exploring Team roles and Processes - Importance of Building and Developing Strong Team - Leadership Qualities - Success of Team Building.

UNIT V TIME MANAGEMENT **6**

Value of time - Concept and applications of time management - Causes for wasting of time - Methods of Time Management - Diagnosing Time Management - Planning for presentation - To - do - list - Prioritizing work

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Improve the leadership skills by identifying the strengths of a team
- Learn to lead a team on a project in an organization
- Helps students to perform on a distinct role and learn to face the challenges
- Build a strong team to achieve their goals with the right choice of people
- Develop the time management skills to achieve success

CHAIRMAN 14/10
BoS (S&H)

TEXT BOOKS:

1. "Soft Skills", Career Development Centre, Green Pearl Publications, 2015.

REFERENCES:

1. Thomas A Harris, "IAm Ok, You Are Ok", Harper and Row, New York 1972.
2. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.
3. Nira Konar, "Communication Skills for Professionals", Eastern Economy Edition, 2010.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	1	2	2	1	1	2	3	1	3
CO2	1	2	1	2	2	1	1	2	3	1	3
CO3	1	2	1	2	2	1	1	3	3	1	3
CO4	1	2	1	2	2	1	1	3	3	1	3
CO5	1	2	1	2	2	1	1	3	3	1	3

CHAIRMAN
BoS (S&H) 14/10

24ME501 **DYNAMICS OF MACHINES**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge on the dynamics analysis of mechanisms.
- Familiarize with balancing methods for rotating and reciprocating masses.
- Study the principles and effects of free damped and undamped vibration systems.
- Learn about the causes and control of forced vibration systems.
- Know the concepts of mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS **9**

Dynamic force analysis - Inertia force and Inertia torque - D Alembert's principle – Dynamic Analysis in reciprocating engines - Gas forces - Inertia effect of connecting rod - Bearing loads - Crank shaft torque – Equivalent Dynamical System - Turning moment diagrams - Fly Wheels.

UNIT II BALANCING **9**

Static and dynamic balancing – Balancing of rotating masses in single and several planes – Balancing of reciprocating masses – Balancing of single cylinder engine and Multi cylinder inline engine – Partial balancing in locomotive engines.

UNIT III FREE VIBRATION **9**

Introduction to vibration – Types of vibration – Single DoF system – Free vibration – Equations of motion - Natural frequency - Types of Damping - Damped vibration - Transverse vibration of shaft - Critical speeds of shafts – Torsional vibration - Two and three rotor torsional systems.

UNIT IV FORCED VIBRATION **9**

Response of one degree freedom systems to periodic forcing - Harmonic disturbances - Disturbance caused by unbalance - Support motion - transmissibility - Vibration isolation

UNIT V MECHANISM FOR CONTROL **9**

Governors - Types - Centrifugal governors – Watt, Porter, Proell and Harnell Governors Characteristics Controlling force curves – Gyroscopes - Gyroscopic forces and torques - Gyroscopic stabilization - Gyroscopic effects in ships and airplanes.

TOTAL: 45 PERIODS

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(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply dynamics analysis of the mechanism.
- Choose balancing methods on rotating and reciprocating masses.
- Solve the effects of free damped and undamped vibration systems.
- Examine the control of forced vibration systems.
- Analyze the mechanisms used for speed control and stability control.

TEXT BOOKS:

1. Khurmi R S, "Theory of Machines", S Chand Publications, 14th edition 2020.
2. Rattan S S, "Theory of Machines", Tata McGraw Hill Publications, 5th Edition, 2019.

REFERENCES:

1. Joseph E Shigley, "Theory of Machines and Mechanisms", Oxford Publications, 4th Edition, 2017.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 3rd Edition, 2005.
3. Benson H Tongue, "Principles of Vibrations", Oxford University Press, 2nd Edition, 2012.
   Robert L Norton, "Kinematics and Dynamics of Machinery", Tata McGraw Hill, 2009.
4. Ghosh A and Mallick A K, "Theory of Mechanisms and Machines", Affiliated East- West Pvt. Ltd., New Delhi, 2008.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	1	-	-	-	-	-	-	2	3	3
CO3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	2	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	-	-	-	-	-	-	2	3	3

CHAIRMAN
(BoS / MECH)

24ME502	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

(Use of approved PSG design data book is permitted)

OBJECTIVES:

The student should be made to:

- Identify the different types of steady and variable stresses in machine components.
- Describe the steps to design shafts and couplings for various applications.
- Understand the principles in temporary and permanent joints.
- Examine the function and behavior of energy-storing elements in mechanical systems.
- Assess suitable design solutions for bearings, seals and gaskets.

UNIT I FUNDAMENTAL CONCEPTS IN DESIGN **9**

Introduction to the design process – factors influencing machine design – Direct, Bending and torsional stress equations – Design of curved beams – crane hook and 'C' frame – Factor of safety – theories of failure – stress concentration – Design for variable loading – Soderberg and Goodman relations.

UNIT II SHAFTS AND COUPLINGS **9**

Design of solid and hollow shafts based on strength and rigidity – critical speed – Keys and splines – Design of rigid couplings – muff and flange type– Introduction to flexible couplings – Bushed pin type.

UNIT III TEMPORARY AND PERMANENT JOINTS **9**

Threaded fasteners – Bolted joints including eccentric loading – Knuckle joints – Welded joints – Butt, Fillet and parallel transverse fillet welds – Welded joints subjected to bending, torsional and eccentric loads – Riveted joints for structures.

UNIT IV SPRINGS AND ENGINE COMPONENTS **9**

Springs – Design of helical, Leaf and Belleville springs – Design of Crankshaft – Design of Connecting rod

UNIT V BEARINGS AND MISCELLANEOUS ELEMENTS **9**

Sliding contact and rolling contact bearings – Design of Hydrodynamic journal bearings, Sommerfeld Number – Selection of Rolling Contact bearings – Design of Seals and Gaskets.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Recall the design of machine parts under static and variable loads
- Apply the design of shafts, keys, and couplings for suitable solutions.
- Select the concepts of design for temporary and permanent joints.
- Examine the design methods for energy storing elements.
- Analyze the design concepts of bearings and miscellaneous elements.

TEXT BOOKS:

1. Bhandari V B, "Design of Machine Elements", Tata McGraw-Hill Publishers Co. Ltd, 5th edition, 2020.
2. Khurmi R S and Gupta J K, "Machine Design", S Chand and Company Pvt. Ltd, New Delhi, 14th edition, 2022.

REFERENCES:

1. Joseph Shigley, Richard G. Budynas and J. Keith Nisbett "Mechanical Engineering Design", 11th Edition, Tata McGraw-Hill , 2020.
2. Robert C Juvinall and Kurt M Marshek, "Fundamentals of Machine Component Design", Wiley, 7th Edition, 2020.
3. Sundararajamoorthy T V and Shanmugam N, "Machine Design", Anuradha Publications, Chennai, 2017.
4. Faculty of Mechanical Engineering, PSG College of Technology, "PSG Design Data Book", Kalaikathir Achagam, 2020.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	-	-	-	-	-	-	2	3	2
CO4	3	3	3	2	-	-	-	-	-	-	2	3	2
CO5	3	3	3	2	-	-	-	-	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24ME503 **THERMAL ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Describe IC engines and list various auxiliary systems used in engines.
- Understand thermodynamic laws, cycle operations and IC engine performances.
- Compare boiler types, auxiliary features and performance parameters.
- Identify steam nozzle performance and critical pressure ratio.
- Know impulse and reaction turbine principles and their applications.

UNIT I INTERNAL COMBUSTION ENGINES **9**

IC engine – Classification, working, components and their functions - Ideal and actual - Valve and port timing diagrams, p-v diagrams – two stroke & four stroke, and SI & CI engines – comparison – Carburettor – Geometric, operating, and performance comparison of SI and CI engines - desirable properties and qualities of fuels - Lean and rich mixtures – Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT II GAS AND STEAM POWER CYCLES **9**

Cycles: Otto, Diesel, Dual, Brayton - Calculation of mean effective pressure – Air standard efficiency – Comparison of cycles – Rankine, reheat and regenerative cycle.

UNIT III BOILERS **9**

Types and comparison - Cochran boiler, Babcock and Wilcox boiler, LaMont, Benson, and Loeffler boilers – Mountings and Accessories – Fuels - Solid, Liquid and Gas – Performance calculations - Boiler trial.

UNIT IV STEAM NOZZLES **9**

Types and Shapes of nozzles – Flow of steam through nozzles – Critical pressure ratio – Variation of mass flow rate with pressure ratio – Effect of friction – Metastable flow.

UNIT V STEAM TURBINES **9**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions - multi-staging, compounding and governing.

TOTAL: 45 PERIODS

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(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize IC engine components, functions and auxiliary systems.
- Relate thermodynamic concepts in gas and steam power cycles.
- Illustrate boiler types, auxiliaries, and related performance parameters.
- Calculate steam nozzle parameters and critical pressure ratio.
- Analyze steam flow, velocity diagrams and performance characteristics of turbines.

TEXT BOOKS:

1. Ganesan.V, " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2020.
2. Mahesh. M. Rathore, "Thermal Engineering-I", 1st Edition, Tata McGraw Hill, 2018.

REFERENCES:

1. Ballaney. P, "Thermal Engineering", 25th Edition, Khanna Publishers, 2017.
2. Domkundwar, Kothandaraman, & Domkundwar, "A Course in Thermal Engineering", 6th Edition, Dhanpat Rai & Sons, 2013.
3. Gupta H.N, "Fundamentals of Internal Combustion Engines", 2nd Edition, Prentice Hall of India, 2013.
4. Mathur M.L and Mehta F.S., "Thermal Science and Engineering", 3rd Edition, Jain Brothers Pvt. Ltd, 2018.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	1	2	2
CO2	2	2	1	1	-	-	-	-	-	-	1	2	2
CO3	2	2	2	1	-	-	-	-	-	-	1	2	2
CO4	3	2	2	1	-	-	-	-	-	-	1	2	2
CO5	3	2	2	1	-	-	-	-	-	-	1	2	2

CHAIRMAN
(BoS / MECH)

24ME504 **AUTOMOBILE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Familiarize with the construction, working principles and functions of various engine components
- Know the function of various engines auxiliary systems.
- Classify the different types of transmission system used in automobiles
- Study the working principle of steering, brakes and suspension system
- Provide knowledge of electric and hybrid vehicles.

UNIT I VEHICLE STRUCTURE AND ENGINES **9**

Types of automobiles – vehicle construction and different layouts – chassis, frame and body – vehicle aerodynamics (various resistances and moments involved) – IC engines - components, functions and materials – Variable Valve Timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS **9**

Electronically controlled gasoline injection system for SI engines – Diesel Pump - Electronically controlled injection system - unit injector system, rotary distributor type and common rail direct injection system – Ignition system: Battery, Magneto and Electronic Ignition Systems, Transistorized coil ignition system, capacitive discharge ignition system – Turbochargers - waste gate turbocharger, variable geometry turbocharger – Lubrication and Cooling Systems

UNIT III TRANSMISSION SYSTEMS **9**

Clutch - types and construction – gear boxes - types and construction – gear shift mechanisms - overdrive - transfer box – fluid flywheel – torque converter – propeller shaft, slip joints and universal joints – differential and rear axle – hotch kiss drive and torque tube drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEM **9**

Steering geometry and types of steering gear box – power steering – pneumatic and hydraulic braking system - Antilock Braking System (ABS) - Electronic Brake force Distribution (EBD) and traction control - types of front axle - types of suspension system.

UNIT V ELECTRIC AND HYBRID VEHICLES **9**

Electric Vehicles: History of electric vehicles – Components of electric vehicle – layout & working of electric vehicles - comparison with internal combustion engine - advantages and disadvantages of EV. Hybrid Vehicles: Components of hybrid vehicles – layout & working principle of hybrid vehicles - comparison with electric vehicles - advantages and disadvantages of hybrid vehicles.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the various types of automobiles, vehicle layouts, and aerodynamic factors affecting performance.
- Understand the principles of engine auxiliary systems including fuel injection, ignition systems, turbochargers, lubrication, and cooling.
- Summarize the type of transmission systems and other auxiliary components
- Apply the steering geometry, braking systems and suspension mechanisms for improved handling, comfort, and safety.
- Identify the appropriate electric and hybrid vehicle technology for sustainable development.

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering Vol 1 & 2", Standard Publishers, New Delhi, 13th Edition, 2020.
2. Jain K K and Asthana R B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2nd Edition, 2012.

REFERENCES:

1. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 13th Edition, 2001.
2. Joseph Heitner, "Automotive Mechanics", East-West Press, 2nd Edition, 2015.
3. Martin W Stockel and Martin T Stockel, "Auto Fundamentals", The Goodheart-Will Cox Company Inc, USA, 12th Edition, 2019.
4. Ganesan V, "Internal Combustion Engines", Tata McGraw-Hill, 4th Edition, 2017.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	2

CHAIRMAN
(BoS / MECH)

24ME505 **CAD/CAM**

L	T	P	C
3	0	2	4

OBJECTIVES:

The student should be made to:

- Impart fundamental knowledge of engineering drawing standards for design.
- Know the concepts of 2D drafting views, title blocks, and documentation for engineering drawings.
- Use knowledge in creating and manipulating 3D models using various modelling techniques and operations.
- Understand the concepts of assembly modelling techniques, approaches, and analysis methods.
- Gain knowledge and skills in CNC machining concepts, CAM programming, and tool path generation for efficient manufacturing.

UNIT I BASICS OF DESIGNS **9**

Understanding of Projections, Scales, units, Geometric Dimensioning and Tolerancing (GD & T) its symbols, Special characteristics and Title Block readings, Revision / Engineering Change Notice (ECN) status of drawings – Customer Specific requirements – Drawing Grid reading.

UNIT II 2D DRAFTING **9**

Projection views – Orthographic view, Auxillary view, Full and Half Section views, Broken Section view, Offset Section view – Title Block creation – Bill of Materials (BOM) creation – Notes creation - Ballooning of 2D drawing and its features for Inspection reporting.

UNIT III 3D MODELLING **9**

Conversion of Views – 2D to 3D & 3D to 2D – Parametric and Non-Parametric modelling – Tree features of 3D modelling and its advantages – Surface modelling – BIW (Body in White) – Solid modelling, Boolean operations like Unites, Subtraction, Intersect, etc.

UNIT IV ASSEMBLY MODELLING **9**

Basics of Assembly modelling, Purpose of Assembly modelling & its advantages – Top to Down & Bottom Up modelling approaches – Analysis of Clearances – Undercuts – Interferences – Stack up analysis – Cumulative effect of Tolerances in after assembly conditions – Motion analysis.

UNIT V CAM **9**

Basics of CNC Machining – 3, 4 & 5 Axis machines – CNC and Part Programing, CAM programing 2D & 3D – Elements of CAM Orientation, Boundary Creation, Cutter Path Selection, Cutter Compensation – Machining Stocks, Roughing, Re-roughing, Semi Finishing & Finishing - Tool Path Generation, Industrial Standard Language (ISL) and Milling Programing – Machining program simulation, integration of program with machine – Estimation of CNC Cycle time – Post Process NC Code conversion and Setup Sheet Preparation.

THEORY:45 PERIODS

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LIST OF EXPERIMENTS:

1. Design of 2D Orthographic sketching from given drawings.
2. Generating 2D drafting and fabrication of assembly drawing with balloons & BOM to the various components.
3. Design of 3D models from industrial level drawings.
4. Construction of 3D surface model of jug using 3D modelling software.
5. Creation of 3D assembly model of flange coupling using 3D modelling software.
6. Creation of 3D assembly model of universal joint using 3D modelling software.
7. Creation of 3D assembly model of Screw Jack using 3D modelling software.
8. Creation of 3D assembly model of helical gear shaft using 3D modelling software.
9. Perform the turning operation using CNC lathe / Simulation Software.
10. Perform the contour profile using CNC milling machine / Simulation Software.

TOTAL: 30 PERIODS

TOTAL:75 PEROIDS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals of design principles and concepts.
- Construct accurate 2D projection views, title blocks with detailed Bill of Materials (BOMs).
- Develop 3D models from 2D drawings with parametric / non-parametric methods.
- Build assembly modelling using top-down and bottom-up approaches.
- Apply the relevant codes to perform the machining operations.

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" McGraw Hill Education, 2017
2. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing",Pearson Education,5th Edition, 2019.
3. P N Rao "CAD/CAM:Principles and Applications" McGraw Hill Education, 3rd Edition, 2017.

REFERENCES:

1. Radhakrishnan P, Subramanyan S. and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 4th Edition, 2018.
2. Ibrahim Zeid , R Sivasubramanian "CAD/CAM : Theory and Practice", McGraw Hill Education,2nd Edition, 2020.
3. J. Srinivas "CAD/CAM: Principles and Applications"'. Oxford University Press, 2017.
4. A. Jacob Moses, Renjin J. Bright, Anup Goel, Ruchi Agarwal – "Computer Aided Design & Manufacturing" Technical Publications, 2020.

CHAIRMAN
(BoS / MECH)

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	1	2	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	2	2	2
CO4	3	3	3	2	3	-	-	-	-	-	2	2	2
CO5	3	2	2	1	3	-	-	-	-	-	2	2	2

CHAIRMAN
(BoS / MECH) 17/09/25

24ME505 **CAD/CAM**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Computer System with necessary accessories	30 Nos.
2.	Licensed Modelling software	30 Users
3.	CNC Lathe	1 No.
4.	CNC Milling Machine	1 No.
5.	CAM Software for machining centre and turning centre	10 Nos.
6.	Printer	1 No.

CHAIRMAN
(BoS / MECH)

24ME506L **DYNAMICS LABORATORY**

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to:

- Learn the dynamic principles in mechanical systems.
- Perform the balancing of rotating body.
- Gain knowledge in natural frequencies and vibration responses.
- Familiarize with transmissibility ratio and natural frequency of the tuned vibration absorber.
- Know the importance of governors and gyroscope in practical applications

LIST OF EXPERIMENTS:

1. Determination of mass moment of inertia of connecting rod using turn table apparatus and pendulum setup.
2. Determination of mass moment of Inertia using bifilar suspension and compound pendulum.
3. Implementation of dynamic balancing on rotating masses in several planes system.
4. Measurement of torsional natural frequency of single rotor system.
5. Compute critical speeds of shafts with concentrated loads.
6. Measurement of natural frequency single degree of freedom spring mass system.
7. Identification of transmissibility ratio using vibrating table.
8. Determination of natural frequency of tuned vibration absorber.
9. Comparison of the range sensitivity and effort for Porter, Proell and Hartnell.
10. Identification of gyroscopic effect and couple on motorized gyroscope.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Compute the moment of inertia of mechanical elements.
- Apply balancing techniques to the rotating systems.
- Analyze different types of vibrations in mechanical elements.
- Determine the dynamic responses of vibration absorber setup.
- Examine the performance of dynamic systems of governors and gyroscopes.

CHAIRMAN
(BoS / MECH) 17/09/25

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-	-	2	3	2
CO2	3	2	-	-	-	-	-	2	-	-	2	3	2
CO3	3	2	-	-	-	-	-	2	-	-	2	3	2
CO4	3	2	-	-	-	-	-	2	-	-	2	3	2
CO5	3	2	-	-	-	-	-	2	-	-	2	3	2

CHAIRMAN
(BoS / MECH)

24ME506L **DYNAMICS LABORATORY**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	Turn table apparatus	1 No.
2.	Pendulum apparatus	1 No.
3.	Bifilar suspension setup	1 No.
4.	Rotating masses balancing setup	1 No.
5.	Torsional Vibration of single rotor system setup	1 No.
6.	Whirling of shaft setup	1 No.
7.	Spring mass vibration setup	1 No.
8.	Vibrating table setup	1 No.
9.	Tuned vibration absorber and FFT analyzer	1 No.
10.	Universal Governor apparatus	1 No.
11.	Motorized gyroscope	1 No.

CHAIRMAN
(BoS / MECH) 17/09/25

24ME507L **THERMAL ENGINEERING LABORATORY**

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to:

- Learn the valve timing and port timing diagram for Engines
- Understand the characteristics of fuels/Lubricates
- Conduct performance test for Diesel and Petrol Engines.
- Perform the energy balance test on diesel engine
- Know the Performance of air compressor, steam generator, steam turbine

LIST OF EXPERIMENTS:

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Determination of Flash Point and Fire Point of various fuels / lubricants.
4. Performance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Heat Balance Test on 4 – stroke Diesel Engine.
8. Performance test on a two stage Reciprocating Air compressor
9. Performance and Energy Balance Test on a Steam Generator.
10. Performance and Energy Balance Test on Steam Turbine.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Illustrate valve, port timing and actual p–v diagrams for various engines.
- Identify the flash point and fire point of fuels, lubricants using standard testing methods.
- Examine the performance test for Diesel and Petrol Engines
- Analyze the heat losses and energy generation in diesel engines.
- Examine the performance tests for air compressors, steam generators, and steam turbines.

CHAIRMAN
(BoS / MECH) 17/09/25

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO2	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	3	2	2	2	-	-	-	-	2	-	2	2	1
CO4	3	2	2	2	-	-	-	-	2	-	2	2	1
CO5	3	2	2	2	-	-	-	-	2	-	2	2	1

CHAIRMAN
(BoS / MECH)

24ME507L THERMAL ENGINEERING LABORATORY

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Description of Equipment	Quantity Required
1.	I.C Engine - 2 stroke and 4 stroke model	Each 1 No.
2.	Open cup and Closed cup Apparatus	Each 1 No.
3.	Redwood viscometer and Say bolt Viscometer	Each 1 No.
4.	4-stroke Diesel Engine with mechanical loading.	1 No.
5.	4-stroke Diesel Engine with hydraulic loading.	1 No.
6.	4-stroke Diesel Engine with electrical loading.	1 No.
7.	Multi-cylinder Petrol Engine	1 No.
8.	Data Acquisition system with any one of the above engines	1 No.
9.	Reciprocating Air Compressor	1 No.
10.	Steam Boiler with turbine setup	1 No.

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24EEC501L **PROFESSIONAL SKILLS DEVELOPMENT** **L T P C**

(Common to All Branches) **0 0 2 1**

OBJECTIVES:

The student should be made to:

- Sharpen problem solving skills and to improve thinking ability of the students
- Drive the students to use language with great commitment and cooperation
- Expertise the creative thinking and presentation skills to meet company needs
- Develop and foster the soft skills through individual and group activities
- Expose students to right attitudinal and behavioural thoughts

UNIT I INTRODUCTION TO BASIC ARITHMETIC AND PERSONALITY TRAITS **6**

Aptitude - Numbers, Average, Percentage, Profit and loss, Picture pattern.
Soft skills - Personality development, Professional ethics, Perception insights, attitude and behavioral changes.

UNIT II CONCEPT OF PROPORTIONALITY & INTERPERSONAL SKILLS **6**

Aptitude - Time and work, Pipes and cisterns, Series completion, Critical reasoning.
Soft skills - Developing self - esteem, Significance of interpersonal behaviour and interpersonal relationships.

UNIT III AN APPROACH TO COGNITIVE APTITUDE AND LEADERSHIP SKILLS **6**

Aptitude - Time, speed and distance, Boats and streams, Races and games, Syllogism.
Soft skills - Leadership skills - Characteristics and importance of leadership, Roles and responsibilities of a good Leader

UNIT IV CONTEMPORARY APTITUDE AND SITUATIONAL RESPONSES **6**

Aptitude - Crypt arithmetic, Ranking, Logarithms, Cubes, Analogy.
Soft skills - Decision making - Processes and challenges, Creative and Critical thinking.

UNIT V NON-VERBAL REASONONG AND INFLUENCING OTHERS **6**

Aptitude - Clocks, Non - verbal reasoning, Permutation, Classifications.
Soft skills - Presentation skills - Make use of visual aids with modern tools, Insights on persistence and perseverance.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Ability to solve both analytical and logical problems in an effective manner
- Practice to organize and convey the information in such an optimistic way.
- Deliver a professional and constructive presentation
- Recognize explicit assumptions and their consequences
- Access the needed information effectively and efficiently

CHAIRMAN 14/10
BoS (S&H)

TEXT BOOKS:

1. Aggarwal R S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing New Delhi, Revised Edition Feb 2017.
2. MurtyG R K, "Soft Skills for Success", DGM Icfai Books, Revised Edition, 2005.

REFERENCES:

1. Abhijit Guha, "Quantitative Aptitude for All Competitive Examinations", McGraw Hill Education; Sixth edition 2016.
2. AggarwalRS, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing; New Delhi, 2018.
3. Arun Sharma, "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education; Eighth Edition, 2018.
4. Covey Sean, "Seven Habits of Highly Effective Teens", Fireside Publishers, New York, 1998.
5. Carnegie Dale, "How to win Friends and Influence People", Simon & Schuster, New York, 1998.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	2	3	1	1	1	3	2	1	2
CO2	2	1	1	1	1	2	2	2	2	1	2
CO3	2	3	2	2	2	3	2.	3	3	1	2
CO4	2	3	2	3	3	2	1	3	2	3	2
CO5	1	1	2	2	3	1	2	3	3	1	2

CHAIRMAN
BoS (S&H) 14/10

VERTICAL 1

Thermal Power Engineering

24ME101PE **REFRIGERATION AND AIR CONDITIONING**

L	T	P	C
3	0	0	3

(Use of standard Refrigerant table and Psychrometric Charts are permitted)

OBJECTIVES:

The student should be made to:

- Illustrate the basic principles and concepts of refrigeration applied in the engineering practice
- Know the concepts of refrigeration system components, properties of refrigerants and applications of refrigeration systems
- Acquire knowledge about Psychrometric processes and its properties
- Classify different air-conditioning systems
- Study the cooling load calculations in various systems

UNIT I REFRIGERATION CYCLE **9**

Review of thermodynamic principles of refrigeration - Air cycle refrigeration system – Vapour compression refrigeration cycle - use of P-H charts - multistage and multiple evaporator systems - cascade system - COP comparison - Vapour absorption refrigeration system. Ammonia water and Lithium - Bromide water systems - Steam jet refrigeration system.

UNIT II REFRIGERATION SYSTEM **9**

Compressors: Types - based on operation and based on arrangement - Condensers: Types-air cooled, water cooled and evaporative condensers - Evaporators: Flooded and dry expansion types - Expansion devices: Capillary tube, Automatic expansion valve, Thermostatic expansion valve - Refrigerants: Properties and Selection - Eco friendly refrigerants: Ozone Depletion Potential (ODP) and Global Warming Potential (GWP).

UNIT III PSYCHROMETRIC PROCESSES **9**

Review of fundamental properties of psychrometry, Psychrometric chart, Psychrometry properties calculation, Psychrometric processes, Bypass factor, Apparatus Dew Point (ADP) temperature, numerical problems.

UNIT IV AIR CONDITIONING SYSTEMS **9**

Air conditioning - definition, standards of temperature, humidity and air motion, components of air conditioning system - Summer, winter and year-round air conditioners, Window, Split air conditioners, Central air conditioner systems - Air distribution system - Thermal insulation of air conditioning systems - applications

UNIT V COOLING LOAD CALCULATIONS **9**

Types of load - design of space cooling load - heat transmission through building – Solar radiation – infiltration - internal heat sources (sensible and latent) – outside air and fresh air load - estimation of total load - Domestic, commercial and industrial systems - central air conditioning systems.

TOTAL: 45 PERIODS

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(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concepts of refrigeration and refrigeration system
- Relate the different types of compressors and different types of refrigerants
- Use the Psychrometric chart to represent the properties of air at various conditions.
- Choose the salient design of air-conditioning systems used in various applications
- Analyze cooling load calculations for different types of Air-Conditioning requirements.

TEXT BOOKS:

1. Rajput R K, "Refrigeration and Air-Conditioning", S K Kataria Sons, 3rd Edition, 2015.
2. Khurmi R S, "Refrigeration and Air-Conditioning", S Chand, 2011.

REFERENCES:

1. Manohar Prasad, “Refrigeration and Air-Conditioning", Wiley Eastern Ltd., 2010.
2. Ramesh Arora, "Refrigeration and Air-Conditioning", Prentice Hall of India, 2010.
3. Arora and Domkundwar, "Refrigeration and Air-Conditioning", Dhanpat Rai and Co,2009.
4. Stocker W F and Jones J W, "Refrigeration and Air-Conditioning", McGraw Hill,2009.
5. Arora C P, "Refrigeration and Air-Conditioning", Tata McGraw Hill, New Delhi, 4thEdition, 2021.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	1	2	2
CO2	2	2	1	-	-	-	-	-	-	-	1	2	2
CO3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO4	2	2	1	-	-	-	-	-	-	-	1	2	2
CO5	3	2	2	-	-	-	-	-	-	-	1	2	2

CHAIRMAN
(BoS / MECH)

24ME102PE **GAS DYNAMICS AND JET PROPULSION** **L T P C**

(Use of Standard Gas Table is permitted) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Know the basic concepts of compressible fluid flow
- Familiarize the principle and concept of Rayleigh and Fanno flow
- Recognize the phenomenon of shock waves and its effect on flow
- Explore about jet propulsion and its engines
- Gain the knowledge about the working and performance of rocket propulsion

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOW **9**

Energy and momentum equations of compressible fluid flow - stagnation state, mach waves and mach cone - effect of mach number on compressibility - isentropic flow through variable area ducts - nozzle and diffuser.

UNIT II FLOW THROUGH CONSTANT AREA DUCTS **9**

Flow through constant area ducts with heat transfer (Rayleigh flow) and friction (Fanno flow) - basic equations - limiting conditions - variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS **9**

Governing equations - effects of shock - variation of flow parameters across the normal and oblique shocks - Prandtl-Meyer relations - Rankine - Hugoniot relations - applications.

UNIT IV JET PROPULSION **9**

Theory of jet propulsion - thrust equation - thrust power and propulsive efficiency – operating principle, cycle analysis and performance of ram jet, turbojet, turbofan, pulse jet and turbo prop engines.

UNIT V ROCKET PROPULSION **9**

Types of rocket engines - propellants - feeding systems - ignition and combustion theory of rocket propulsion - performance study – staging - terminal and characteristic velocity - applications.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concept of compressible flow through variable area ducts
- Summarize the heat transfer and friction in constant area ducts
- Apply the principles and effects of normal and oblique shocks for various flow parameters
- Analyze the various types and cycle performances of jet propulsion engines
- Examine the performance phenomenon of rocket propulsion

TEXT BOOKS:

1. Yahya S M, "Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion", New Age International Pvt Limited, New Delhi, 6th Edition, 2018.
2. John D Anderson, "Modern Compressible Flow", McGraw Hill, 4th Edition, 2020.

REFERENCES:

1. Cohen H, Rogers G E C and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 5th Edition, 2013.
2. Ganesan V, "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 3rd Edition, 2010.
3. Sutton GP, "Rocket Propulsion Elements", John wiley, New York, 9th Edition, 2016.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	-	2	2
CO2	2	2	2	1	-	-	-	-	-	-	-	2	2
CO3	3	2	2	1	-	-	-	-	-	-	-	2	2
CO4	3	2	2	1	-	-	-	-	-	-	-	2	2
CO5	3	2	2	1	-	-	-	-	-	-	-	2	2

CHAIRMAN
(BoS / MECH)

24ME103PE	ENERGY STORAGE DEVICES (COMMON TO EEE AND MECH)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the necessity, types, comparison, and applications of energy storage systems.
- Relate modelling approaches for the design and analysis of thermal storage systems using simulation tools like TRNSYS..
- Gain knowledge on battery performance and mathematical modelling techniques.
- Acquire knowledge of the principles and operations of various types of fuel cells.
- Explore the principles, and applications of advanced and hybrid energy storage technologies.

UNIT I INTRODUCTION **7**

Necessity of energy storage – Types of energy storage – Comparison of energy storage technologies – Applications.

UNIT II THERMAL STORAGE SYSTEM **10**

Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach, Use of TRNSYS..

UNIT III ELECTRICAL ENERGY STORAGE **10**

Fundamental concept of batteries – measuring of battery performance, charging and discharging, power density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide, Li-ion batteries - Mathematical Modelling for Lead Acid Batteries – Flow Batteries.

UNIT IV FUEL CELL **9**

Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantages and disadvantages.

UNIT V ALTERNATE ENERGY STORAGE TECHNOLOGIES **9**

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications.

TOTAL: 45 PERIODS

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(BoS / MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the need, types, and applications of energy storage technologies.
- Apply modelling techniques for designing and analyzing thermal storage systems using TRNSYS.
- Examine battery performance to develop models for lead-acid and flow batteries.
- Assess the working principles of various types of fuel cells.
- Develop the applications of advanced and hybrid energy storage systems.

TEXT BOOKS:

1. Robert A.huggins,'Energy Storage', Fundamentals, Materials and Applications", Springer, 2nd Edition,2016
2. Ibrahim Dincer and Mark A. Rosen, 'Thermal Energy Storage Systems and Applications', John Wiley & Sons, 3rd Edition, 2021.

REFERENCES:

1. Ru-shi Liu, Lei Zhang and Xueliang sun, 'Electrochemical technologies for energy storage and conversion', Wiley publications, 2nd Volume set, 2012.
2. James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3rdEdition, 2018.
3. Lunardini.V.J, 'Heat Transfer in Cold Climates', John Wiley and Sons 1981, 1st Edition.
4. Schmidt.F.W. and Willmott.A.J., 'Thermal Energy Storage and Regeneration', Hemisphere Publishing Corporation, 1981, 1st Edition.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	-	2	-	-	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-
CO4	3	3	2	-	-	1	-	-	-	-	-
CO5	3	2	2	2	-	2	-	-	-	-	-

CHAIRMAN
(BoS / MECH)

24ME104PE	ADVANCED IC ENGINES COMMON TO AGE AND MECH)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Study the working of Gasoline fuel injection systems and SI combustion
- Know the working of Diesel fuel injection systems and CI combustion.
- Understand the sources, formation mechanisms, and control methods for engine emissions.
- Discuss the various alternative fuel resources and their utilization techniques in IC engines.
- Acquire knowledge of advanced combustion modes and future powertrain systems

UNIT I SPARK IGNITION ENGINES **9**

Air-fuel Mixtures –Automotive Engine Air-fuel Mixture Requirements – Stages of combustion – Normal and Abnormal combustion, Factors affecting knock, Effects of compression ratio – Combustion chambers – Fuel injection systems – Mono-point, Multipoint & Direct injection.

UNIT II COMPRESSION IGNITION ENGINES **9**

Stages of combustion – Factors affecting the delay Period – Phenomenon of Knock – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Swirl Measurement – Direct and Indirect Combustion Chambers – Turbo charging –Variable Geometry turbochargers.

UNIT III EMISSION FORMATION AND CONTROL **9**

Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling emissions – In-cylinder treatments – After treatment systems – Three Way Catalytic converter, Selective Catalytic Reduction, De-NOx Catalyst, Diesel Oxidation Catalyst and Particulate Traps – Methods of emission measurement – Emission norms and Driving cycles National and International Emission Standards.

UNIT IV ALTERNATIVE FUELS **9**

Need for alternate fuels – Alcohol, Vegetable Oils, Bio -Gas, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits – Utilisation Methods - Engine Modifications and Emissions – Performance Characteristics of SI and CI engines.

UNIT V ALTERNATE COMBUSTION AND POWERTRAIN SYSTEM **9**

Homogeneous Charge Compression Ignition (HCCI) – Low Temperature Combustion - Reactivity Controlled Compression Ignition (RCCI) – Gasoline Compression Ignition – Lean Burn Engine – Stratified Charge Engine – Surface Ignition Engine — Spark Assisted HCCI - Hybrid Electric Vehicles– Fuel Cells.

TOTAL: 45 PERIODS

CHAIRMAN
(BoS / MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the working of injection systems and SI combustion.
- Explain the working of Combustion chamber and CI combustion.
- Identify the source and the mechanism of emission formation and control methods.
- Select the various alternative fuels and their adaptability in internal combustion (IC) engine applications.
- Apply advanced combustion modes and assess future powertrain systems.

TEXT BOOKS:

1. V. Ganesan, "Internal Combustion Engines", VthEdition, Tata McGraw Hill, 2012.
2. John B. Heywood, "Internal Combustion Engines Fundamentals", McGraw-Hill, 2nd Edition 2018.

REFERENCES:

1. B.P. Pundir, "IC Engines Combustion & Emission", Narosa Publishing House, 2nd Edition,2014.
2. Richard Stone, "Introduction to Internal Combustion Engines", Palgrave Macmillan Limited, 4th Edition, 2012.
3. EranSher, Handbook of Air Pollution from Internal Combustion Engines: Pollutant Formation and Control, Academic Press, 1998.
4. K.K. Ramalingam, "Internal Combustion Engine Fundamentals", SciTech Publications, 2011.
5. R.B. Mathur and R.P. Sharma, "Internal Combustion Engines", Dhanpat Rai & Sons, 2007

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	-	-	-	-	-	-	2
CO2	2	2	2	2	-	-	-	-	-	-	2
CO3	2	2	1	1	-	-	-	-	-	-	2
CO4	2	2	1	1	-	2	-	-	-	-	1
CO5	2	2	-	-	-	2	-	-	-	-	-

CHAIRMAN
(BoS / MECH)

24ME105PE **DESIGN OF HEAT EXCHANGERS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Describe the types, components and classifications of various heat exchangers.
- Understand the heat transfer methods and parameters for designing heat exchangers.
- Explain the stresses, failures and vibrations in tubes and pressure vessels.
- Know the types, design features and performance of compact heat exchangers.
- Compare the design and performance characteristics of condensers and cooling towers.

UNIT I INTRODUCTION **9**

Types of heat exchangers, shell and tube heat exchangers - regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA).

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS **9**

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers - LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS **9**

Stress in tubes - header sheets and pressure vessels - thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER **9**

Types - Merits and Demerits - Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS **9**

Types of condensers - Design of surface and evaporative condensers – Mean temperature difference - Heat transfer coefficient during condensation - Pressure drop calculation - Cooling tower - Performance characteristics.

TOTAL: 45 PERIODS

CHAIRMAN
(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize the different heat exchanger types as classified by TEMA standards.
- Apply the heat exchangers in industries with its design considerations.
- Examine the stress-induced failures in various components of heat exchangers.
- Differentiate the compact and plate heat exchangers by design and performance factors.
- Analyze the condenser and cooling tower performance based on operating parameters.

TEXT BOOKS:

1. Shah.R. K., Dusan P. Sekulic, "Fundamentals of heat exchanger design", 2nd Edition, John Wiley & Sons, 2023.
2. Sadik Kakac, Hongtan Liu & Anchasa Pramuanjaroenkij., "Heat Exchangers: Selection, Rating, and Thermal Design", 4th Edition, CRC Press, USA, 2020.

REFERENCES:

1. Kuppan Thulukkanam, "Heat Exchanger Design Handbook", 3rd Edition, CRC Press, USA, 2024.
2. Ramesh K. Shah, Dusan P. Sekulic. , "Fundamentals of Heat Exchanger Design", 2nd Edition, John Wiley & Sons Inc, USA, 2023.
3. Robert W. Serth, "Process heat transfer principles and applications", 2nd Edition, Academic press, Elesevier, 2014.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	-	-	2	2
CO2	3	2	2	2	1	-	-	-	-	-	-	2	2
CO3	2	2	2	2	1	-	-	-	-	-	-	2	2
CO4	3	2	2	2	1	-	-	-	-	-	-	2	2
CO5	3	3	2	1	1	-	-	-	-	-	-	2	2

CHAIRMAN
(BoS / MECH)

24EE606PE **SOLAR ENERGY ENGINEERING AND TECHNOLOGY** **(Common to AGE, EEE and Mech)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The students should be made to:

- Understand the principles of solar energy conversion and methods for measuring and estimating solar radiation under various climatic conditions.
- Design standalone and grid-connected photovoltaic systems.
- Analyze the components and semiconductor physics of grid-connected PV systems,
- Evaluate the fundamentals, performance, testing and applications of solar air heaters and concentrating solar collectors
- Describe different thermal energy storage techniques and solar energy applications

UNIT I INTRODUCTION **9**

Energy scenarios – Overview of solar energy conversion devices and applications – Physics of propagation of solar radiation from the sun to the earth – Sun earth geometry, Extra-terrestrial and terrestrial radiation – Solar energy measuring instruments – Geometry, angles and measurement – Estimation of radiation under different climatic conditions – Estimation of total radiation.

UNIT II PHOTOVOLTAIC SYSTEMS **9**

Semiconductor physics – Fundamentals of solar PV cells – Performance characterization of PV cells – Photovoltaic modules and arrays – Components of standalone PV system – Design of standalone PV system – Functioning and components of PV system – Design of a grid connected PV system – Performance analysis of a grid connected PV system.

UNIT III GRID CONNECTED PV SYSTEMS **9**

Schematics semiconductor physics – Component semiconductor physics – Charge conditioners semiconductor physics – Interface components – Balance of system components – PV system in buildings.

UNIT IV SOLAR AIR HEATERS AND CONCENTRATIC COLLECTOR **9**

Basics and performance analysis of solar air heaters – Testing and application of solar air heaters – Fundamentals of concentrating collectors – Concentrating collector technologies and working principle – Concentrating collector.

UNIT V THERMAL ENERGY STORAGE AND APPLICATIONS **9**

Sensible heat, latent heat and thermo-chemical energy storage – Solar pond – Solar pond power plant design – Emerging technologies – Solar energy applications in cooking, desalination, refrigeration and electricity generation – Tutorial: COP of VARS and performance analysis of PVT collector.

TOTAL: 45 PERIODS

CHAIRMAN

BoS (EEE) 16/10/25

COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain solar radiation fundamentals, sun–earth geometry and measurement techniques
- Construct standalone and grid-connected photovoltaic systems based on design principles and application requirements
- Examine the semiconductor physics and components of grid-connected PV systems
- Assess the operation, performance, testing procedures and applications of solar air heaters and concentrating solar collectors
- Design basic layouts of solar pond power plant considering thermal energy extraction and conversion

TEXT BOOK:

1. Tiwari G N, "Solar Energy, Fundamentals, Design, Modeling and Applications", Narosa, 2013.

REFERENCES:

1. Sukhatme S P and Nayak J K, "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill, 2006.
2. Duffie J A and Beckman W A, "Solar Engineering of Thermal Processes", John Wiley, 2006.
3. Yogi Goswami D, Kreith Frank and Jan F Kreider, "Principles of Solar Engineering", Taylor and Francis, 2000.
4. Green M A, "Third Generation Photovoltaics: Advanced Solar Energy Conversion", Springer, 2003.
5. Goetzberger A and Hoffmann V U, "Photovoltaic Solar Energy Generation", Springer Verlag, 2010.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	–	–	–	–	2
CO2	3	3	3	2	–	2	–	–	–	–	2
CO3	3	3	3	2	–	2	–	–	–	–	2
CO4	3	3	3	3	–	–	–	–	–	–	2
CO5	3	3	3	3	–	2	–	–	–	–	2

CHAIRMAN
BoS (EEE)

24ME106PE **POWER PLANT ENGINEERING** **L T P C**

(COMMON TO EEE AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Describe the components of coal-based thermal power plants and their functions.
- Understand the types and components of diesel, gas turbine, combined plants.
- Explain the fundamental concepts of nuclear engineering and nuclear power plants.
- Know the principles and applications of power generation from renewable energy sources.
- Compare the energy, economic, and environmental aspects of various power plants.

UNIT I COAL BASED THERMAL POWER PLANTS **9**

Layout of modern coal power plant, super critical boilers, FBC boilers, coal handling, pulveriser, ash handling and types of draught – surface condenser types – cooling towers – feed water treatment - binary cycles – cogeneration system.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS **9**

Diesel power plant: layout, components – Gas turbine power plant: open and closed cycles, gas turbine plant improvisation methods – Combined cycle power plants – Integrated gasifier based combined cycle systems.

UNIT III NUCLEAR POWER PLANTS **9**

Basics of nuclear engineering, layout and subsystems of nuclear power plants, working of nuclear reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canada Deuterium - Uranium reactor (CANDU), breeder, gas cooled and liquid metal cooled reactors – safety measures for nuclear power plants.

UNIT IV POWER FROM RENEWABLE ENERGY **9**

Hydroelectric power plants: typical layout and associated components – Principle, construction and working of wind, tidal, Solar Photo Voltaic (SPV), solar thermal, geo thermal, biogas and fuel cell power systems.

UNIT V POWER PLANT SYSTEM ANALYSIS **9**

Power tariff types, load distribution parameters, load curve – comparison of site selection criteria – relative merits and demerits – capital and operating cost of different power plants – pollution control technologies including waste disposal options for coal and nuclear power plants.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize the layout, construction and working of thermal power plant components.
- Relate the layout, construction and working of diesel, gas and combined plants.
- Demonstrate the nuclear power plant components and their operational layout.
- Illustrate the layout, construction and operation of renewable energy power plant components.
- Analyze the economics, environmental impacts and cost estimation of power plants.

TEXT BOOKS:

1. Rajput. R. K., “A Textbook of Power Plant Engineering”, 6th Edition, Laxmi Publications, 2023.
2. Nag. P.K., "Power Plant Engineering", 5th Edition, Tata McGraw – Hill Publishing Company Ltd., 2021.

REFERENCES:

1. Arora S C and Domkundwar S, “Power Plant Engineering”, 8th Edition, Dhanpat Rai and Sons, New Delhi, 2016.
2. Godfrey Boyle, “Renewable Energy”, 3rd Edition, Oxford University Press in association with the Open University, 2012.
3. El-Wakil. M.M., "Power Plant Technology", 1st Edition, Tata McGraw – Hill Publishing Company Ltd., 2010.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	-	2	-	-	-	-	2
CO2	2	1	1	-	-	2	-	-	-	-	2
CO3	3	1	1	-	-	2	-	-	-	-	2
CO4	3	1	1	-	-	2	-	-	-	-	2
CO5	3	2	1	-	-	2	-	-	-	-	2

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24ME107PE SUSTAINABLE POWER GENERATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamentals of solar thermal and photovoltaic power generation.
- Relate the principles and design of wind, hydro, and biomass power generation systems.
- Examine the significance of hydrogen energy and fuel cells as future energy solutions.
- Interpret the principles of geothermal, ocean thermal, wave, and tidal energy systems through analysis and design considerations.
- Apply appropriate energy storage technologies and conduct economic analyses using various financial evaluation tools.

UNIT I SOLAR THERMAL AND PHOTOVOLTAIC POWER GENERATION 9

Introduction to global and Indian renewable energy scenarios-Overview of current power generation technologies-Concept and significance of renewable energy-Fundamentals of solar thermal energy conversion-Solar thermal power plant design and analysis: flat plate collectors, concentrating collectors-Working principles and applications of ORC (Organic Rankine Cycle), RC (Rankine Cycle), and Stirling engines-Fundamentals of solar photovoltaic (PV) energy conversion-Design of solar PV power plants- Performance analysis of standalone and grid-connected PV systems

UNIT II WIND, HYDRO, AND BIOMASS POWER GENERATION 9

Introduction and classification of wind energy systems-Components, theory, design, and analysis of wind turbines: horizontal and vertical axis types-Wind farm design and layout considerations-Introduction to hydroelectric power generation-Overview of micro, mini, and small hydro power plants- Types and working of hydraulic turbines-Selection and design criteria for pumps and turbines-Theory and analysis of hydro power plant operation-Fundamentals of biomass energy conversion-Biochemical and thermochemical routes of bioenergy production-Design and analysis of reactors for clean power generation- Introduction to IGCC (Integrated Gasification Combined Cycle) systems.

UNIT III HYDROGEN ENERGY AND FUEL CELLS 9

Importance of hydrogen as a future energy carrier-Various methods for hydrogen generation- Basic principles of fuel cells- Design and working of different types of fuel cells- Applications and advantages of fuel cells- Future prospects of hydrogen energy and IGFC (Integrated Gasification Fuel Cell) systems

UNIT IV GEO AND OCEAN THERMAL ENERGY, WAVE AND TIDAL ENERGY 9

Fundamentals and classification of geothermal energy systems- Theory, design, and analysis of geothermal power plants- Fundamentals and classification of ocean thermal energy systems- Theory, design, and working of ocean thermal power plants- Fundamentals and classification of wave and tidal energy systems- Design and analysis of wave and tidal power plants

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UNIT V ENERGY STORAGE AND ENERGY ECONOMICS **9**

Different modes and technologies of energy storage- Design and analysis of thermal, mechanical, and electrochemical energy storage systems- Cost analysis in energy projects- Interest rate, accounting rate of return (ARR), payback period, discounted cash flow (DCF)- Net present value (NPV), internal rate of return (IRR)- Inflation effect and life cycle analysis (LCA) of energy systems

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the technologies and systems of solar thermal and photovoltaic power generations.
- Explain the design concepts and operational principles of wind, hydro, and biomass-based power systems.
- Apply knowledge of hydrogen production methods and fuel cell technologies for power generation applications.
- Examine the design and operational challenges associated with geothermal, ocean thermal, wave, and tidal energy technologies.
- Analyze various energy storage technologies and financial analysis tools for the assessment of energy systems.

TEXT BOOKS:

1. J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4th Edition, 2021.
2. G. Boyle, "Renewable Energy: Power for a Sustainable Future, Oxford University press, 3rd Edition, 2012.
3. G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2019.

REFERENCES:

1. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 4th Edition, 2013.
2. R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer, 2nd Edition, 2012.
3. https://onlinecourses.nptel.ac.in/noc25_ge54/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	2		-	-	-	2	2	2
CO2	2	2	1	1	-	2		-	-	-	2	2	2
CO3	3	2	2	2	-	2		-	-	-	2	2	2
CO4	3	2	2	2	-	3		-	-	-	2	2	2
CO5	3	2	2	2	-	3		-	-	-	2	2	-

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VERTICAL 2

Design Systems and Development

24ME201PE **NEW PRODUCT DEVELOPMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamental concepts and stages of new product development.
- Gain knowledge in material specifications, standards, and manufacturing processes.
- Conduct studies to prepare detailed technical reports for new product development.
- Analyze product qualification parameters and perform market surveys to benchmark similar products.
- Apply reverse engineering techniques, including cloud point generation and conversion of point cloud data into 3D models.

UNIT I INTRODUCTION **9**

Introduction – Reading of Drawing – Grid reading, Revisions, Engineering Change Note (ECN) – Component material grade, Specifications, customer specific requirements – Basics of monitoring of NPD applying Gantt chart, Critical path analysis – Fundamentals of BOM (Bill of Materials), Engg BOM & Manufacturing BOM. Basics of MIS software and their application in industries like SAP, MS Dynamics, Oracle ERP Cloud – Design Data Management (DDM) – QFD.

UNIT II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS **9**

Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis), Fabrications, Welding process – Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission – Fundamentals of DFMEA - PFMEA, Fundamentals of FEA - Bend Analysis – Hot Distortion – Metal and Material Flow, Fill and Solidification analysis.

UNIT III ESSENTIALS OF NPD **9**

Request For Quotation (RFQ) Processing – Feasibility Studies & reporting – Cross Function Team (CFT) discussion on new product and reporting – Concept design, Machine selection for tool making, Machining – Manufacturing Process selection, Machining Planning, cutting tool selection – Various Inspection methods – Manual measuring, CMM – Geometric Optical Measuring (GOM), Lay out marking and Cut section analysis – Tool Design and Detail drawings preparation, release of details to machine shop and CAM programming – Tool assembly and shop floor trials – Initial sample submission with PPAP documents.

UNIT IV CRITERIONS OF NPD **9**

New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc – Agreement with customer for testing frequencies – Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

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UNIT V REPORTING & FORWARD-THINKING OF NPD 9

Detailed study on PPAP with 18 elements reporting – APQP and its 5 Sections - APQP vs PPAP – Importance of Standard Operating Procedure (SOP) – Purpose & documents, deployment in shop floor. Prototyping & RPT - Concepts, Application and its advantages, 3D Printing – resin models, Sand cores for foundries; Reverse Engineering. Cloud points generation, converting cloud data to 3D model – Advantages & Limitation of RE, Concurrent Engineering (CE) – Basics, Application and its advantages in NPD (to reduce development lead time, time to Market, Improve productivity and product cost).

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamental concepts, processes, and customer-specific requirements in new product development.
- Apply material specification standards and select suitable manufacturing processes based on product requirements.
- Prepare feasibility studies and generate comprehensive technical reports.
- Develop product qualification data and perform market surveys to benchmark competing products.
- Select reverse engineering methods for converting scanned cloud data into accurate 3D product models.

TEXT BOOKS:

1. Sten Jonsson, "Product Development - Work for Premium Values", Liber and Copenhagen Business School Press, Malmo, Sweden, (2004).
2. Karl T. Ulrich, Maria C. Young, Steven D. Eppinger, "Product Design & Development", McGraw Hill, 7th Edition, 2019.

REFERENCES:

1. Steven C Wheelwright & Kim B. Clark, "Revolutionizing Product Development", The Free Press, 2006.
2. Robert G. Cooper, "Winning at New Products", Basic Books, 5th edition, 2017.
3. Bulsara M.A & Thakkar H.R, "Product Design & Value Engineering", Charotar Publishing House Pvt. Ltd., 2nd Edition, 2015.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	-	1	2	1
CO3	3	2	2	1	-	-	-	-	-	-	1	2	1
CO4	3	3	2	1	-	-	-	-	-	-	1	2	1
CO5	3	3	2	1	-	-	-	-	-	-	1	-	-

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24ME202PE **PRODUCT DESIGN AND MANUFACTURING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamental concepts and processes of product design, innovation, and the product life cycle.
- Introduce the principles and applications of value engineering, material selection, and aesthetic design in engineering.
- Equip with the knowledge of design for manufacturing and assembly, failure analysis, and disassembly planning.
- Provide knowledge on plant layout, quality control methods, cost analysis, and intellectual property rights including patents.
- Familiarize with modern rapid prototyping technologies and their applications in product development.

UNIT I INTRODUCTION **9**

Design by Evolution – Design by innovation – Production - Consumption cycle – product realization process - capital circulation - manufacturing capability - Interchangeability - product life cycle - steps for engineering design process - defining problem and setting objectives - developing provisional designs - decision making - morphology of design – product characteristics - developing products - attributes - factors for successful products.

UNIT II VALUE ENGINEERING **9**

Engineering materials - importance of material selection - factors - procedures – manufacturing processes - primary - secondary - tertiary - selection of manufacturing process - steps - types of value – Value engineering - methodology - function analysis system technique - steps – quality function deployment - house of quality - visual design - elements - principles – Aesthetic design - balance - proportions - Emphasis - juxtaposition - Rhythm - unity.

UNIT III DESIGN FOR MANUFACTURING AND ASSEMBLY **9**

Introduction – purpose of design review – Failure Mode and Effect Analysis - DFM guidelines - methods for evaluating design for assembly – Method Time Measurements (MTM) standards - stages of disassembly process planning – product recovery approach – evaluation of disassembly planning – Design for Environment – strategy - process – Computer Integrated Manufacturing - processes involved - benefits - CIM integration – Reverse Engineering - process 3D scanning process.

UNIT IV PLANT LAYOUT DESIGN AND PATENTING **9**

Plant layout - factors - types – Cost and price structure - direct cost, indirect cost – design and manufacturing costs - Quality - factors – Statistical Process Control - control chart – Design of Experiments - acceptance sampling - bench marking types process - benefits - out sourcing – mass customization - approaches – creativity – innovation - types of copyright - types of patents - specifications of patent - procedure for patent registration - advantages of owning patent.

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UNIT V RAPID PROTOTYPING **9**

Rapid Prototyping - process - topography - photo sculpture - concurrent engineering - geometrical modelling technique - Stereo Lithography - Beam Interference Solidification – Solid Ground Curing - Holographic Interference Solidification - Electro setting - Ballistic Particle Manufacture - Multi Jet Modelling - Fused Deposition Modelling - Shape Deposition Manufacturing - Selective Laser Sintering – Laser Engineering Net Shaping - Gas Phase Deposition - Three Dimensional Printing - Laminated Object Manufacturing – Paper Lamination Technology - Applications.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the steps involved in the product design process and distinguish between design by evolution and innovation.
- Apply value engineering techniques and material selection principles to optimize product design.
- Identify product designs using DFMA guidelines and Failure Mode and Effect Analysis.
- Choose appropriate plant layout design, quality control techniques, and patenting procedures.
- Utilize various rapid prototyping methods and assess their suitability for different product development scenarios.

TEXT BOOKS:

1. Karl Ulrich, Steven Eppinger and Maria C. Yang, "Product design and development" McGraw-Hill Higher Education, 7th Edition, 2020
2. Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., "Integrated Product and Process Design and Development: the product realization process" CRC Press, 2nd Edition, 2009.

REFERENCES:

1. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, "Product Design for Manufacture and Assembly", CRC Press, 3rd Edition, 2010.
2. C. K. Chua, K. F. Leong and C. S. Lim, "Rapid Prototyping: Principles and Applications", Cambridge University Press, 2014.
3. https://onlinecourses.nptel.ac.in/noc25_me67/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	2	-	-	-	-	-	-	-	2	3	2
CO3	3	2	2	1	-	-	-	-	-	-	2	2	3
CO4	3	2	2	1	-	-	-	-	-	-	2	3	1
CO5	3	2	2	1	-	-	-	-	-	-	2	3	3

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24ME203PE **SYSTEM DESIGN FOR SUSTAINABILITY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamentals of sustainability and its significance in design.
- Know life cycle approaches and tools for product development.
- Explore methods and tools for designing sustainable product-service systems.
- Outline the challenges in implementing sustainable transitions in system design.
- Familiarize with criteria and tools for sustainability-focused engineering design.

UNIT I FUNDAMENTALS OF SUSTAINABILITY **9**

Introduction to Sustainability - Definition and Scope of Sustainable Development - Importance of Sustainability in Engineering and Product Design - Evolution of Sustainability in Design Thinking - Sustainability in Global Context - Systems Thinking in Sustainability - Indicators and Metrics of Sustainability - Stakeholders in Sustainable Development.

UNIT II PRODUCT LIFE CYCLE DESIGN **9**

Concept and principles of Life Cycle Thinking - Stages of a product life cycle - Environmental impacts across the life cycle - Cradle-to-Grave vs. Cradle-to-Cradle approaches - Design Methods and Strategies for Life Cycle Sustainability - Introduction to LCA Tools and Software - Benefits of incorporating LCA in product design - Case Studies Using Life Cycle Approaches.

UNIT III SUSTAINABLE PRODUCT SERVICE SYSTEMS **9**

Definition - principles of Sustainable Product Service Systems (S-PSS) - Difference between traditional product models and S-PSS models - Environmental, social and economic sustainability aspects of S-PSS - Classification of S-PSS - Sustainable Product Service Solutions - Transition Paths from Products to Services - Barriers and Challenges in Adopting S-PSS Models.

UNIT IV METHODS AND TOOLS FOR DESIGNING S-PSS **9**

Tools for Sustainable System Innovation - Stakeholder Analysis, Value Mapping, System Mapping - Design Methods: IDEO, Design Thinking, Need Approach - Application of Eco-Design and Circular Economy Tools – User Centered and Context-Based Approaches.

UNIT V SUSTAINABILITY TOOLS AND INTEGRATION IN ENGINEERING DESIGN **9**

Introduction to Design for Sustainability framework – Multi Criteria Decision Making (MCDM) in sustainable design - Design for Environment: principles and guidelines - Application - Sustainability trade-offs and decision support systems - Engineering Design Criteria for Sustainability - Guidelines and Checklists for Sustainable Design - integrating LCA, S-PSS, and DFS in the design process - Future Trends in System Sustainability.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concept and evolution of sustainability in the context of design.
- Apply life cycle thinking and assessment tools to evaluate sustainability.
- Develop sustainable product-service system strategies.
- Use design tools and methods for sustainable system development.
- Identify sustainability considerations in engineering design practices.

TEXT BOOKS:

1. Vezzoli, C., Kohtala, C., Srinivasan, A., Xin, L., Fusakul, M., Sateesh, D., & Diehl, J. C, "Product-service system design for sustainability", Routledge, (2017).
2. Fabio Girardi & Carlo Vezzoli, "Designing Sustainable Product-Service Systems", Springer, 2014.

REFERENCES:

1. Ashby, M. F, "Materials and the Environment: Eco-informed Material Choice", Butterworth-Heinemann, (2012).
2. Hauschild, M.Z., Rosenbaum, R.K., & Olsen, S.I, "Life Cycle Assessment: Theory and Practice", Publisher: Springer, 2018.
3. Fiksel, J, "Design for Environment: A Guide to Sustainable Product Development", McGraw-Hill, (2009).
4. https://onlinecourses.nptel.ac.in/noc25_de21/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	3	-	-	-	-	-	2	-
CO2	3	3	2	2	-	2	-	-	-	-	-	2	-
CO3	2	2	2	-	2	3	-	-	-	-	-	2	2
CO4	3	3	2	2	3	2	-	-	-	-	-	2	2
CO5	2	2	2	2	2	3	-	-	-	-	-	2	2

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24ME204PE **DESIGN CODES AND STANDARDS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the purpose and importance of engineering codes and standards.
- Learn various codes and standards used across different industries.
- Know about the sources, publishers, and processes of standardization.
- Familiarize national, international regulations and certification process.
- Identify design codes for equipment and systems in various engineering applications.

UNIT I INTRODUCTION **9**

Introduction to Codes and Standards - Definition of Codes and Standards - Need for codes and standards - Objective of Codes and Standards - Overview of Codes, Standards, and Good Engineering Practices.

UNIT II CODES **9**

Codes and Standards used in Different Industry - Material, Design, Inspection and Construction Codes - Process Industry Codes - Machinery Design codes - Codes used in Oil and Gas Industry - Welding Codes - Machine Design – Automotive – HVAC - Performance Test Codes - Other Discipline codes.

UNIT III STANDARDS **9**

Sources of Codes and Standards - Publishing Authorities - International Societies and Professional Bodies - Process of Standardisation and Code publishing in Professional Bodies and Companies - Interdisciplinary Codes.

UNIT IV REGULATIONS **9**

Government and Federal Regulations - Need for them - Indian and International Regulations - Standards organisations - Weather and Climatic codes - IS, ISO, IBR, OISD - Certification Bodies - Authorities and Engineers to certify – PE, Chartered Engineers.

UNIT V DESIGN CODES **9**

Codes and Standards applicable in Process Industry Equipment Design - Pressure Vessel Design Codes - Heat Exchanger Design Codes - Wind and Seismic Codes - Machinery Codes - Package Equipment Design Codes - Performance Test Codes - ASTM, ASME, API, AWS, ANSI, ISO, ASHRAE..

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Classify the various codes and standards for industrial customisation.
- Identify appropriate codes for specific industries and applications.
- Explain the role of professional bodies and standardization processes.
- Interpret and comply with Indian and international regulations.
- Apply relevant design codes in various industrial equipments.

TEXT BOOKS:

1. Sam Mannan, Lees, "Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control", 4th Edition, Elsevier, 2012.
2. Charles E. Baukal Jr., "Codes and Standards in Engineering for Mechanical and Process Industries", CRC Press, 2017.

REFERENCES:

1. ASME Boiler and Pressure Vessel Code (BPVC), American Society of Mechanical Engineers, Latest Edition.
2. API Standards Manual, American Petroleum Institute, Latest Edition.
3. Maan H. Jawad & James R. Farr, Structural Analysis and Design of Process Equipment, 3rd Edition, Wiley, 2018.

Mapping of COs with POs and PSOs

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CO1	2	2	2	-	-	-	-	-	-	-	1	2	-
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CO4	2	2	2	-	-	2	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	1	2	-

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24ME205PE INTRODUCTION TO AIRCRAFT DESIGN

	L	T	P	C
	3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the fundamental aspects and conceptual design of Cargo, Military, and General Aviation sectors.
- Understand the fundamentals of aircraft configuration layout and sizing.
- Gain knowledge in drag and lift coefficient estimation for subsonic aircraft.
- Know about constraint analysis and various aircraft loads.
- Identify the cost estimation methods applied to different types of aircraft.

UNIT I INTRODUCTION 9

Aircraft design- Phases, design stages, process and importance of cost- The design spiral- basic laws and requirements capture Airliners- key issues, design considerations- future airliners, supersonic transport aircraft, Cargo, General aviation and Military aircraft. Design configuration - podded engines on wings, wing sweep, canards and flying wing three surface aircraft - winglets and thrust vectoring.

UNIT II LAYOUT CHOICES AND INITIAL SIZING 9

Choices, Wing Geometry Definitions, Options for Wing layout - Propulsion System - Tail Plane and Landing Gear Layout Landing Gear of some Famous Aircraft - Initial Sizing in Aircraft Design Take-off weight build-up. Estimation - Empty Weight Fraction, Mission Segment Weights, Fuel Weight Fractions - maximum L/D - engine parameters and Design gross weight..

UNIT III DRAG COEFFICIENT AND LIFT COEFFICIENT 9

Subsonic Parasite Drag Estimation - Component Build-up Method - Drag Estimation of Military Aircraft. Estimation of Lift Coefficient - Maximum Lift Coefficient Flaps as High Lift Devices - Transport Aircraft and Military Aircraft.

UNIT IV CONSTRAINT ANALYSIS AND AIRCRAFT LOADS 9

Introduction- Transport Aircraft and Military Aircraft. Refined Sizing-Refined Sizing of Jet Fighter Aircraft. Limit Manoeuvre Envelope Effect of Gust- Aircraft Loads - High Altitude Long Endurance and Morphing of Aircraft Configurations.

UNIT V COST ESTIMATION 9

Aircraft Conceptual Design Life Cycle, Research, Development Test and Evaluation Production Cost Estimation of Transport Aircraft HALE UAV Direct Operating Cost - Fighter Aircraft Life Cycle Range Payload Diagram- Transport Aircraft - Environmental issues in Aircraft Design.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply knowledge in conceptual design of Cargo, Military, and General Aviation
- Identify and formulate the aircraft configuration and Sizing
- Examine the estimation of drag and lift coefficient
- Apply appropriate techniques to analysis Transport, Military, and HALE aircraft constraints
- Analyze the Estimation of Cost for Transport, Military, and UAV aircraft

TEXT BOOKS:

1. Raymer, D. P., "Aircraft Design - A Conceptual Approach", AIAA Educational Series, 7th Ed., 2024.
2. Leland M. Nicolai and Grant E. Carichner, "Fundamentals of Aircraft and Airship Design Volume I – Aircraft Design", AIAA Education Series, 2010

REFERENCES:

1. Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R., "Introduction to Aeronautics: A Design Perspective", AIAA Educational Series, 3rd ed., 2015
2. Jenkinson, L. R., Simpkin, P. and Rhodes, D., "Civil Jet Aircraft Design", Arnold Publishers, London, 1999.
3. Fielding, J., "Introduction to Aircraft Design", Cambridge Aerospace Series, Cambridge University Press, 2017
4. https://onlinecourses.nptel.ac.in/noc25_ae20/preview

Mapping of COs with POs and PSOs

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CO2	3	3	2	2	-	-	-	-	-	-	2	2	-
CO3	3	3	2	2	-	-	-	-	-	-	3	2	-
CO4	3	3	2	2	-	-	-	-	-	-	2	2	-
CO5	2	2	-	-	-	-	-	-	-	-	2	2	-

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24ME206PE **INTELLIGENT MOBILITY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know about the concept of automotive electronics and intelligent vehicles.
- Study the working principles of various sensors in smart systems.
- Understand the basic control system in behavior of autonomous vehicle systems.
- Explain the fundamentals of wireless networking and technology.
- Understand the connections of autonomous vehicle technologies on intelligent decision-making.

UNIT I INTRODUCTION TO AUTOMATED, CONNECTED, AND INTELLIGENT VEHICLES **9**

Concept of Automotive Electronics, Electronics Overview, History & Evolution, Infotainment, Body, Chassis, and Powertrain Electronics, Introduction to Automated, Connected, and Intelligent Vehicles.

UNIT II SENSOR TECHNOLOGY FOR SMART MOBILITY **9**

Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, LIDAR Sensor Technology and Systems, Camera Technology, Night Vision Technology, Other Sensors, Use of Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems

UNIT III CONNECTED AUTONOMOUS VEHICLE **9**

Basic Control System Theory applied to Automobiles, Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous Vehicles, Role of Surroundings Sensing Systems and Autonomy, Role of Wireless Data Networks and Autonomy

UNIT IV VEHICLE WIRELESS TECHNOLOGY & NETWORKING **9**

Wireless System Block Diagram and Overview of Components, Transmission Systems – Modulation/Encoding, Receiver System Concepts– Demodulation/Decoding, Wireless Networking and Applications to Vehicle Autonomy, Basics of Computer Networking – the Internet of Things, Wireless Networking Fundamentals.

UNIT V CONNECTED CAR & AUTONOMOUS VEHICLE TECHNOLOGY **9**

Connectivity Fundamentals, Navigation and Other Applications, Vehicle-to-Vehicle Technology and Applications, Vehicle-to-Roadside and Vehicle-to-Infrastructure Applications, Autonomous Vehicles - Driverless Car Technology, Moral, Legal, Roadblock Issues, Technical Issues, Security Issues

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the principles of integrated control systems and their role in accident avoidance and autonomous vehicle management.
- Understand the concept of remote sensing and the various sensor technologies.
- Examine autonomous vehicles and their functioning with smart systems.
- Apply the concepts of wireless communications and wireless data networks in intelligent vehicles.
- Assess the connected vehicle and its role in automated vehicles technology.

TEXT BOOKS:

1. "Intelligent Transportation Systems and Connected and Automated Vehicles", 2016, Transportation Research Board
2. Radovan Miucic, "Connected Vehicles: Intelligent Transportation Systems", 2019, Springer

REFERENCES:

1. Hossein Pishro-Nik, "Connected and Automated Vehicles: Technologies and Challenges," 2022, Springer.
2. Tom Denton, "Automobile Electrical and Electronic systems, Roultedge", Taylor & Francis Group,5th Edition,2018
3. William B. Ribbens, "Understanding Automotive Electronics," 7th Edition, 2017, Butterworth-Heinemann.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	1	-	-	-	-	2	2	1
CO2	2	2	1	1	-	1	-	-	-	-	2	2	1
CO3	3	2	1	1	-	1	-	-	-	-	3	2	1
CO4	3	2	1	1	-	1	-	-	-	-	2	2	1
CO5	3	2	1	1	-	1	-	-	-	-	2	2	1

CHAIRMAN
(BoS / MECH)

24ME207PE **COMPUTATIONAL FLUID DYNAMICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know governing equations and boundary conditions in CFD for various flow problems.
- Understand turbulence models and mesh generation techniques for CFD applications.
- Apply CFD techniques for internal and external flow problems and interpret simulation results.
- Familiarize with external and thermal flow problems in complex phenomena.
- Learn finite volume methods and algorithms for pressure–velocity coupling in CFD.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS **9**

Basics of Computational Fluid Dynamics (CFD) – governing equations of fluid dynamics – continuity, momentum and energy equations – chemical species transport – physical boundary conditions – time-averaged equations for turbulent flow – turbulent – kinetic energy equations – mathematical behaviour of partial differential equations on CFD - elliptic, parabolic and hyperbolic equations.

UNIT II TURBULENCE MODELS AND MESH GENERATION **9**

Turbulence models, mixing length model, two equation (k-C) models – high and low Reynolds number models – structured grid generation – unstructured grid generation – mesh refinement – adaptive mesh – software tools.

UNIT III APPLIED PROJECTS ON INTERNAL FLOW **9**

Internal fluid flow – pipe bends, branch and lateral – symmetric – transient – header flow distribution post processing – different CFD outputs: contour plots, surface plots, plotting, vectors, turbulence modelling and external flow – flow over a circular cylinder, simple car and an aeroplane.

UNIT IV APPLIED PROJECTS ON EXTERNAL AND THERMAL FLOW **9**

Radiation problems – heat transfer distribution – porous media – pump – fan – gaseous combustion – particle study – multiphase problems.

UNIT V FLOW FIELD ANALYSIS **9**

Finite volume methods – representation of the pressure gradient term and continuity equation staggered grid – momentum equations – pressure and velocity corrections – pressure correction equation, simple algorithm and its variants – PISO algorithms.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize the governing equations and boundary conditions for solving CFD problems.
- Select appropriate turbulence models and generate suitable computational meshes for accurate CFD analysis.
- Identify internal and external fluid flow outputs using appropriate turbulence models and post-processing methods.
- Explain the heat transfer, radiation, porous media, combustion, and multiphase flows using CFD tools.
- Apply finite volume techniques and implement SIMPLE and PISO algorithms for accurate flow field analysis.

TEXT BOOKS:

1. Anderson "Computational Fluid Dynamics - The Basics with Application", McGraw Hill,Indian Edition, 2019.
2. Versteeg HK and Malalasckera W, "An Introduction to Computational Fluid Dynamics:The finite volume Method", Pearson Education Ltd., 3d Edition, 2021.

REFERENCES:

1. Anil W Date, "Introduction to Computational Fluid Dynamics", Cambridge University Press, 2009.
2. Chung T J., "Computational Fluid Dynamics", Cambridge University Press, 2nd Edition,2014.
3. Muralidhar K and Sundararajan T, "Computational Fluid Flow and Heat Transfer",Narosa Publishing House, New Delhi, 2014.
4. Suhas Patankar, "Numerical Heat Transfer and Fluid Flow", CRC Press, 1" Edition, 2017.
5. "ANSYS Workbench Manual", ANSYS Inc., 2025.
6. https://onlinecourses.nptel.ac.in/noc25_me165/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	2	2	-	-	-	-	-	-	2	2	2

CHAIRMAN
(BoS / MECH)

24ME208PE **PRESSURE VESSELS AND PIPING DESIGN**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn about mechanical design fundamentals and its applications.
- Understand knowledge in pressure vessel fundamentals.
- Know the design procedure and criteria for pressure vessels.
- Gain knowledge in the design of piping systems and their components.
- Familiarize with stress analysis concepts relevant to pipe support design.

UNIT I INTRODUCTION **9**

Engineering drawing fundamentals - piping drawings - piping and instrumentation diagram - plot plan layout - mechanical design fundamentals - pressure, temperature, flow rate, stress, strain, theories of failure - methods for determining stresses - terminology and ligament efficiency- applications.

UNIT II STRESSES IN PRESSURE VESSEL **9**

Introduction stresses in circular ring and cylinder - dilation of pressure vessels – membrane stress analysis of vessel cylindrical, spherical and conical heads - thermal stresses discontinuity stresses in pressure vessels.

UNIT III DESIGN OF PRESSURE VESSEL **9**

Pressure vessel design as per ASME Section VIII - design of shell, head, nozzles and saddles as per ASME for internal and external pressure - welding reinforcement calculations – calculating allowable stress as per ASME section II.

UNIT IV PIPING ELEMENT AND MATERIALS **9**

Piping components - pipe, fittings, flanges, gaskets, bolting and valves - isolation, regulation, non-return and special purpose valves - piping materials - piping codes and standards - pipe sizing, diameter and pressure drop calculations.

UNIT V PIPING SUPPORTS AND STATIC STRESS ANALYSIS **9**

Piping supports restraints and hangers variable and constant load spring hangers selection design methodologies - method of analysis-static stress analysis - piping flexibility-code stress requirement.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the mechanical design concepts and its applications.
- Describe the induced stresses and their impact on pressure vessel.
- Design pressure vessels with a variety of applications.
- Apply engineering standards to the design of piping and choice of materials.
- Examine the stress variations in piping support systems.

TEXT BOOKS:

1. Mohinder L Nayyar, "Piping handbook". McGraw Hill Handbook, 8th Edition, 2006.
2. Henry H Bedner, "Pressure Vessels, Design Hand Book", Kriegr publishering company, 2nd Edition, 1991.

REFERENCES:

1. Bansal R K., "Strength of Materials", Laxmi Publications Pvt. Ltd., 7th Edition, 2022.
2. ASME Pressure Vessel and Boiler Code, Section VIII Divison 1 & 2", 2024.
3. Sam Kannapan, "Introduction to Pipe Stress Analysis", ABI Enterprises, 3rd Edition, 2008.
4. Dennis Moss and Michael Basic, "Pressure Vessel Design Manual", Butterworth- Heinemann, 4th Edition, 2012.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	1	2	1
CO2	3	2	2	1	-	-	-	-	-	-	1	2	1
CO3	3	2	2	1	-	-	-	-	-	-	1	2	1
CO4	2	2	2	1	-	-	-	-	-	-	1	2	1
CO5	2	2	2	1	-	-	-	-	-	-	1	2	1

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VERTICAL 3

Advanced Manufacturing

24ME301PE	METAL ADDITIVE MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the foundational concepts and relevance of Additive Manufacturing
- Use CAD tools to design and prepare 3D models to process-specific design constraints.
- Explain the operating mechanisms, and classifications of various processes.
- Describe the characteristics of various metal additive techniques.
- Explore the future potential and sustainability of additive manufacturing technologies.

UNIT I INTRODUCTION TO ADDITIVE MANUFACTURING & DESIGN CONSIDERATIONS **9**

Introduction – Evolution, Classification, Benefits & Limitations of Additive Manufacturing - Design Freedom in AM – Complex geometries, Functionally Graded Materials (FGMs), Customization– Modular Design Principles– Topology Optimization – Concepts and tools.

UNIT II CAD AND DIGITAL TOOLS **9**

CAD Tools for AM – Requirements and specialized features – Pre-processing and slicing strategies – Design rules and constraints for AM – Modelling and Simulation for AM - Process modelling, defect prediction, File Formats.

UNIT III METAL ADDITIVE MANUFACTURING PROCESSES AND TECHNOLOGIES **9**

Fundamentals of Metal AM Physics - Thermal and phase transformations - Laser-based Metal AM Processes – Extrusion-Based Metal AM - Filament-based AM systems – Powder-bed fusion systems

UNIT IV TECHNIQUES USED IN METAL ADDITIVE MANUFACTURING **9**

Directed Energy Deposition (DED) - Binder and Material Jetting Processes – Sheet Lamination Techniques – Powders, filaments – production and handling - Microstructure, porosity, defects – Heat treatment, machining, surface finishing.

UNIT V POST-PROCESSING, TESTING & FUTURE TRENDS **9**

Testing and Quality Assurance – NDT methods - Reverse Engineering - 3D scanning, CAD reconstruction - Value Analysis and Cost Consideration - Sustainability and Future of Metal AM.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the basic concepts, evolution, and relevance of additive manufacturing in modern industry.
- Apply CAD tools to model components suitable for additive manufacturing, considering design constraints.
- Identify various additive manufacturing processes based on their classifications and operating mechanisms.
- Develop the different metal additive manufacturing techniques with relevant applications
- Select appropriate methods to assess the sustainability of additive manufacturing technologies in various sectors.

TEXT BOOKS:

1. Balasubramanian K R, and Senthilkumar V, "Additive manufacturing applications for metals and composites", IGI Global, 6th Edition, 2020.
2. Celik E, "Additive manufacturing: Science and Technology", Walter de Gruyter GmbH & Co, 2nd Edition, 2025.

REFERENCES:

1. Lachmayer, Roland, Tobias Ehlers, and René Bastian Lippert, "Design for additive manufacturing" Springer Nature, 1st Edition, 2024.
2. Rajendrachari S, "Practical Implementations of Additive Manufacturing Technologies", Springer Nature, 4th Edition, 2024.
3. Ajay Kumar, Ashish Kumar Srivastava, Naveen Sharma, Parveen Kumar, "3D Printing Technologies Digital Manufacturing, Artificial Intelligence, Industry 4.0", Walter de Gruyter GmbH & Co, 1st Edition, 2024.
4. https://onlinecourses.nptel.ac.in/noc25_me130/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	1	-	-	2	2	2	2
CO2	3	2	2	-	2	-	1	-	-	2	2	2	2
CO3	2	2	2	-	3	-	1	-	-	2	2	2	2
CO4	3	1	-	-	2	-	2	-	-	2	2	2	2
CO5	3	2	2	-	2	-	1	-	-	2	2	2	2

CHAIRMAN
(BoS / MECH)

24ME302PE APPLIED HYDRAULICS AND PNUEMATICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn hydraulic power systems types and its components performance.
- Understand hydraulic Pumps and its types used in different applications.
- Obtain the knowledge in Pneumatic operations and its flow parameters.
- Learn actuators and control valve system in fluid power transmission.
- Gain knowledge by doing case studies on different circuit components.

UNIT I FUNDAMENTALS OF FLUID POWER AND HYDRAULICS 9

Introduction - power transmission methods - merits - demerits - brief history - basic components - basic Jaws and symbols: pascal's law - hydraulic jack, hydraulic brake, pressure intensifier - bernoulli equation - venturi - torricelli theorem - siphon - continuity equation - flow configuration - concept of pressures - gas laws and numerical - fluid power symbols for various hydraulic and pneumatic components, hydraulic lines, color coding, miscellaneous and port configurations.

UNIT II HYDRAULIC PUMP 9

Hydraulic Pumps - classifications - pumping theory - ideal pump - pump losses – efficiency curve - constructional features and operations of external gear pump, internal gear pump, gerotor pump, screw pump and vane pumps - piston pumps - hand pump, bent axis axial piston pump, swash plate axial piston pump, radial piston pumps - pump failure and cavitation.

UNIT III PNEUMATIC SYSTEMS AND COMPONENTS 9

Introduction - air preparation - energy loss and cost break down - compressor - classification - air receiver - construction and operation of single and multi-stage piston pump - rotary vane compressor, twin lobe air compressor, screw compressor, liquid ring compressor and selection criteria - pneumatic pressure drop effect - minimizing pressure drop - predictions using various empirical formulae and nomogram - air distribution system - sizing of pipes, tubes, materials and fittings - air flow parameters - compressed air piping system and installation tips - air dryers - need - methods - types - refrigerated air dyers, absorption dryer, adsorption dyer, membrane dryer - analysis of moisture removal from air.

UNIT IV CONTROL COMPONENTS 9

Control Elements - constructional details, operations and application areas of various types of directional control valves, pressure control valves and flow control valve - actuators: rotary and linear actuators - types, characteristics, operations, efficiencies, torque and power - numerical analysis - subsystems: reservoirs - hydraulic fluids - seals - filters - accumulators – maintenance - servo and proportional valves: constructional details, operations and applications - hydrostatic transmission and control: different configurations and analysis - pump and motor characteristics. Electro Pneumatic System - Ladder diagram – timer circuits.

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UNIT V DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS **9**

Circuit Design and Analysis: development of single actuator circuits, development of multiple actuator circuits, cascade method for sequencing - role of modeling and simulation in hydraulic components - case studies - research challenges - status and developments: stationary hydraulics and mobile hydraulics. Trouble shooting techniques.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand fluids and its power systems and component usages.
- Utilize various pumps for different industrial applications.
- Apply the knowledge of various pneumatic system components to solve industrial problems.
- Develop various circuits with sensors, actuators, and timers to different usages.
- Identify the solutions for various industrial Problems using trouble shooting methods.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", 7th Edition, Pearson, 2017.
2. Majumdar, S.R., "Oil Hydraulics Systems – Principles and Maintenance", Tata McGraw Hill, 2001.
3. Srinivasan.R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints, 3rd edition,2019

REFERENCES:

1. Jagadeesha. T., "Pneumatics Concepts, Design and Applications", Universities Press, 2015.
2. Joshi.P., "Pneumatic Control", Wiley India, 2008.
3. James A. Sullivan, "Fluid Power Theory and Applications", Fourth Edition, Prentice Hall, 1997.
4. Shanmuga sundaram. K., "Hydraulic and Pneumatic Controls". Chand & Co, 2006.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	1	2	1
CO2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	2	-	-	-	-	-	-	-	1	2	1
CO4	3	2	2	-	-	-	-	-	-	-	1	2	1
CO5	3	2	2	2	-	-	-	-	-	-	1	2	1

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24ME303PE	PRODUCT LIFE CYCLE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Know PLM opportunities and infrastructure in product management.
- Gain the knowledge in PLM data management and its functions.
- Identify different PLM module and its approaches in commercial applications.
- Study the PLM/PDM strategy, benefits and barriers in the industrial implementations.
- Understand EAI technology use and purpose in the integration of PLM/PDM system.

UNIT I TERMINOLOGIES OF PLM **9**

Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications

UNIT II FUNCTIONS AND FEATURES OF PLM/PDM **9**

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration

UNIT III PDM/PLM MODULES AND SOFTWARES **9**

Case studies based on top few commercial PLM/PDM tools – Teamcenter, Windchill, ENOVIA, Aras PLM, SAP PLM, Arena, Oracle Agile PLM and Autodesk Vault. -Architecture of PLM software-selection criterion of software for particular application.

UNIT IV IMPLMENTATION OF PLM IN INDUSTRIES **9**

Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organisation, users, product or service, process performance- process compliance and process automation.

UNIT V SOFTWARE CUSTOMISATION/INTEGRATION IN PDM/PLM **9**

PLM work flow Customization – objectives, methods, use, types and purpose of EAI technology (Middleware) and Integration, connectivity methods with legacy data base, CAD, SLM and ERP systems.

TOTAL: 45 PERIODS

CHAIRMAN
(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the various methods and approaches in PLM
- Apply data functions and communication features with the integration of PLM/PDM.
- Implement PLM/PDM modules and software in commercial business programme.
- Develop the approaches followed in PLM/PDM applications in business functions.
- Identify suitable PLM/PDM connectivity methods with other data bases, CAD and ERP systems.

TEXT BOOKS:

1. Product Lifecycle Management for a Global Market, Springer; 2014, ISBN-10: 3662516330
2. Gerardus Blokdyk, "Product life-cycle management PLM", 5star cooks, 2019

REFERENCES:

1. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", Springer Publisher, 2013.
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, "Implementing and Integrating ProducData Management and Software Configuration Management", Artech House Publishers, 2003.
3. John Stark, "Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question", Springer Publisher, 2007
4. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", Springer Publisher, 2024.
5. Michael Grieves, "Product Life Cycle Management", Tata McGraw Hill, 2006.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	-	2	1
CO2	2	2	1	1	-	-	-	-	-	-	-	2	1
CO3	2	2	1	1	-	-	-	-	-	-	-	2	1
CO4	2	2	1	1	-	-	-	-	-	-	-	2	1
CO5	2	2	1	1	-	-	-	-	-	-	-	2	1

CHAIRMAN
(BoS / MECH)

24ME304PE PLANT LAYOUT AND MATERIAL HANDLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Obtain the knowledge of plant layout techniques and its types
- Study the equipment cost, purpose and demands in the selection of material handling system
- Identify Various applications of Hoist and auxiliary equipment in industrial applications.
- Gain knowledge in all type of conveying equipment and its control method.
- Understand the maintenance and safety guidelines followed in material handling system.

UNIT I PLANT LAYOUT **9**

Principle of plant layout - types of layouts - planning a layout - economics by types of layouts - evaluation of alternate layout - factors influencing plant layout - material factor - man factor - movement factor - service factor - building factor - plant layout techniques and models - flow planning and analysis - plant arrangement - process arrangement.

UNIT II MATERIAL HANDLING EQUIPMENTS **9**

Principle of material handling - from to chart - estimating equipment requirement - effects of variation of demand - selection of material handling - continuous and intermittent flow fixed path equipment - variable path equipment - special purpose vehicle - cost criteria for equipment decision - movement costs - labour and investment rates - operating cost - loading and unloading cost.

UNIT III AUXILIARY AND HOISTING EQUIPMENT **9**

Hoppers - Gates- Feeders- Chutes-positioners- Ball Table- Weighing and Control Equipment- Pallet loaders and unloaders -applications and advancements. Hoisting equipment - pulley - hoist - monorail conveyors - monorail telpher - crane trolley - cranes - revolving or rotary cranes - cranes travelling on guide rails - trackless cranes - bridge crane - cable crane - floating cranes - crane helicopters.

UNIT IV CONVEYOR SYSTEM **9**

Traction type conveyors - belt conveyors - chain conveyors - push through conveyors - indexing conveyor - cable conveyor - traction less type conveyors - sliding friction gravity conveyor - roller conveyor - screw or spiral conveyors - twin helical conveyor - oscillating conveyors.

UNIT V ORGANISATION, MAINTENANCE AND SAFETY **9**

Organization - material handling activities in organization - maintenance of industrial trucks, conveyor, cranes and hoists - safety in material handling - safety regulation in material handling - employee training - recommendation for safe use of hoist - design and operation conditions - operation control - material storage guidelines - housekeeping - aisles and passageways.

TOTAL: 45 PERIODS

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(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the factors involved in plant process layout and plant arrangement.
- Select suitable material handling equipment for specific operations in industry.
- Use the various types of auxiliary equipment in material handling system.
- Choose suitable conveying equipment for different applications.
- Apply the safety procedures and condition to be followed in working environment

TEXT BOOKS:

1. Choudary R B, Tagore G RN, "Plant layout and materials handling", Khanna publisher, 2nd Edition, 2016.
2. Siddhartha Ray, "Introduction to Materials handling", New Age International Publishers, 2nd Edition, 2017

REFERENCES:

1. Pemberton AW, "Plant layout and Material handling", The Macmillan Press Ltd, 2016.
2. Gary R Kreiger, John F Montgomery, "Accident prevention manual for industrial operations", N.S.C., Chicago, 1 11h Edition, 2012.
3. Mark A. Friend, James P. Kohn "Fundamentals of Occupational Safety and Health", 7th Edition, Bernan Press, 2018.
4. Matthew P. Stephens, "Manufacturing Facilities Design & Material Handling", Purdue University Press, 6th Edition, 2019.
5. Michael Rivkin, "Bulk Material Handling: Practical Guidance for Mechanical Engineers", Kindle Edition, Partridge Publishing Singapore, 2018.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	-	-	-	-	-	2	-	-	2	2
CO5	3	2	-	-	-	-	-	-	2	-	-	2	-

CHAIRMAN
(BoS / MECH)

24ME305PE	RAPID MANUFACTURING (COMMON TO BME AND MECH)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the fundamentals and evolution of rapid manufacturing.
- Learn product design principles and reverse engineering techniques in RM.
- Explore various RM processes and their material compatibility.
- Gain knowledge on 3D printing and post-processing techniques.
- List the role of digital tools in rapid product development.

UNIT I INTRODUCTION TO RAPID MANUFACTURING AND DESIGN FUNDAMENTALS **9**

Introduction – Evolution, Need, and Scope - Benefits and Limitations of RM– Product Design Process Overview – Product Development Process - Design for Modularity – Principles and Applications.

UNIT II REVERSE ENGINEERING AND 3D MEASUREMENT **9**

Reverse Engineering – Reverse Engineering Integration with CAD – Subtractive versus Rapid Manufacturing - 3D Measurement Techniques – File Formats – Data Handling - Digital Model Repair - Pre-processing Techniques

UNIT III ADDITIVE MANUFACTURING PROCESSES: POLYMERS, POWDERS, LIQUIDS AND LAMINATES **9**

Polymerization - Stereolithography Process - Digital Light Processing – Powder-based Processes - Selective Laser Sintering Process– Liquid Based Process - Multi Jet Fusion - Material Jetting process Sheet Stacking Process - Laminated Object Manufacturing - Extrusion based processes.

UNIT IV 3D PRINTING AND POST PROCESSING TECHNIQUES **9**

Additive Manufacturing – 3D Printing and 3D Scanning Process – Beam Deposition Process – Directed Energy Deposition Method - Electron Beam Additive Manufacturing – Metal Materials Used in RM - Hybrid Manufacturing - Post-processing concerns- Cost Estimation and Economic Aspects of RM.

UNIT V RAPID PRODUCT DEVELOPMENT AND INDUSTRIAL APPLICATIONS **9**

Rapid Product Development - CAD/CAE/CAM – CIM and Automation in RM - Software Tools for Design & Simulation - Case Studies in RM - Plant Simulation.

TOTAL: 45 PERIODS

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(BoS / MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals and scope of Rapid Manufacturing and design principles.
- Apply reverse engineering and 3D measurement techniques in product digitization.
- Develop various RM processes based on material and process characteristics.
- Solve post-processing techniques and perform costing analysis for RM components.
- Choose CAD/CAM tools and applications through appropriate software.

TEXT BOOKS:

1. Kamrani, Ali K, and Emad Abouel Nasr, "Engineering design and rapid prototyping", Springer Science & Business Media, 2nd Edition, 2015.
2. Gebhardt Andreas, "Understanding additive manufacturing", Hensar Publication, 2nd Edition 2019.

REFERENCES:

1. Gibson I, Rosen D, Stucker B, and Khorasani M, "Additive manufacturing technologies", Vol.17, Springer 2021.
2. Hopkinson N, Hague R, and Dickens P, "Rapid manufacturing: an industrial revolution for the digital age" John Wiley & Sons, 6th edition, 2013.
3. Pham D and Dimov S S, "Rapid manufacturing: the technologies and applications of rapid prototyping and rapid tooling", Springer Science & Business Media, 1st Edition, 2012.
4. https://onlinecourses.nptel.ac.in/noc25_me125/preview

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	1	1	-
CO2	3	2	1	-	2	-	-	-	1	1	-
CO3	3	2	1	-	2	-	-	-	1	1	-
CO4	3	2	1	-	2	-	-	-	1	1	-
CO5	2	2	1	1	2	-	-	-	1	1	-

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24ME306PE **DIGITAL MANUFACTURING AND IOT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the various features of digital manufacturing
- Study the development of digital manufacturing, product lifecycle, and supply chain management
- Obtain knowledge of smart manufacturing systems modified for the digital workplace
- Understand the IoT technologies that bolster digital manufacturing processes
- Identify the significance of digital twins in modern manufacturing

UNIT I INTRODUCTION **9**

Introduction – Need – Overview of Digital Manufacturing and the Past – Aspects of Digital Manufacturing: Product life cycle, Smart factory, and value chain management – Practical Benefits of Digital Manufacturing – The Future of Digital Manufacturing.

UNIT II DIGITAL LIFE CYCLE & SUPPLY CHAIN MANAGEMENT **9**

Collaborative Product Development, Mapping Requirements to specifications – Part Numbering, Engineering Vaulting, and Product reuse – Engineering Change Management, Bill of Material and Process Consistency – Digital Mock up and Prototype development – Virtual testing and collateral. Overview of Digital Supply Chain - Scope& Challenges in Digital SC - Effective Digital Transformation - Future Practices in SCM

UNIT III SMART FACTORY **9**

Smart Factory – Levels of Smart Factories – Benefits – Technologies used in Smart Factory – Smart Factory in IoT- Key Principles of a Smart Factory – Creating a Smart Factory – Smart Factories and Cybersecurity

UNIT IV INDUSTRY 4.0 **9**

Introduction of Industry 4.0 –Internet of Things – Industrial Internet of Things – Framework: Connectivity devices and services – Intelligent networks of manufacturing – Cloud computing – Data analytics –Cyber physical systems –Machine to Machine communication – Case Studies. Basics of Artificial Intelligent and Machine learning, Deep Learning

UNIT V DIGITAL TWIN TECHNOLOGY **9**

Basic Concepts – Features and Implementation – Digital Twin: Digital Thread and Digital Shadow-Building Blocks – Types – Characteristics of a Good Digital Twin Platform – Benefits, Impact & Challenges – Future of Digital Twins.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Gain knowledge about digital manufacturing Techniques
- Summarize the digital product development lifecycle and supply chain management.
- Outline the appropriate digital procedures to verify practical work in factory settings.
- Summarize Internet of Things concepts effectively in digital manufacturing.
- Explain digital twin technology to analyze manufacturing processes.

TEXT BOOKS:

1. Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited, 2012.
2. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things" A Press, 2016.

REFERENCES:

1. Lihui Wang and Andrew YehChing Nee, Collaborative Design and Planning for Digital Manufacturing, Springer-Verlag London Limited, 2009.
2. Andrew Yeh Chris Nee, Fei Tao, and Meng Zhang, "Digital Twin Driven Smart Manufacturing", Elsevier Science., United States, 2019
3. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing the Digital Transformation", Springer Series in Advanced Manufacturing., Switzerland, 2017
4. Ronald R. Yager and Jordan Pascual Espada, "New Advances in the Internet of Things", Springer., Switzerland, 2018.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	1	2	-
CO2	2	2	1	-	-	2	-	-	-	-	1	2	-
CO3	2	2	1	-	-	2	-	-	-	-	1	2	-
CO4	2	2	1	-	3	2	-	-	-	-	1	2	-
CO5	2	2	1	-	3	2	-	-	-	-	1	2	-

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24ME307PE	MATHEMATICAL MODELLING OF MANUFACTURING PROCESSES	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the mathematical foundations of various manufacturing processes.
- Explore analytical models for conventional and non-conventional processes.
- Study the process of Forming and welding process through mathematical modeling
- Relate the manufacturing processes using mathematical tools.
- Apply mathematical models to optimize and control manufacturing operations.

UNIT I FUNDAMENTALS OF MANUFACTURING AND MODELLING APPROACHES 9

Introduction to Manufacturing Processes: Definition, types, and classification of manufacturing processes, Importance of mathematical modeling in manufacturing, Overview of process selection criteria. Physics of Manufacturing Processes: Thermo-mechanical, metallurgical, and fluid flow aspects, Fundamentals of heat transfer, stress-strain relationships, Need and scope of mathematical modeling, Basic equations governing process physics (continuity, momentum, energy)

UNIT II CONVENTIONAL AND NON-CONVENTIONAL MACHINING PROCESSES 9

Conventional Machining (Turning, Milling,) Force, temperature, and surface finish modeling, Tool wear and tool life models, Empirical and analytical modeling approaches Non-Conventional Machining (ECM, EDM, USM,) Energy sources and working principles, Governing equations and process parameter modeling, Applications and accuracy considerations

UNIT III DEFORMATION-BASED MANUFACTURING PROCESSES 9

Metal Forming Processes (Forging, and Extrusion,): Plasticity theory in modelling, Slab method and upper bound method, FEM in metal forming, Welding Processes: Heat source modelling (Gaussian and double ellipsoid models), Thermal cycle analysis and residual stress prediction, Weld pool shape prediction and solidification

UNIT IV SOLIDIFICATION AND SURFACE ENGINEERING PROCESSES 9

Casting and Powder Metallurgy: Solidification modeling: nucleation, growth, and shrinkage, Flow and thermal analysis in casting, Sintering kinetics in powder metallurgy. Coating and Additive Manufacturing: Modeling of layer-by-layer deposition, Thermal and material flow behavior, Melt pool dynamics and geometry control. Heat Treatment Processes: Diffusion modeling and phase transformation, Temperature profile and hardness prediction, Quenching and distortion modeling.

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UNIT V ADVANCED AND EMERGING MANUFACTURING MODELS 9

Micro/Nano Scale Manufacturing: Size effects and scaling laws, Modeling of micro-cutting, nano-indentation, and lithography, Molecular dynamics and multiscale modeling approaches. Processing of Non-Metallic Materials (Polymers, Ceramics, Composites): Thermal and flow modeling in polymer processing (injection molding, extrusion), Fracture and wear modeling in ceramics, Curing and fiber orientation models in composites

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the role of mathematical modelling in analyzing manufacturing processes.
- Solve mathematical models for machining, conventional, and non-conventional processes.
- Understand the processes involved in metal forming and welding performance.
- Apply mathematical models to surface engineering processes.
- Examine the of advanced manufacturing processes at the micro and nano scale.

TEXT BOOKS:

1. P. C. Sharma, A Textbook of Production Engineering, S. Chand Publishing. 1999
2. A Ghosh and A K Mallik: Manufacturing Science, East-West Press Pvt Ltd,2nd Edition, 2010
3. V K Jain: Advanced Machining Processes, Allied Publishers, Mumbai, 2002.

REFERENCES:

1. S. Kalpakjian, Manufacturing Processes for Engineering Materials, Pearson Education. 2021
2. Yusuf Altintas, Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design, Cambridge University Press.2012
3. J. A. Schey, Introduction to Manufacturing Processes, McGraw-Hill.2000
4. M. P. Groover, Fundamentals of Modern Manufacturing, Wiley,2020
5. https://onlinecourses.nptel.ac.in/noc25_me142/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-		1	1
CO2	2	2	1	1	-	-	-	-	-	-		1	1
CO3	2	2	1	1	-	-	-	-	-	-		1	1
CO4	3	3	2	2	-	-	-	-	-	-		1	1
CO5	3	3	2	2	-	-	-	-	-	-		1	1

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24ME308PE **NON DESTRUCTIVE TESTING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain basic knowledge of non-destructive testing (NDT) and evaluation methods
- Learn the procedures involved in liquid penetrant and magnetic particle testing
- Familiar with thermography and eddy current testing methods
- Identify knowledge of ultrasonic testing and acoustic emission techniques
- Understand the principles and procedures of radiographic testing methods

UNIT I OVERVIEW OF NON-DESTRUCTIVE TESTING AND VISUAL INSPECTION 9

Introduction - steps in non-destructive testing and evaluation of objects - factors influencing the reliability of non-destructive evaluation - manufacturing processes and their defects - stages of design, manufacture and life cycle management - comparison of destructive and non-destructive testing - visual inspection: basic principles - unaided visual inspection - optical aids used for visual inspection - applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 9

Liquid penetrant testing: principle - procedure - penetrant testing materials - methods - water washable and post emulsification methods - applications and limitations - interpretation of results.
Magnetic particle testing: theory of magnetism - principle - procedure - methods - equipment - magnetizing techniques - demagnetization of materials - methods of demagnetization - interpretation and evaluation of test indications - applications and limitations.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING 9

Thermography: principle - contact and non contact inspection methods - techniques - passive and active approach - infrared radiation and infrared detectors - applications. Eddy current testing: principle - factors - instrumentation - sensing elements - probes - techniques - high sensitivity, multi frequency and phased array - applications - advanced eddy current testing methods: magneto optic and eddy current imaging - pulsed - low frequency - SQUID based eddy current testing.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 9

Ultrasonic Testing: principle - ultrasonic transducers - ultrasonic flaw detection equipment - modes of display - A scan, B scan and C scan - inspection methods - transmission and pulse echo method - techniques - straight beam, angle beam, time of flight diffraction, phased array ultrasound and immersion - applications of normal beam inspection in detecting fatigue cracks, inclusions, slag, porosity and inter granular cracks. Acoustic Emission technique: principle - signal parameters - instrumentation - applications - leak testing methods.

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UNIT V RADIOGRAPHY (RT) **9**

Introduction - principle - electromagnetic radiation sources - X ray source, production of rays, gamma ray sources - radiographic imaging - geometrical factor - radiographic film, screen, film density, radiographic sensitivity, penetrameter and determining the radiographic exposure - inspection techniques - single wall single image, double wall penetration, multiwall penetration - real time radiography

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the principles of visual inspection and non-destructive evaluation techniques
- Summarize the liquid penetrant and magnetic particle testing procedures in industries
- Outline thermography and eddy current testing methods
- Apply ultrasonic testing and acoustic emission techniques
- Construct various radiation sources and apply appropriate radiographic testing methods

TEXT BOOKS:

1. Baldev Raj, Jayakumar T, Thavasimuthu M "Practical Non-Destructive Testing", Narosa Publishing House, 3rd Edition, 2019.
2. Prasad J and Nair C G K, "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Education, 2nd Edition, 2017.

REFERENCES:

1. Ravi Prakash, "Non-Destructive Testing Techniques", New Age International Publishers, 1st Revised Edition, 2010.
2. Charles, Hellier J," Handbook of Nondestructive evaluation", McGraw Hill, New York, 3rd Edition, 2020.
3. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, Volume-I 7, 9th Edition, 2000.
4. Peter J Shull, "Non-Destructive Evaluation: Theory, Techniques and Application", New York: Marcel Dekker, 1st Edition, 2002.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	1	-	-	-	-	-	-	-	2	2	-
CO4	3	2	1	-	-	-	-	-	-	-	2	2	-
CO5	3	2	1	-	-	-	-	-	-	-	2	2	-

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VERTICAL 4

Materials Engineering

24ME401PE **COMPOSITE MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge in the fundamentals of composite materials.
- Understand the fabrication techniques of polymer and metal matrix composites.
- Explore the synthesis processes of ceramic matrix and carbon-carbon composites.
- Learn the principles of laminate design and perform strength analysis of composites.
- Apply inter-laminar stresses and study advanced composite materials.

UNIT I INTRODUCTION **9**

Fundamentals of composites need for composites - classifications of composites - Matrix-Polymer Matrix Composites (PMC), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMC), Graphite Matrix Composites - Reinforcement Particle reinforced composites, Fiber reinforced composites. Types of fiber and resin materials, properties and advantages.

UNIT II PROCESSING TECHNIQUES FOR POLYMER MATRIX AND METAL MATRIX COMPOSITES **9**

Thermo set matrix composites: hand layup, spray, filament winding, Pultrusion, autoclave moulding – bag moulding - thermoplastic matrix composites - film stacking, diaphragm forming, thermoplastic tape laying- interfaces in PMCs - structure, properties and application of PMCs - recycling of PMC's. Metallic matrices: aluminium, titanium, magnesium, copper alloys - processing of MMCs: liquid state, solid state, in situ fabrication techniques - diffusion bonding powder metallurgy techniques interfaces in MMCs - mechanical properties - machining of MMCS - Applications.

UNIT III PROCESSING CERAMIC AND CARBON – CARBON COMPOSITES **9**

Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process in situ chemical reaction techniques: chemical vapour deposition, chemical vapour impregnation, solgel - interfaces in CMCs - mechanical properties and applications of CMCs ,Carbon-Carbon Composites - Applications.

UNIT IV COMPOSITE LAMINATES AND ANALYSIS **9**

Basic assumptions of laminated anisotropic plates - Laminate Constitutive Equations - Coupling Interactions, Balanced Laminates Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates - Quasi-isotropic Laminates - Evaluation of Lamina Properties from Laminate Tests -Determination of Lamina stresses with in Laminate

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UNIT V SMART COMPOSITES 9

Concepts of Inter-laminar Stresses - Effect of Stacking Sequence on Inter-laminar Stresses -Fracture Mechanics of Fiber Composites - Fracture Mechanics Concepts and Measures of Fracture Toughness, Adhesively Bonded Joints - Bonding Mechanisms - Joint Failure Modes - Biocomposites, Composites in Smart Structures- Additive Manufacturing of Composites, Hybrid Composites

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the properties of fibers and reinforcement materials.
- Extend the fabrication of polymer matrix and metal matrix composite synthesis.
- Explain the processes involved in ceramic matrix and carbon-carbon composite.
- Examine the strength characteristics of composite laminates.
- Apply inter-laminar stresses in fiber composites and bonding mechanism.

TEXT BOOKS:

1. Krishnan K Chawla, "Composite Materials: Science and Engineering", International Edition, Springer, 2019.
2. Agarwal B D, Broutman L J and Chandrashekhara, "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 4^{th} Edition, 2017.
3. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures",University Press India Pvt. Ltd., Hyderabad, 2022.

REFERENCES:

1. Mallick P K, "Fiber Reinforced Composites: Materials, Manufacturing and Design",CRC Press, New Delhi, 3^{rd} edition 2019.
2. Deborah D L and Chung, "Composite Materials: Functional Materials for Modern Technologies", Springer, 2003.
3. Autar K Kaw, "Mechanics of Composite Materials", Taylor and Francis, 2^{nd} Edition,2005.
4. Carlos A Mota Soares, "Mechanics of Composite Materials and Structures", Springer,2014.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	2	3	2
CO2	2	2	1	1	-	-	-	-	-	-	2	3	2
CO3	2	2	1	1	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	2	-	-	-	-	2	3	2
CO5	3	2	2	-	-	2	-	-	-	-	-	3	2

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24ME402PE **POWDER METALLURGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Introduce the principles and importance of Powder Metallurgy in advanced manufacturing.
- Provide powder production techniques and their influence on particle properties
- Explain powder characterization methods and their relevance to shaping and compaction
- Impart the fundamentals and mechanisms of sintering and advanced densification techniques
- Develop the ability to select appropriate powder processing for specific applications based on material and performance requirements

UNIT I FUNDAMENTALS OF POWDER METALLURGY **9**

Introduction to Powder Metallurgy - Definition of Powder – types – forms-classification- Powder Fabrication- Mechanical Fabrication-crushing and milling – ball mills –planetary mills- Chemical Fabrication – Reduction of oxides –hydrogen reduction-carbon reduction Electrolytic Fabrication – Atomization-Principles and types of atomization-gas atomization-water atomization-Ultrasonic atomization.

UNIT II POWDER PROPERTIES AND CHARACTERIZATION **9**

Microstructure Control – Powder production method on internal structure-cooling rate effects on grain size and phase formation - Powder Characterization - Particle Size Measurement - BET Surface Area- Interparticle Friction - Powder Packing – theoretical and practical density-Importance of powder packing-Mixing – Types of mixers-tumble-ribbon-V-type –Blending.

UNIT III COMPACTION AND SHAPING TECHNIQUES **9**

Shaping and Compaction - Principles of powder compaction- Die design considerations- Density distribution and green strength- Defects in compaction- lamination- cracking- Slurry Techniques - Slip casting- Tape casting- Gel casting- Cold Isostatic Pressing (CIP)- Cold Isostatic Pressing (CIP)- Applications and advantages- Additive shaping methods.

UNIT IV SINTERING PROCESSES **9**

Sintering Theory - Fundamentals of sintering: diffusion, neck growth-shrinkage- Sintering stages: initial, intermediate- Grain growth and densification- Solid State Sintering - Activated Sintering - Role of additives Liquid Phase Sintering- Conditions and mechanisms- transient vs. persistent liquid phase- Wetting behavior and capillary action- Atmosphere control during sintering.

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UNIT V ADVANCED DENSIFICATION METHODS **9**

Full Density Processing - Need for full-density components- Hot Isostatic Pressing (HIP) - Working principle and equipment- Typical materials and applications- Advantages over conventional sintering- Spark Plasma Sintering (SPS) Pulsed current sintering mechanism- Advantages: rapid heating, nanostructure retention- Applications in ceramics and nanomaterials- Microwave sintering and other emerging techniques.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the principles and importance of powder metallurgy in advanced manufacturing.
- Understand powder characterization techniques such as particle size analysis, surface area and flowability.
- Describe shaping and compaction methods and application techniques.
- Apply the fundamentals of sintering and advanced densification techniques in powder metallurgy.
- Select appropriate powder processing routes for specific applications based on materials and performance requirements.

TEXT BOOKS:

1. Randall M. German, "Powder Metallurgy Science", Metal Powder Industries Federation (MPIF), New Delhi, 7th Edition, 2024
2. P.C. Angelo & R. Subramanian, " Powder Metallurgy: Science, Technology and Applications", PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2022.

REFERENCES:

1. B.K. Datta, “An Advanced Technique of Processing Engineering Materials”, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
2. W.D. Jones “Principles of Powder Metallurgy”, The Institute of Materials, 2nd Edition, UK, 2021.
3. A.K. Sinha,” Introduction to Powder Metallurgy”, Dhanpat Rai Publications, 2nd Edition, 2020.
4. https://onlinecourses.nptel.ac.in/noc25_mm42/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	2	2	-
CO2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	2	2	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	-	-	-	-	-	-	-	2	2	2

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24ME403PE **CARBON MATERIALS AND MANUFACTURING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand carbon materials and their significance in science and engineering.
- Gain in-depth knowledge of carbon allotropes and their transformation mechanisms.
- Explore various industrial methods for synthesis and processing of carbon-based materials.
- Analyze the various properties of carbon materials using advanced characterization techniques.
- Learn the applications of carbon in nanoelectronics, energy, aerospace, and other technologies.

UNIT I CARBON AND ITS ALLOTROPES **9**

Introduction to materials and manufacturing-Mathematical representation of material properties - Introduction to carbon- carbon on the Earth and in outer space- carbon in technology and economy- Carbon isotopes- carbon atomic structure - hybridization- Diamond, graphite, carbyne and curved carbons- Classification of carbon allotropes- conversion of one allotropic form into another -phase diagram of carbon.

UNIT II GRAPHITE AND NON-GRAPHITIZING CARBONS **9**

Engineering carbons - Graphite crystal structure - stacking faults- rhombohedral graphite - Graphite ore processing - synthetic graphite production from needle coke- Kish graphite - polymer-derived graphite- Highly Oriented Pyrolytic Graphite (HOPG)- Pyrolysis of gaseous hydrocarbons- kinetics of graphitization- polymer –dervied carbon- Coking and charring mechanism –Microstructure of non-graphitizing carbon - Glass-like carbon: introduction-properties and industrial manufacturing-pyrolysis of polymers and other solid hydrocarbons- microfabrication with glass-like carbon.

UNIT III STRUCTURED CARBONS **9**

Photolithography, X-Ray and Nano-Imprint Lithography- Conversion of microfabricated structure into carbon-activated carbon: introduction- properties and industrial manufacturing- Carbon black: introduction-properties and industrial manufacturing- Carbon fibers: introduction and properties- melt spinning of petroleum pitches – electrospinning and viscoelasticity –Carbonization of polyacrylonitrile fibers- Mechanical property testing methods for carbon fibers - defects in carbon fibers- Carbon Fiber Reinforced Plastic (CFRP) and machining of CFRPs.

UNIT IV CARBON COMPOSITES, GRAPHENE, AND NANOTUBES **9**

Carbon/carbon, carbon/metal and carbon/concrete composites – Manufacture and properties-Graphene- introduction and crystal structure-Graphene history- nomenclature- chemical vapor deposition of graphene- Graphene CVD parameter optimization - Defects in graphene and notation-carbone nanotube-introduction and properties-vapor phase growth of carbon nanotube.

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UNIT V ADVANCED CARBON FORMS 9

Vapor deposited diamond- diamond-like carbon- X-ray diffraction analysis of carbon-Raman spectroscopy of carbon- Transmission electron microscopy of carbon- gas adsorption isotherms and surface area analysis of porous carbons- numerical problem solving-large scale industrial applications of carbon materials- Micro and nano-scale applications of carbon materials- rigid and flexible devices- device characteristics and challenges- supply chain of industrial carbons- summary and overview.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the structure, hybridization, and classification of carbon and its various allotropes.
- Describe the synthesis, processing, and structural control of graphite and polymer-derived carbon materials.
- Apply production processes and properties of structured carbons like activated carbon, carbon black, and carbon fibers.
- Choose characterization techniques to determine the properties of carbon materials.
- Develop advanced characterization methods and applications of carbon materials in industrial and nano-scale devices.

TEXT BOOKS:

1. M.S. Dresselhaus, G. Dresselhaus, and P. Avouris, Carbon Nanotubes: Synthesis, Structure, Properties, and Applications, Springer, 2nd Edition, 2020
2. Peter Morgan, Carbon Fibers and Their Composites, CRC Press, 2nd Edition, 2016

REFERENCES:

1. M. Endo, S. Iijima, and M.S. Dresselhaus, Carbon Nanotubes, Elsevier, 2017
2. Francis D. Fischer, Carbon Materials for Advanced Technologies, Elsevier, 2016
3. K. Kaneko, J. Silva, T. Bandosz, Porous Carbons: From Synthesis to Applications, Royal Society of Chemistry, 1st Edition, 2019
4. https://onlinecourses.nptel.ac.in/noc24_mm07/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	2	-	-	-	-	-	-	-	-	2	2

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24ME404PE	BIO MATERIALS & CERAMICS	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Gain knowledge on biomaterials and their classifications.
- Explain the types and applications of polymeric and composite biomaterials.
- Understand biocompatibility testing and the biological response of biomaterials.
- Familiarize with various bio-implants and surgical aids.
- Explore the characteristics of metallic and ceramic biomaterials.

UNIT I INTRODUCTION TO BIOMATERIALS **9**

Biomaterial – Types of Biomaterials – Biocompatibility – Biological material – Biodegradable material – Bioresorbable material – Bio-inert material – Bio-active material – Pyrogenicity – Minimum Requirements of Biomaterials – Surface Properties of Biomaterials – Desirable Properties of Biomaterial – Performance of Biomaterials – Applications of Biomaterials

UNIT II POLYMERIC & COMPOSITE BIOMATERIALS **9**

Polymeric Biomaterials: Introduction – Basic structures of Polymers – Hydrogel – Bone cement – Fluorocarbon polymers – Silicon Rubber – Bioactive Polymers – Biodegradable Polymers – Applications – Composite Biomaterials: Introduction – Dental filling Composites & cement – Porous Composites – Fibrous & Particulate composites.

UNIT III BIOCOMPATIBILITY TESTING & RESPONSE OF BIOMATERIAL TO HUMAN BODY **9**

Biocompatibility Testing: Introduction – In-Vitro Testing – In-Vivo Testing – Hypersensitivity – Haemocompatibility – Odontocompatibility – Osteocompatibility – Cytotoxicity – Genotoxicity – Carcinogenicity – Response of Biomaterial to Human Body: Blood-Biomaterial Interactions – Biomaterials – Tissue Interactions – Tissue response to Implants – Inflammation – Wound Healing – Foreign Body Response – Infection and Tumorigenesis of Biomaterials

UNIT IV BIO-IMPLANTS & SURGICAL AIDS **9**

Stent, Vascular grafts – Artificial Heart valves – Inferior Vena cava filter – Contact lenses – Intra-ocular Lenses – Artificial Silicon Retina – Temporary fixation Devices – Total Hip Replacement – Total Knee Replacement – Dental filling – Restoration material – Dental implants – Suture materials – Wound dressings – Tissue Adhesives

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UNIT V METALLIC & CERAMIC BIOMATERIALS 9

Metallic Biomaterials: Introduction – Co-Cr Alloys – Nitinol – Dental metals, Corrosion of Metallic implants – Manufacturing of Metallic implants – Applications – Ceramic Biomaterials: Introduction – Types of Ceramics – Bio-inert ceramics: Alumina – Zirconia – Carbon – Bioresorbable ceramics: Calcium Phosphate – Bioactive ceramics: Glass ceramics – Applications

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Classify biomaterials based on properties and applications.
- Describe the structure and behavior of polymeric and composite biomaterials.
- Apply biocompatibility, biological responses and testing methods for bio materials.
- Identify the types of bio-implants and their medical applications.
- Select the applications of metallic and ceramic materials in biomedical fields.

TEXT BOOKS:

1. William R. Biomaterials Science: An Introduction to Materials in Medicine, 4th Edition, Academic Press, 2020.
2. Michael Shuler, Fikret Kargi, Matthew DeLisa. Bioprocess Engineering: Basic Concepts, 3rd Edition, Prentice Hall International Series, 2017.
3. Park Joon Bu, Biomaterials Science and Engineering,3rd Edition, New York Springer Science, Business Media,2007.

REFERENCES:

1. Wei-Shou Hu. Cell Culture Bioprocess Engineering, 2nd Edition, CRC Press, 2020.
2. Ratner B.D. Biomaterials Science: An Introduction to Materials in Medicine, 3rd Edition, Academic Press, 2012.
3. Tadashi Kokubo. Bioceramics and Their Clinical Applications, 1st Edition, Woodhead Publishing, 2017.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	2
CO2	2	1	1	-	-	-	-	-	-	-	-	2	2
CO3	3	1	1	-	-	-	-	-	-	-	-	2	2
CO4	3	1	1	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	2	2

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24ME405PE **FUNDAMENTALS OF NANO TECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the concepts and significance of nanoscience and nanotechnology.
- Learn the various methods used to prepare nanomaterials.
- Identify different types of nanomaterials and study their properties.
- Gain knowledge on techniques to observe and measure materials at the nanoscale.
- Explore how nanomaterials are used in real-world applications across different fields.

UNIT I INTRODUCTION **9**

Nanoscale science and technology - implications for physics, chemistry, biology and engineering - classifications of nanostructured materials - nanoparticles - quantum dots - nanowires - ultra-thin films - multilayered materials - length scales involved and effect on properties - mechanical, electronic, optical, magnetic and thermal properties.

UNIT II TECHNIQUES OF NANO-SCALE FABRICATION **9**

Introduction to fabrication methods: co-precipitation, ultrasonication, mechanical milling, colloidal routes, self-assembly, vapour phase deposition, Metal Organic Chemical Vapor Deposition (MOCVD), sputtering, evaporation, molecular beam epitaxy and atomic layer epitaxy.

UNIT III ADVANCED NANOMATERIALS **9**

Nanoforms of carbon buckminster fullerene - graphene and carbon nanotube - single wall carbon nanotubes multi wall carbon nanotubes - methods of synthesis: arc-growth, laser ablation, chemical vapour deposition routes, plasma chemical vapour deposition - structure - property relationships applications - nanometal oxides ZnO, TiO_2, MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, ferrites, nanoclays - functionalization and applications – quantum wires, quantum dots - preparation, properties and applications.

UNIT IV IMAGING TECHNIQUES OF MATERIALS **9**

X-ray diffraction technique, scanning electron microscopy transmission electron microscopy including high-resolution imaging - surface analysis techniques - Atomic Force Microscopy (AFM), Scanning Probe Microscopy (SPM), Scanning tunneling microscopy (STM), Scanning Near-field Optical Microscopy (SNOM) and Secondary Ion Mass Spectroscopy (SIMS) – nano indentation

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UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

Nano infotech: information storage - nano computer, molecular switch, super chip and nano crystal Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, nano medicines, targetted drug delivery and bioimaging Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)-nano sensors - nano crystalline silver for bacterial inhibition - nanoparticles for sun barrier products - photostat, printing, solar cell and battery.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the key principles of nanotechnology and the types of nanomaterials.
- Explain how different nanomaterials are synthesized using standard methods.
- Apply the common nanomaterials based on their needs.
- Select the characterization tools to understand nanoscale features.
- Develop the applications of nanotechnology in areas like medicine, electronics, and materials engineering.

TEXT BOOKS:

1. John Dinardo N, "Nanoscale Characterization of surfaces & Interfaces",Weinheim Cambridge, Wiley-VCH, 2nd Edition, 2008.
2. Gabor L Hornyak and John J Moore,"Fundamentals of Nanotechnology",CRC Press, 1st Edition, 2009.
3. Shanmugam S, Nanotechnology, 1st Edition, New Delhi, India: Gaurav Book Center,2020.

REFERENCES:

1. Charles P Poole, Frank J Owens," Introduction to Nanotechnology", John Wiley and Sons, 1st Edition, 2003.
2. Waqar Ahmed and Mark J Jackson, "Emerging Nanotechnologies for Manufacturing", Elsevier Inc, 2nd Edition, 2014.
3. Fahrner W R, "Nanotechnology and Nanoelectronics", Springer (India) Private Ltd, 2011.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	2	2	1
CO2	2	2	2	-	2	-	-	-	-	-	2	2	1
CO3	3	2	2	-	2	-	-	-	-	-	3	2	1
CO4	3	2	2	-	2	-	-	-	-	-	2	2	1
CO5	3	2	2	-	2	-	-	-	-	-	2	2	1

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24ME406PE **ADVANCED MATERIALS AND PROCESSES**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the principles of metastable materials and their relevance to functional alloy systems.
- Explore the processing, properties and applications of bulk metallic glasses and shape memory alloys.
- Understand the role of microstructure in the behavior of super alloys and nanomaterials.
- Explain the mechanisms behind magnetic behavior and high-temperature performance of advanced materials.
- Explore the synthesis, unique properties, and potential applications of nanomaterials and other advanced functional alloys.

UNIT I METASTABLE AND FUNCTIONAL ALLOYS **9**

Fundamentals of metastability in materials- Thermodynamics and kinetics of metastable phases- Overview of functional alloys and their unique properties- Significance in modern materials engineering and applications

UNIT II BULK METALLIC GLASSES **9**

Fundamentals of BMGs: Atomic structure, thermodynamic principles, glass forming ability - Processing Techniques- Rapid solidification, casting techniques - Properties of BMGs: Mechanical-strength, hardness, thermal, corrosion resistance - Applications: Aerospace, biomedical devices, electronics

UNIT III SHAPE MEMORY ALLOYS **9**

Basics of SMAs: Shape memory effect, martensitic transformation – Pseudoelasticity-Mechanism and characteristics – Materials- Ni-Ti, Cu-based SMAs - Applications: Medical stents, actuators, couplings - Case Studies-Industrial and biomedical usage examples.

UNIT IV HIGH-TEMPERATURE AND MAGNETIC MATERIALS **9**

High-Temperature Materials- Creep resistance, oxidation resistance, phase stability – Super alloys-Alloy design for Ni-based, Co-based super alloys, Microstructure control and precipitation strengthening, High-temperature mechanical properties and processing - Magnetic Materials- Soft magnetic materials-properties, Hard magnetic materials: types, hysteresis behavior, applications

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UNIT V NANOMATERIALS AND ADVANCED FUNCTIONAL ALLOYS **9**

Nanomaterials: Synthesis: Bottom-up and top-down approaches, Properties: Size-dependent mechanical, thermal, and magnetic properties - Non-equilibrium Processes: Rapid solidification, Inert gas condensation, Single crystal growth techniques - Advanced Functional Alloys: Smart materials, multifunctional materials, Emerging applications in sensors, actuators, and energy devices.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals of metastability and functional alloys
- Describe the processing, properties, and applications of bulk metallic glasses and shape memory alloys.
- Summarize the role of microstructure in governing the behavior of superalloys and nanomaterials.
- Apply the mechanism of magnetic behavior and high temperature performance to advanced material systems.
- Examine nanomaterials synthesis behavior of advanced functional alloys in emerging technologies.

TEXT BOOKS:

1. Isabella Gallino & Ralf Busch, "Physical Metallurgy of Bulk Metallic Glass-Forming Liquids", Springer Series in Materials Science, Vol. 341, 1st edition, 2024.
2. C. Suryanarayana & Akihisa Inoue, "Bulk Metallic Glasses ", CRC Press / Taylor & Francis, 2nd Edition, 2024.

REFERENCES:

1. Gallino & Busch., "Physical Aging Studies in Bulk Metallic Glasses", Springer Series in Materials Science, Vol. 341, 1st Edition 2025.
2. A. Rao et al., "Design of Shape Memory Alloy (SMA) Actuators", 1st Edition, 2023.
3. https://onlinecourses.nptel.ac.in/noc25_mm53/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	2	2	1
CO2	2	2	1	1	-	-	-	-	-	-	2	2	1
CO3	2	2	1	1	-	-	-	-	-	-	2	2	2
CO4	3	2	2	1	-	-	-	-	-	-	2	2	1
CO5	3	2	2	1	-	-	-	-	-	-	2	2	2

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24ME407PE **MICRO ELECTRO MECHANICAL SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamentals and scaling laws of microsystems.
- Explore various microsensors and actuators used in MEMS.
- Learn the key microfabrication techniques and materials.
- Study microsystem manufacturing and packaging methods.
- Apply microsystems in automotive, biomedical, aerospace, and telecom fields.

UNIT I INTRODUCTION **9**

Microsystems: Overview-Microsystems - Working Principle of Microsystems - Scaling Laws - Scaling in Geometry - Scaling in Rigid Body Dynamics - Scaling in Electrostatic Forces - Scaling in Electromagnetic Forces - Scaling in Electricity - Scaling in Fluid Mechanics - Scaling in Heat Transfer.

UNIT II MICRO SENSORS AND ACTUATORS **9**

Micro sensors and Actuators: Micro Sensors - Micro Actuation Techniques - Micro Pump - Micro Motors - Micro Valves – Micro Grippers - Micro Accelerometers.

UNIT III MICRO SYSTEM FABRICATION **9**

Micro System Fabrication: Substrates - Single Crystal Silicon Wafer Formation MEMS Materials - Photolithography – Ion Implantation - Diffusion - Oxidation - Chemical Vapour Deposition (CVD) - Physical Vapor Deposition - Deposition by Epitaxy - Etching Process.

UNIT IV MICRO SYSTEM DESIGN AND MANUFACTURING **9**

Micro System Design and Manufacturing: Bulk Micro Manufacturing - Surface Micromachining - Lithographic Galvano Forming Abforming (LIGA) - Stepped Lithographic Galvano Forming Abforming (SLIGA). Micro System Packaging Materials - Die level -Device Level - System Level - Packaging Techniques - Surface Bonding - Wire Bonding - Sealing - Design Considerations.

UNIT V MICRO SYSTEM APPLICATIONS **9**

Micro System Applications: Automotive - Aerospace – Telecommunication, Optical & RF MEMS for Telecom and AR/VR, Advanced Bio-Medicals MEMS, AI Enhanced and Intelligent Sensors.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the basic principles and scaling laws governing microsystems.
- Describe the operation of various microsensors and micro actuators.
- Apply the steps and processes involved in microsystem fabrication and material selection.
- Build the microsystem manufacturing techniques and packaging methods.
- Choose the applications of MEMS technologies in various industrial sectors.

TEXT BOOKS:

1. Hsu, Tai Ran, MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering, 2nd Edition, John Wiley & Sons, 2020.
2. Kim, Eun Sok, Fundamentals of Microelectromechanical Systems (MEMS), 1st Edition, McGraw Hill, 2021.
3. Nitaigour Premchand, Chand Mahalik, MEMS, 2nd Edition McGraw Hill, 2019

REFERENCES:

1. Korvink, Jan G., & Paul, Oliver, "MEMS: A Practical Guide to Design, Analysis, and Applications", Springer, 2019.
2. Zhang, Dan, Wei & Bin (Eds.), "Advanced Mechatronics and MEMS Devices", Springer, 2017, ISBN -978-3-319-32178-3
3. Howe & Ricco Microsystems & Nanosystems Series, Springer,2023.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	-	-	1	2	1
CO2	2	2	-	-	2	-	-	-	-	-	1	2	1
CO3	3	2	1	-	1	-	-	-	-	-	1	2	1
CO4	3	2	1	-	1	-	-	-	-	-	1	2	1
CO5	3	2	1	-	2	-	-	-	-	-	1	2	1

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24ME408PE **MATERIAL CHARACTERIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the basic principles of optics and their applications in microscopy
- Learn the structure, function, and imaging mechanisms of optical and advanced microscopes.
- Gain detailed knowledge of Scanning Electron Microscopy and its surface characterization.
- Apply the fundamentals of X-ray diffraction in analyzing crystal structures and internal stresses.
- Explore the principles, imaging, and diffraction techniques of Transmission Electron Microscopy.

UNIT I FUNDAMENTALS OF OPTICS AND OPTICAL MICROSCOPY **9**

Fundamentals of optics- Ray Optics-Resolution and Magnification-Aberrations in Lenses-Optical microscope and its instrumental details-Components of Optical Microscope-Optical Path and Image Formation-Magnification and Resolution-Microscope Calibration-Maintenance and Handling-Variant in optical microscopes.

UNIT II IMAGE FORMATION **9**

Image formation- Phase contrast microscopy- Polarised light microscopy- Differential interference contrast microscopy- Fluorescence microscopy- Sample preparation and applications of optical microscopes.

UNIT III SCANNING ELECTRON MICROSCOPY (SEM) **9**

Introduction to Scanning Electron Microscopy (SEM)- Instrumental details and image formation of SEM- Various SEM imaging techniques - Spectroscopy in SEM- Sample preparation techniques for SEM- Applications of SEM in materials characterization.

UNIT IV X-RAY DIFFRACTION AND ANALYSIS **9**

Fundamentals of X-ray scattering- Bragg's Law derivation and intensity factors- Crystallite size and strain effects on diffraction- Indexing-profile fitting-peak broadening. Quantitative analysis using XRD - Residual stress analysis - Instrumentation and experiments in XRD.

UNIT V TRANSMISSION ELECTRON MICROSCOPY (TEM) **9**

Introduction to Transmission Electron Microscopy (TEM)- Diffraction mechanisms in TEM-Various imaging techniques- Spectroscopy in TEM- Sample preparation for TEM - Applications of TEM in materials science- Instrumental components- Comparison of microscopy techniques.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the principles of optics and image formation in optical microscopy.
- Describe the features and applications of various optical microscopy techniques.
- Summarize the working and applications of SEM imaging for surface characterisation.
- Develop interpretation of crystal structure, strain, and residual stress using XRD analysis.
- Choose TEM instrumentation, diffraction, and imaging modes for materials analysis.

TEXT BOOKS:

1. David J. Smith, "Introduction to Electron Microscopy for Biologists", Academic Press, 3rd Edition, 2020.
2. Zeev Zalevsky and Israel Gannot," Optical Microscopy: Emerging Methods and Applications", Springer, 1st Edition, 2020.

REFERENCES:

1. Joseph Goldstein et al.," Scanning Electron Microscopy and X-ray Microanalysis", Springer, 4th Edition, 2017.
2. L. Reimer," Transmission Electron Microscopy: Physics of Image Formation and Microanalysis", Springer, 5th Edition, 2013.
3. https://onlinecourses.nptel.ac.in/noc25_mm18/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	2	1
CO2	2	2	-	-	-	-	-	-	-	-	2	2	1
CO3	2	2	-	-	2	-	-	-	-	-	2	2	1
CO4	3	2	-	-	3	-	-	-	-	-	2	2	1
CO5	3	2	-	-	2	-	-	-	-	-	2	2	1

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VERTICAL 5

Industrial Engineering

24ME501PE **INDUSTRIAL SAFETY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamental concept and principles of industrial safety
- Know principles of maintenance engineering.
- Recognize the wear and its reduction.
- Explore the faults in various tools, equipments and machines
- Learn the periodic maintenance procedures in preventive maintenance

UNIT I INDUSTRIAL SAFETY **9**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure - describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, - Safety colour codes - Fire prevention and firefighting, equipment and methods.

UNIT II MAINTENANCE ENGINEERING **9**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department - Types of maintenance - Types and applications of tools used for maintenance - Maintenance cost & its relation with replacement economy - Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION **9**

Wear- types, causes, effects, wear reduction methods, lubricants - types and applications - Lubrication methods - general sketch - working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication - Definition, principle and factors affecting the corrosion - Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING **9**

Fault tracing-concept and importance - decision tree concept, need and applications, - sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools - hydraulic, pneumatic, automotive, thermal and electrical equipment's like, Any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors - Types of faults in machine tools and their general causes.

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UNIT V PERIODIC AND PREVENTIVE MAINTENANCE 9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes - overhauling of mechanical components, overhauling of electrical motor - common troubles and remedies of electric motor, repair complexities - definition, need, steps and advantages of preventive maintenance - Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets - Program and schedule of preventive maintenance of mechanical and electrical equipment - Advantages of preventive maintenance.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the fundamental concept and principles of industrial safety
- Explain the principles of maintenance engineering
- Choose the wear, corrosion and its prevention techniques.
- Illustrate the faults in various tools, equipments and machines
- Apply periodic maintenance procedures in preventive maintenance.

TEXT BOOKS:

1. L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.
2. Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, 3rd Edition, CRC Press, 2018.

REFERENCES:

1. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017
2. R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011
3. W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub, 2014

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	-	-	2	1	-	-	-	-	2	2
CO2	2	1	1	-	-	2	1	-	-	-	-	2	2
CO3	2	2	1	-	-	2	1	-	-	-	-	2	2
CO4	2	1	1	-	-	2	1	-	-	-	-	2	2
CO5	3	2	2	-	-	2	1	-	-	-	-	2	2

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24ME502PE **SOCIAL INNOVATION IN INDUSTRY 4.0**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the concept, need, and scope of social innovation in Industry 4.0
- Explore various types of social innovation and their role in value creation and entrepreneurship.
- Apply design and prototyping techniques for developing innovative solutions in different domains.
- Know about costing, intellectual property rights (IPR), and innovation strategies for sustainable development
- Assess the societal impact of innovations through case studies and real-world applications

UNIT I INTRODUCTION **9**

Social innovation – Definitions, scope, and importance – Overview of Industry 4.0 – Need for social innovation in the digital era – Role of technology in solving societal challenges – Introduction to value creation and entrepreneurship.

UNIT II TYPES AND STRATEGIES OF SOCIAL INNOVATION **9**

Types of social innovation – Incremental vs. radical innovation – Sustainable entrepreneurship – Innovation strategies – Design for social innovation – Integration with Industry 4.0 technologies

UNIT III DESIGN AND PROTOTYPING FOR INNOVATION **9**

Design thinking approach – Tools for design – Prototyping techniques – Application in medical devices and agricultural implements – Innovation in healthcare and agriculture – Rapid manufacturing concepts.

UNIT IV COSTING, IPR, AND INNOVATION MANAGEMENT **9**

Cost estimation for prototypes – Cost-benefit analysis – Intellectual Property Rights (IPR) basics – Patents, copyrights, and trademarks – Managing innovation for scalability and sustainability – Types of innovation in practice.

UNIT V SOCIETAL IMPACT ANALYSIS **9**

Case studies in social innovation across sectors – Innovation in medical devices, agriculture, and rural development – Societal impact analysis – Measuring and evaluating outcomes – Future trends in social innovation and Industry 4.0.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the principles of social innovation and Industry 4.0
- Classify and analyze types of social innovations and entrepreneurship models
- Apply design thinking and prototyping techniques to develop innovative solutions.
- Develop the appropriate methods of costings and IPR.
- Identify real-world case studies and assess societal impact.

TEXT BOOKS:

1. Hopkinson, N., Hague, R. & Dickens, P. (Eds.), Rapid Manufacturing: An Industrial Revolution for the Digital Age, John Wiley & Sons, 2006.
2. Murray, R., Caulier-Grice, J. & Mulgan, G., The Open Book of Social Innovation, London: NESTA, 2010.

REFERENCES:

1. Nicolopoulou, K., Karataş-Özkan, M., Janssen, F. & Jermier, J. (Eds.), Sustainable Entrepreneurship and Social Innovation, Taylor & Francis, 2016.
2. Phills, J. A., Deiglmeier, K., & Miller, D. T., Rediscovering Social Innovation, Stanford Social Innovation Review, 2008.
3. Schwab, K., The Fourth Industrial Revolution, Crown Business, 2017.
4. Tidd, J., & Bessant, J., Managing Innovation: Integrating Technological, Market and Organizational Change, 7th Edition, Wiley, 2020
5. https://onlinecourses.nptel.ac.in/noc23_me71/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	2	3	2	-	-	2	2	-
CO2	3	2	2	-	-	2	3	2	-	-	2	2	-
CO3	3	2	2	-	2	3	3	2	-	-	2	2	-
CO4	3	2	-	-	2	3	3	3	-	-	2	2	-
CO5	3	2	-	-	2	3	3	3	-	-	2	2	-

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24ME503PE LABOUR WELFARE AND INDUSTRIAL RELATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the background, concepts, and frameworks of Industrial Relations (IR) and the role of trade unions.
- Learn the causes and settlement mechanisms for industrial disputes.
- Acquire knowledge on labour welfare concepts and provisions
- Examine the provisions of social security legislations, implementation challenges.
- Identify new labour laws, codes and their impact on industrial relations.

UNIT I INTRODUCTION TO INDUSTRIAL RELATIONS & TRADE UNIONS 9

Industrial Relations (IR) Background, Post-independence developments, Functions of IR - Approaches towards IR & Models of IR - Introduction to Trade Unions (TUs), Labour Legislations, Worker's Participation - Employers' Federations: Role in IR - Salient Features of IR in India - Trade Unionism

UNIT II INDUSTRIAL DISPUTES & COLLECTIVE BARGAINING 9

Industrial Disputes: Meaning, Causes, Interest & Rights Disputes - Strikes: Forms & Effects - Industrial Disputes Act 1947: Dispute Settlement Machineries - Statutory & Non-statutory Measures for Settlement - Collective Bargaining: Importance, Theories, Hurdles in India

UNIT III LABOUR WELFARE 9

Labour Welfare: Introduction, Objectives, Classification -Intra-mural & Extra-mural Labour Welfare Services - Evolution of Social Security Measures, Welfare Provisions in Select Labour Laws - Social Security: ILO Convention No. 102

UNIT IV SOCIAL SECURITY 9

Social Security Legislations: Evolution & Growth - Provisions for Old Age, Unemployment, Gratuity - Issues in Labour Welfare & Social Security, Review of Welfare Amenities (Rural & Agricultural Labour) - Role of Welfare Officer, Problems in Enforcement, Need for Integrated Social Security Scheme

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UNIT V LABOUR LAWS, PARTICIPATION & LABOUR CODES **9**

Factories Act 1948: Definitions, Authorities, Health & Safety, Welfare, Hazardous Processes, Working Hours, Employment of Young Persons, Leave with Wages, Penalties - Payment of Wages Act 1936: Objective, Scope, Wage Legalities, Deductions - Minimum Wages Act 1948: Scope, Fixation, Procedures - Equal Remuneration Act 1976: Scope, Definitions, Provisions - Workers' Participation in Management: Degrees & Forms, Works Committee, Joint Management Councils, Participation in PSUs & Private Sector, The Participation of Workers in Management Bill 1990 - Labour Codes: Introduction, Code on Wages 2019, Occupational Safety, Health & Working Conditions Code 2020, Industrial Relations Code 2020, Code on Social Security 2020

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the evolution, approaches, and salient features of IR in India.
- Describe the objectives, structures, and legal framework of trade unions.
- Classify and assess labour welfare measures and understand their relevance.
- Interpret the objectives, provisions, and practical implications of key social security legislations and schemes.
- Identify major labour laws and labour codes and assess their implications for both employers and employees.

TEXT BOOKS:

1. Taxmann. "Taxmann's New Labour & Industrial Laws", 1st Edition, Taxmann Publications Private Limited. 2023
2. Monappa A., Nambudiri R. & Selvaraj, P. (2013). "Industrial Relations and Labour Laws". 2nd Edition. New Delhi: McGraw Hill Education India Pvt .Ltd.

REFERENCES:

1. Sinha, Sinha and Shekhar. "Industrial Relations Trade Unions and Labour Legislations", 2nd Edition. New Delhi: Pearson Publications. 2013
2. https://onlinecourses.nptel.ac.in/noc25_mg159/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	2	2	3	-	-	2	1	-
CO2	2	1	-	-	-	2	2	3	-	-	2	1	-
CO3	2	1	-	-	-	2	2	3	-	-	2	1	-
CO4	2	1	-	-	-	2	2	3	-	-	2	1	-
CO5	2	1	-	-	-	2	2	3	-	-	2	1	-

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24ME504PE	INDUSTRIAL AUTOMATION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the architecture and components of industrial automation systems
- Learn various measurement techniques used in automated systems
- Apply different control strategies in PID and advanced control structures
- Relate sequence control for PLC programming systems
- Explore various drives and industrial communication networks for automated control

UNIT I INTRODUCTION **9**

Industrial automation – Architecture of automation systems – Need for control systems – Types of sensors – Temperature, pressure, force, displacement, speed, flow, level, humidity, and pH measurements – Signal conditioning – Error estimation – Calibration methods.

UNIT II PROCESS CONTROL AND PID TECHNIQUES **9**

Basics of process control – Open-loop and closed-loop systems – Transfer functions – Proportional, Integral, Derivative (P, PI, PID) control modes – Tuning methods – Real-time PID implementation – Stability and response analysis.

UNIT III ADVANCED INDUSTRIAL CONTROL STRUCTURES **9**

Feed forward and ratio control – Predictive control – Control of systems with inverse response – Cascade control – Overriding and selective control – Split range control – Application examples in process industries.

UNIT IV SEQUENCE CONTROL AND PLC PROGRAMMING **9**

Sequence control fundamentals – Programmable Logic Controllers (PLC) – Relay Ladder Logic (RLL) – Scan cycle – RLL syntax and design – Structured programming approach – Advanced RLL programming – PLC hardware environment.

UNIT V ACTUATORS, DRIVES AND INDUSTRIAL NETWORKING **9**

Machine tool control – CNC systems overview – Hydraulic actuators – Pneumatic actuators – Proportional and servo valves – DC, stepper, induction, synchronous motors – Drive systems – Fieldbus architecture – Sensor/actuator networking – Industrial communication protocols.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe industrial automation architecture, sensors, and signal conditioning
- Apply process control concepts and PID techniques for system stability
- Implement advanced industrial control strategies in process industries
- Develop PLC programs using RLL and structured programming methods
- Integrate actuators, drives, and networking systems in automation

TEXT BOOKS:

1. Krishnan R, "Electric Motor Drives, Modelling, Analysis and Control", Prentice Hall India, 1st Edition, 2002.
2. Mukhopadhyay S, Sen S & Deb A K, "Industrial Instrumentation, Control and Automation", Jaico Publishing House, 1st Edition, 2013.

REFERENCES:

1. Stephanopoulos G, "Chemical Process Control, An Introduction to Theory and Practice", Prentice Hall India, 2nd Edition, 2012.
2. Merritt H E, "Hydraulic Control Systems", Wiley, 1st Edition, 1991.
3. Kuo B C, "Automatic Control Systems", Wiley, 9th Edition, 2014.
4. Ogata K, "Modern Control Engineering", Prentice Hall, 5th Edition, 2010.
5. https://onlinecourses.nptel.ac.in/noc25_ee42/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO2	2	2	1	-	-	-	-	-	-	-	-	2	1
CO3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	-	2	-	-	-	-	-	2	2	1
CO5	3	2	1	-	2	-	-	-	-	-	2	2	1

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24ME505PE **INDUSTRIAL LAYOUT DESIGN AND SAFETY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the industrial facility layout design principles, process and material flow analysis and product and equipment analysis.
- Understand the facilities layout design algorithms and selecting appropriate software.
- Explore the facilities layout problem modelling tools and algorithms for production, warehouse, and material handling.
- Know safety planning and management principles in industries.
- Acquire knowledge on various safety management approaches in industries.

UNIT I INTRODUCTION **9**

Industrial Facility Layout: Definition, Types of Layout Problems, Engineering Design Problem Approach – Product Analysis, Equipment Selection, Personnel Requirement Analysis, Space Requirement and Availability – Process and Material Flow Analysis, Data Requirement for Layout Decisions, Tools for Presenting Layout Designs.

UNIT II FACILITIES LAYOUT DESIGN & ALGORITHMS **9**

Traditional Approaches to Facility Layout, Systematic Layout Planning, Special Considerations in Office Layout, Engineering Design Problem Approach, Code Compliance, OSHA, ADA Regulations, and Other Considerations in Facility Design – Algorithms for the Layout Problem, Construction Algorithms, Improvement Algorithms, Hybrid Algorithms, Introduction to layout software's.

UNIT III FACILITIES LAYOUT PROBLEM MODELS & ALGORITHMS **9**

Models for the Layout Problem, Generic Modeling Tools, Models for the Single-Row Layout Problem, Models for the Multi row Layout Problem with Departments of Equal and Unequal Area – Material Handling, Principles, Types, Models for Material-Handling System Design – Storage and Warehousing, Warehouse Functions, Warehouse Design and Operation.

UNIT IV SAFETY PLANNING & MANAGEMENT **9**

Introduction: Elements of Safety Programming, Safety Management. Upgrading Safety Developmental Programs: Safety Procedures, Arrangements and Performance Measures, Education, Training and Development in Safety. Safety Performance: An Overview of an Accident, Occupational Health and Industrial Hygiene. Understanding the Risks: Prevention of Accidents involving Hazardous Substances. Indian Factories Act 1948 for Health and Safety.

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UNIT V APPROACHES IN SAFETY MANAGEMENT **9**

Safeguarding against Common Potential Hazards: Trips, Slips and Falls, Preventing Electrocution, Static Electricity, Hazardous Energy Control. Specific Hazard Control Measures: Forklift Hazard Control, Tractor Hazard Control - Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the industrial facility layout design principles and process sequences.
- Summarize the facilities layout design algorithms and select appropriate software.
- Apply the facilities layout problem modelling tools and algorithms for production, warehouse, and material handling.
- Develop the safety planning and management principles in industries.
- Examine the various safety management approaches in industries.

TEXT BOOKS:

1. Sunderesh S. Heragu, "Facilities Design", 5th Edition, CRC Press Taylor & Francis Group, 2022.
2. L. M. Deshmukh, "Industrial Safety Management: Hazard Identification and Risk Control", Tata McGraw-Hill Publishing Co. Ltd., 2005.

REFERENCES:

1. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.
2. Industrial Hazard and Safety Handbook: (Revised impressionby Ralph W King and John Magid, 2013
3. Matthew P. Stevens and Fred E. Meyers, "Manufacturing Facilities Design and Material Handling", 5th Edition, Purdue University Press, 2013.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	1	2	1
CO2	2	2	1	-	1	-	-	-	-	-	1	2	1
CO3	3	2	2	1	1	-	-	-	-	-	1	2	1
CO4	3	2	2	1	1	-	-	-	-	-	1	2	1
CO5	3	2	2	1	1	-	-	-	-	-	1	2	1

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24ME506PE PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the basic concepts of process planning.
- Learn the different activities involved in process planning.
- Gain knowledge on costing and estimation.
- Use suitable methods to estimate production costs.
- Perform machining time calculations for various manufacturing operations.

UNIT I FUNDAMENTALS OF PROCESS PLANNING 9

Introduction- methods of process planning-Drawing interpretation - Material evaluation – steps in process selection - Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9

Process parameters calculation for various production processes-Selection jigs and fixtures- selection of quality assurance methods - Set of documents for process planning-Economics of process planning – Break even analysis

UNIT III COSTING AND ESTIMATION 9

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labour cost, material cost- allocation of overhead charges- depreciation cost.

UNIT IV ESTIMATION OF COSTS IN PRODUCTION SHOP 9

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Relate suitable processes, equipment, and tools for different industrial products.
- Describe how to prepare a process planning activity chart.
- Apply the different methods of cost estimation.
- Select the costs for various jobs in shop floor.
- Identify machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, "Process planning, Design/Manufacture Interface", Elsevier science technology Books, 1st Edition, 2003.
2. Adithan M, "Process Planning and Cost Estimation", New Age International Pvt. Ltd, New Delhi, 2nd Edition, 2015.

REFERENCES:

1. Banga T R and Sharma S C, "Mechanical Estimating and Costing", Khanna Publishers, New Delhi, 17th Edition, 2015.
2. Panneerselvam R, Sivasankaran P, "Process Planning and Cost Estimation", Prentice-Hall of India Pvt. Ltd, New Delhi, 2016.
3. Chitale A V and Gupta R C, "Product Design and Manufacturing", Prentice-Hall of India Pvt. Ltd, New Delhi, 7th Edition, 2023.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	1	1	2	1
CO2	2	2	1	-	-	-	-	-	-	2	1	2	1
CO3	3	2	2	1	-	-	-	-	-	2	1	2	2
CO4	3	2	2	1	-	-	-	-	-	2	2	2	2
CO5	3	2	2	1	-	-	-	-	-	2	2	2	2

CHAIRMAN
(BoS / MECH)

24ME507PE **QUALITY CONTROL AND RELIABILITY ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the fundamental principles and techniques of statistical quality control.
- Understand the control charts for variables and attributes.
- Gain knowledge of acceptance sampling procedures and their applications.
- Explore the concepts of reliability and life testing.
- Illustrate key concepts and modern techniques in reliability engineering.

UNIT I INTRODUCTION TO QUALITY CONTROL **9**

Introduction, definition of quality, basic concept of quality, definition of Statistical Quality Control (SQC), benefits and limitation of SQC, quality assurance, quality control: quality cost – variation in process – process capability

UNIT II VARIABLES AND ATTRIBUTES **9**

Control charts – p, np, c, u, x, r and s charts – theory of control chart - control chart for non-conforming – state of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING **9**

Lot sampling – types – probability of acceptance in single, double and multiple sampling techniques – Operating Characteristic (OC) curves – producer's risk and consumer's risk – Acceptance Quality Limit (AQL), Lot Tolerance Percent Defective (LTPD) and Average Outgoing Quality Limit (AOQL) concepts – standard sampling plans for AQL and LTPD – uses of standard sampling plans.

UNIT IV LIFE TESTING AND RELIABILITY **9**

Life testing – objectives – failure data analysis, mean failure rate, mean time to failure, mean time between failure and hazard rate – weibull model, system reliability, series, parallel and mixed configuration – maintainability and availability – acceptance sampling based on reliability test – OC curves.

UNIT V QUALITY AND RELIABILITY **9**

Reliability improvements – techniques – use of pareto analysis – design for reliability – redundancy unit and standby redundancy – optimization in reliability – product design – product analysis – product development – product life cycles.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe key concepts of quality and process control.
- Implement effective methods for processing attributes and variables.
- Develop sampling concepts and procedures with relevant techniques.
- Apply life testing principles and measurement parameters.
- Examine modern reliability techniques and approaches to product analysis.

TEXT BOOKS:

1. Douglas C. Montgomery, Introduction to Statistical Quality Control, John Wiley, 8th Edition, 2024.
2. Srinath L. S., Reliability Engineering, Affiliated East West Press, 4th Edition, 2008.

REFERENCES:

1. Besterfield D. H., Quality Control, Prentice Hall, 9th Edition, 2018.
2. Patrick O. Connor, Andre Kleyner, Practical Reliability Engineering, John Wiley, 6th Edition, 2021.
3. Grant, Eugene L., Statistical Quality Control, McGraw-Hill, 7th Edition, 2017.
4. Gupta R. C., Statistical Quality Control, Khanna Publishers, 9th Edition, 2012.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	1	2	-
CO2	2	2	1	-	-	-	-	-	-	1	1	2	-
CO3	3	3	2	-	1	-	-	-	-	1	1	2	-
CO4	3	3	2	-	1	-	-	-	-	1	1	2	-
CO5	3	3	2	-	1	-	-	-	-	1	1	2	-

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24ME508PE **APPLIED ERGONOMICS** **L T P C**

3 0 0 3

OBJECTIVES:

The student should be made to:

- Know the concept and importance of ergonomics and relevances
- Learn human capabilities and measurement methods
- Understand physical ergonomics and assessment tools
- Assess cognitive ergonomics and environmental factors
- Formulate workplace design and safety considerations

UNIT I INTRODUCING ERGONOMICS 9

Fundamentals of ergonomics - human Factors – disciplines - physical - cognitive and organizational – Ergonomics: workplace - principles - applications – evaluation.

UNIT II ANTHROPOMETRY 9

Human body – structure and function – Anthropometric: types – application - design – measuring techniques - statistical treatment of data and percentile calculations.

UNIT III PHYSICAL ERGONOMICS 9

Posture: biomechanics - physiological background - sitting – standing - change of posture - hand and arm postures - Movement: lifting - carrying - pulling - pushing - repetitive motions - Tools and techniques: Rapid Upper Limb Assessment (RULA) – Rapid Entire Body Assessment (REBA) and Ovako Working Posture Assessment (OWAS) Method.

UNIT IV COGNITIVE ERGONOMICS 9

Work counter - environmental issues - physical work capacity - factors affecting work capacity - communication and cognitive issues - information processing and perception - interaction with machines - mental workload.

UNIT V OCCUPATIONAL SYSTEM EVALUATION 9

Work system evaluation - contribution of ergonomics to workstation design - analysis of workplace design - work envelopes - workplace evaluation tools - Safety - occupational safety and stress at various workplace - health management rules – Introduction to Biomechanics – principles of work in design

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the importance of ergonomics and its assessment methods
- Explain the knowledge of anthropometry with their fundamental structures.
- Apply the suitable methods to detect ergonomic risk factors
- Identify cognitive concerns with workers effectively
- Develop the key aspects of workplace component design

TEXT BOOKS:

1. Robert Bridger, "Introduction to Human Factors and Ergonomics", CRC Press, 4th Edition, 2021.
2. Gavriel Salvendy," Handbook of human factors and ergonomics", Wiley & sons, 4th Edition, 2012.

REFERENCES:

1. Wickens C D, Hollands J G, Banbury S, & Parasuraman R, "Engineering Psychology and Human Performance" Routledge, 4th Edition, 2020.
2. Dul J & Weerdmeester B, "Ergonomics for Beginners: A Quick Reference Guide" CRC Press, 3rd Edition, 2018.
3. Kroemer K H E & Grandjean E, "Fitting the Task to the Human: A Textbook of Occupational Ergonomics", CRC Press, Reprint Edition, 2017.
4. Pamela McCauley-Bush, "Ergonomics: Foundational Principles, Applications, and Technologies", Taylor & Francis, 1st Edition, 2012.
5. https://onlinecourses.nptel.ac.in/noc25_me05/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	1	-	-	-	-	-	-	-	1	1	-
CO3	3	2	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	-	-	-	-	-	-	-	1	1	-
CO5	3	2	1	-	-	3	-	-	-	-	1	1	-

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VERTICAL 6

Robotics and Automation

24ME601PE **AUTOMATION IN MANUFACTURING** **L T P C**

(Use of Design data books and catalogues is permitted) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Understand the role of automation and system design in manufacturing
- Identify components and fabrication methods for automation systems
- Explain functions of sensors and microprocessors in automation
- Explore drive systems and CNC basics in automation
- Describe hydraulic and pneumatic circuit design and operation

UNIT I AUTOMATION AND SYSTEM DESIGN **9**

Importance of automation in manufacturing – Role of mechatronics in automation - Systems required for automation – Building blocks of an automated system – Working principles – Design considerations for automation systems.

UNIT II FABRICATION OF AUTOMATED SYSTEMS **9**

Selection and specification of automation components – Fabrication techniques and integration – design catalogues – motion elements and actuators – Types.

UNIT III SENSORS AND MICROPROCESSOR **9**

Sensors in automation - types - Construction and working principles of sensors – Microprocessor - Signal conditioning and data acquisition - Use of microprocessors in automation - Configuration, programming, and operation.

UNIT IV DRIVE SYSTEMS **11**

Electrical drives - types, construction, operating principles - Selection criteria – Mechanisms - Ball screws, linear motion bearings, cam systems – Electronic cams, indexing mechanisms, tool magazines - Transfer systems for automation - Introduction to CNC: basic elements, interpolators, and programming fundamentals.

UNIT V HYDRAULIC AND PNEUMATIC SYSTEMS **7**

Hydraulic systems: power packs, pumps, valves - Design of hydraulic circuits – Pneumatic systems: configurations, compressors, valves - Air distribution and conditioning.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain components and design aspects of automation systems
- Demonstrate fabrication and integration techniques for automation
- Apply automation systems using sensors and microprocessors
- Develop the drive systems and CNC tools with suitable applications
- Construct and simulate hydraulic and pneumatic circuit systems

TEXT BOOKS:

1. Mikell P. Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Education, 4th Edition, 2016.
2. William Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson Education, 6th Edition, 2015.
3. S R Majumdar, "Pneumatic Systems: Principles and Maintenance", Tata McGraw-Hill Education, 6th Edition, 2017.

REFERENCES:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education, 7th Edition, 2013.
2. R.K. Rajput, "A Textbook of Mechatronics", S Chand & Company, 1st Edition, 2007.
3. S R Deb & S Deb, "Robotics Technology and Flexible Automation" McGraw-Hill Education, 2nd Edition, 2017.
4. https://onlinecourses.nptel.ac.in/noc25_me154/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	1	2	2
CO2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	-	-	2	-	-	-	-	-	2	2	2
CO5	3	2	2	1	-	2	-	-	-	-	2	2	2

CHAIRMAN
(BoS / MECH)

24ME602PE	PRODUCT PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the objectives and benefits of production planning and control.
- Familiarize the principles of method study and work measurement.
- Explore the significance of product and process planning in manufacturing.
- Learn scheduling methods and control systems for effective production management.
- Apply inventory control techniques in production planning and manufacturing.

UNIT I INTRODUCTION TO PRODUCTION **9**

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspects - aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY **9**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards

UNIT III PRODUCT PLANNING AND PROCESS PLANNING **9**

Product planning-Extending the original product information-Value analysis -Problems in lack of product planning-Process planning - Pre requisite information needed for process planning - Steps in process planning-Quantity determination in batch production-Machine capacity, balancing - Analysis of process capabilities in a multi-product system.

UNIT IV PRODUCTION SCHEDULING **9**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling-Batch production scheduling-Product sequencing – Periodic batch control-Material requirement planning- kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

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UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of Just In Time Systems-Fundamentals of MRP II and ERP-Introduction to agile manufacturing and digital twin technology.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the functions and benefits of production planning and control.
- Understand time study and work sampling techniques to improve productivity.
- Choose process capabilities and balance machine capacities in batch and multi-product systems.
- Use Gantt charts and scheduling rules to optimize production flow.
- Select recent technologies like JIT, ERP and Digital Twin for effective PPC.

TEXT BOOKS:

1. Jain K C & Aggarwal L N, "Production Planning Control and Industrial Management", Khanna Publishers, 8th Edition, 2020.
2. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, 3rd Edition, 2018.

REFERENCES:

1. Chary S N, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 6^{th} Edition, 2019
2. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 3rd Edition, 2016.
3. Elwood S Buffa, and Rakesh K Sarin, "Modern Production / Operations Management", John Wiley and Sons, 8th Edition, 2009.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	2	2	2
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CO3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	-	-	-	-	-	-	-	-	2	2	2

CHAIRMAN
(BoS / MECH)

24ME603PE **ROBOTICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the components, principle and functions of robots.
- Describe the various types of drive system and end effectors.
- Familiarize with the concepts of machine vision system and robot kinematics.
- Gain knowledge in robot programming, languages and AI Techniques.
- Learn safety issues and economic analysis of robots.

UNIT I FUNDAMENTALS OF ROBOT **9**

Robot – definition – robot anatomy – coordinate systems, work envelope types and classification – specifications – pitch, yaw, roll, joint notations, speed of motion, pay load – robot parts and their functions – need for robots – different applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic drives – hydraulic drives – mechanical drives – electrical drives – DC servo motors, stepper motors, AC servo motors – salient features, applications and comparison of all these drives.
End effectors – grippers: mechanical grippers, pneumatic grippers, hydraulic grippers, magnetic grippers, vacuum grippers, two and three fingered grippers – internal and external grippers – selection and design considerations.

UNIT III MACHINE VISION SYSTEM AND ROBOT KINEMATICS **9**

Introduction to machine vision – sensing and digitizing function in machine vision – image processing and analysis – robotic applications.
Introduction to manipulator kinematics – homogeneous transformations and robot kinematics – manipulator path control – Introduction to robot dynamics

UNIT IV ROBOT PROGRAMMING AND LANGUAGES **9**

Methods of robot programming – lead through programming, motion interpolation, robot programming languages – VAL programming – motion commands, sensor commands and end effector commands – Introduction of artificial intelligence – AI techniques – AI Vs Robotics – robotic paradigms-Introduction to ROS.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **9**

Robot Guided Vehicle (RGV) – Automated Guided Vehicle (AGV) – implementation of robots in industries – various steps – safety considerations – robot cell operations – economic analysis of robots.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the concepts of industrial robots and their applications in various sectors.
- Explain robot drive systems and end effectors to industrial tasks.
- Identify the robot kinematic motions for effective robot operation.
- Develop the robot programming languages to perform specific industrial tasks.
- Apply industrial robot safety and economic considerations in industries.

TEXT BOOKS:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, "Industrial Robotics – Technology, Programming and Applications", McGraw Hill Education (India) Private Limited, 2nd Edition, 2018.
2. Craig J. J., "Introduction to Robotics Mechanics and Control", Pearson Education, 4th Edition, 2018.

REFERENCES:

1. Fu K. S., Gonzalez R. C. and Lee C. S. G., "Robotics – Control, Sensing, Vision and Intelligence", McGraw Hill Education (India) Private Limited, 2019.
2. Deb S. R. and Deb S., "Robotics Technology and Flexible Automation", McGraw Hill Education, 2nd Edition, 2017.
3. Klafter R. D., Chmielewski T. A. and Negin M., "Robotic Engineering – An Integrated Approach", Prentice Hall of India Private Limited, 2009.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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CO3	3	2	2	1	-	-	-	-	-	-	2	2	2
CO4	3	2	2	1	2	-	-	-	-	-	2	2	2
CO5	3	2	2	1	2	-	-	-	-	2	2	2	2

CHAIRMAN
(BoS / MECH)

24ME604PE	AUTOMATION IN PRODUCTION SYSTEMS AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the basic principles and functions of manufacturing and production systems.
- Familiarize with the fundamentals of NC technology and its role in part production.
- Explore the applications of cellular manufacturing in modern industries.
- Understand the concepts of flexible manufacturing systems and robotics.
- Interpret the process planning techniques to real-time parts production.

UNIT I INTRODUCTION TO MANUFACTURING AND AUTOMATION 9

Production Systems- Automation in Production Systems- Manual Labour in Production Systems- Automation Principles and Strategies- Manufacturing Industries and Products- Manufacturing Operations- Production Facilities- Product and Production Relationships- Production Performance Metrics- Manufacturing Costs

UNIT II FUNDAMENTALS OF NC TECHNOLOGY 9

Introduction- Conventional Numerical Control- Basic Components of an NC System- NC Coordinate Systems-Control systems-Applications - Part Programming- Programming with Interactive Graphics- Voice NC Programming- Computer Controls in NC- Problems with Conventional NC.

UNIT III PROGRAMMABLE AND CELLULAR MANUFACTURING SYSTEMS 9

Flexible and Programmable Automation-Concept, types, advantages and limitations. Group Technology- Part Families- Three Parts Classification and Coding Systems- GT Machine Cells. Cellular Manufacturing Systems- Cell design and formation-Applications.

UNIT IV FLEXIBLE MANUFACTURING SYSTEMS AND ROBOTICS 9

Flexible Manufacturing System- Components- Analysis of Flexible manufacturing systems- Applications. Industrial Robots- Robot Anatomy- Robot Control Systems- End Effectors- Robot Programming- Robot Accuracy and Repeatability- Robot Applications.

UNIT V COMPUTER-AIDED PROCESS PLANNING 9

Process planning-Steps in Process plan-Types-Process planning Approaches-Automated computer aided process plan- Integration of CAPP with CAD/CAM systems-Process Optimization.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the concepts of automation in production systems and management.
- Explain the applications of part programing in NC technology.
- Apply the concepts of group technology in industrial applications.
- Select the suitable types of robots and their applications in automated production.
- Choose automated Computer aided process planning concepts for product development.

TEXT BOOKS:

1. Mikell P Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Higher Education, United States of America, 4th Edition, 2016.
2. Mikell P Groover and Zimmers E W, " CAD/CAM: Computer-aided Design and Manufacturing ", Prentice-Hall of India Private Limited, New Delhi, 7th Edition, 2003.

REFERENCES:

1. Peter Scallan, "Process planning, The Design / Manufacture Interface", Elsevier science technology books, 1st Edition, 2003.
2. Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey and Ashish Dutta "Industrial Robotics - Technology, Programming and Applications", McGraw Hill Education (India) Private Limited, 2nd Edition, 2018.
3. Yusuf Altintas. "Manufacturing Automation-Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design", Cambridge Aspire, 2nd Edition, 2012.
4. https://onlinecourses.nptel.ac.in/noc25_me135/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	2	2	2
CO2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	2	1	1	2	-	-	-	-	-	2	2	2
CO4	3	2	1	1	2	-	-	-	-	-	2	2	2
CO5	3	2	1	-	-	-	-	-	-	-	2	2	2

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24ME605PE **DRONE TECHNOLOGIES** **(COMMON TO ECE AND MECH)**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Define the fundamental concepts and components of drone technologies.
- Describe the fundamentals of design, fabrication, and programming of drones.
- Demonstrate the methods of flying and operating different types of drones.
- Analyze various real-world applications of drones across multiple sectors.
- Recognize the safety regulations, operational risks, and guidelines for safe drone flying.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY **9**

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING **9**

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts - Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection

UNIT III DRONE FLYING AND OPERATION **9**

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity Removable storage devices- Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS **9**

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY **9**

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Compare the various types of drone technologies, fabrication methods, and programming elements.
- Demonstrate appropriate operational procedures for effective drone functioning.
- Choose relevant sensors and actuators based on the functional requirements of drones.
- Construct drone mechanisms suited for specific real-world applications.
- Develop control programs for operating various types of drones.

TEXT BOOKS:

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, "Make:Getting Started with Drones ",Maker Media, Inc, 2016

REFERENCES:

1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
2. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	3	-	-	-	-	-	-
CO2	2	2	1	-	3	-	-	-	-	-	-
CO3	3	2	2	-	3	2	-	-	-	-	-
CO4	3	2	2	-	3	2	2	-	-	-	2
CO5	3	2	2	-	3	2	2	-	-	-	2

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24ME606PE **FLEXIBLE MANUFACTURING SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Study the fundamentals, components and layout of Flexible Manufacturing Systems .
- Provide knowledge on manufacturing cells, machining centres and their industrial applications.
- Know FMS software structures and relevant modules.
- Explore group technology and Automated Guided Vehicle (AGV) systems
- Discuss the installation, implementation and future trends of FMS.

UNIT I INTRODUCTION **9**

FMS - objectives - FMS concept - components and types of FMS – FMS layout - application of FMS in industries - CIM technology.

UNIT II MANUFACTURING CELL AND MACHINING CENTRES **9**

Introduction to cell - classifications - unattended machining - difference between FMS and FMC - machining centres - types - deburring - types - wash station – classifications - importance of automobile manufacturing.

UNIT III FMS SOFTWARE STRUCTURES AND FUNCTIONS **9**

General structures and requirements of FMS - FMS software - requirements - FMS software modules - general phases of simulation analysis - Reasons to Integrate FMS Computer System to a Central Host Computers - Functions of an FMS Host Computer - types.

UNIT IV GROUP TECHNOLOGY AND MATERIAL HANDLING SYSTEM **9**

Introduction to Group Technology (GT) - reasons for adopting GT - Visual Inspection- Part Classification and Coding-Production Flow Analysis - benefits of GT - obstacles in implementation of GT - Introduction to AGV - types - analysis of AGV systems – Automated Storage and Retrieval Systems (AS/RS) - advanced system - quantitative analysis.

UNIT V FMS INSTALLATION, IMPLEMENTATION AND FUTURE **9**

Introduction to system hardware – Programmable Logic Controller (PLC) – cell controllers – communication networks – types – FMS installation and implementation – case studies: Toyota production system – General Motors leverages common architecture to strategic advantage – Rover LM-500 FMS - Artificial Intelligence and Expert Systems in FMS.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concepts, components and industrial applications of FMS.
- Understand the troubleshooting techniques in machining centres during production.
- Classify the various FMS structures and their functions.
- Select the appropriate Automated Guided Vehicle (AGV) system for effective material flow.
- Apply hardware in installations and implementations of FMS in industries.

TEXT BOOKS:

1. Shivanand H K, Benel M M and Koti V, "Flexible Manufacturing Systems", New Age Internationals Pvt Ltd., New Delhi, 2nd Edition, 2021.
2. Jha N K, "Hand Book of Flexible Manufacturing Systems", Academic Press, 1st Edition, 2013.

REFERENCES:

1. Radhakrishnan P and Subramanian S, "CAD/CAM/CIM", Wiley Eastern Ltd., New Age International Ltd., 2009.
2. Groover M P, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt., New Delhi, 4th Edition, 2016.
3. Serope Kalpakjian, "Manufacturing Engineering and Technology", Pearson, 8th Edition, 2020

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	2	2	1
CO2	2	2	1	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	1	2	-	-	-	-	-	2	2	1
CO4	3	2	2	1	-	-	-	-	-	-	2	2	1
CO5	3	2	2	1	-	-	-	-	-	-	2	2	1

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(BoS / MECH)

24ME607PE **AI IN MECHANICAL SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the fundamentals and significance of AI in modern manufacturing systems
- Learn different types of data and techniques for data collection, preparation and transformation for AI applications
- Gain knowledge about predictive analytics and enabling technologies for Industry 4.0 in mechanical systems
- Explore the global business impact and sustainability aspects associated with AI-driven technologies
- Study various smart applications of AI across sectors such as agriculture, healthcare, education, transportation and manufacturing

UNIT I ARTIFICIAL INTELLIGENCE IN MANUFACTURING **9**

Overview, Need and Application of AI in Manufacturing – Advantages – AI as a Catalyst to Smart Manufacturing – Advantages and Shortcomings - Risk Associates with AI. AI in Process Capabilities: Improvement at Process Level – Benefits at Organizational Level – AI as a Key Component of Future Manufacturing.

UNIT II DATA TYPES AND ITS PREPARATION **9**

Data Types – Structured – Unstructured – Static – Streamed – Attitudinal – Behavioral – Demographic - Data Driven Analytics – User Driven Analytics - Data Validity – Variety - Velocity of Constantly Changing – Attributes - Converting Raw Data into Matrix – Data Clustering - K means Algorithm - Nearest Neighbors - Identifying Objective of Data - Cleaning the Data - Structuring the Data – Data Preparation – Normalization - Binning – Sampling.

UNIT III AI AND ITS PREDICTIVE ANALYTICS **9**

Introduction, Enabling Technologies for Industry 4.0 - Data Technologies (DT): Data Pre-processing, Feature Engineering, Data-driven Analytics, Cyber Physical Production systems and Digital Twin - Platform Technologies (PT) - Operations Technology (OT): Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), Manufacturing Execution System (MES), Customer Relationship Management (CRM), Supply Chain Management (SCM) - Case study: Intelligent Bandsaw System & Challenges.

UNIT IV AI ON GLOBAL BUSINESS AND SUSTAINABILITY **9**

Introduction – Need for AI in Global Business – Future Impact of AI in Global Business Practices, Achieving Sustainability – Smart Manufacturing – Futuristic Agriculture – Transforming Construction – Revolutionizing Manufacturing – Strategic Retailing – Revamping Media and Entertainment – Remodelling Financial Services – Reshaping Education, Adverse Impacts of AI in Sustainability.

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UNIT V SMART APPLICATIONS OF AI **9**

Smart Agriculture – Smart Healthcare – Smart Education – Smart Grids – Smart Transportation and Autonomous Vehicles – Smart Homes – Smart Cities – AI in metal cutting.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the need for AI in manufacturing sector
- Identify and prepare data techniques with relevant Algorithms.
- Develop the concepts of industrial AI and predictive analytics.
- Apply the various concepts of AI in global business and its sustainability.
- Build the different types of smart applications using AI.

TEXT BOOKS:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", Prentice Hall, 2010.
2. Kaushik Kumar, Divya Zindani, Paulo Davim, "Artificial Intelligence in Mechanical and Industrial Engineering", 1st Edition, CRC Press, New York, 2021.

REFERENCES:

1. Geeta Rana, Alex Khang, Ravindra Sharma, Alok Kumar Goel, Ashok Kumar Dubey, "Reinventing Manufacturing and Business Processes Through Artificial Intelligence", 1st Edition, CRC Press, New York, 2022.
2. Masoud Soroush, Michael Baldea, Thomas F. Edgar, "Smart Manufacturing Concepts and Methods", 1st Edition, Elsevier, United States, 2020.
3. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics", 2nd Edition, MIT Press, Cambridge, 2020.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	-	-	-	1	-
CO2	2	1	-	-	1	-	-	-	-	-	-	1	-
CO3	3	2	-	-	1	-	-	-	-	-	-	1	-
CO4	3	2	-	-	1	-	-	-	-	-	1	1	-
CO5	3	2	-	-	1	-	-	-	-	-	1	1	-

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24ME608PE **MAINTENANCE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the concepts of maintenance planning and scheduling
- Identify about the different strategies and types of maintenance
- Gain knowledge on condition monitoring methods and instruments
- Know about the failure analysis and repair methods in mechanical elements
- Provide knowledge on computerization of maintenance and management activities

UNIT I MAINTENANCE PLANNING AND SCHEDULING **9**

Definition - purpose - basic functions of maintenance planning - maintenance objectives and responsibilities - reliability, maintainability and availability - MTBF and MTTR maintenance planning and scheduling steps and techniques in planning - scheduling principles, types and techniques - maintenance organization: line and staff, functional and centralized organizations - maintenance performance measuring indices.

UNIT II MAINTENANCE STRATEGIES AND TYPES **9**

Definition - basis of selecting maintenance strategies - maintenance categories: breakdown maintenance, corrective maintenance, preventive maintenance, routine maintenance, predictive maintenance - comparison - Condition Based Maintenance System (CBMS) - objectives - flow chart-methodology - evolutions of maintenance strategies - repair cycle - Total Productive Maintenance (TPM) - principles and pillars of TPM.

UNIT III CONDITION MONITORING **9**

Condition based maintenance - benefits - Condition Monitoring Techniques - cost comparison with and without condition monitoring - methods and instruments for condition monitoring - leakage, vibration, wear, temperature, crack, corrosion, noise and odour measurement - lubrication monitoring techniques.

UNIT IV FAILURE ANALYSIS AND REPAIR METHODS **9**

Failure analysis – failures rate, mode and their development - failure detection methods - fault tree, event tree analysis root cause failure analysis - FMEA benefits and process flow diagram – failure reporting, analysis and corrective action - weibull analysis - repair methods for gears, rolling contact bearings, guide ways, beds, spindles, lead screw and lead nut.

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UNIT V COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS) 9

Definition - objectives - factors - benefits - components of CMMS - classification of records in integrated CMMS - material management module - codification - job sequencing requirement planning and indent generation future of CMMS - maintenance cost analysis & control - maintenance budget - types.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the maintenance planning and scheduling activities in an organization
- Choose the different maintenance strategies in working environment
- Apply the condition of machineries using various instruments
- Identify failure analysis and repair methods in mechanical elements
- Construct activities of computerized maintenance management system

TEXT BOOKS:

1. Sushil Kumar Srivastava, "Maintenance Engineering Principles, Practices & Management", S.Chand and Co., 1st Edition, 2011.
2. Bhattacharya S N, "Installation, Servicing and Maintenance", S.Chand and Co., 2nd Edition, 2012.

REFERENCES:

1. Keith Mobley R, "Maintenance Engineering Handbook", McGraw Hill, 8th Edition, 2014.
2. Richard Palmer, "Maintenance Planning and Scheduling Handbook", McGraw-Hill Education, 3rd Edition, 2012.
3. Amiya Ranjan Mohanty, "Machinery Condition Monitoring: Principles and Practices", 1st Edition, 2014.
4. Ben Daya Mohamed, "Introduction to Maintenance Engineering: Modelling, Optimization and Management", John Wiley & Sons Inc., 1st Edition, 2016.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	1	3	2
CO2	2	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	-	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2
CO5	3	2	-	-	-	-	-	-	-	-	1	3	2

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VERTICAL 7

Management and Administration

24ME701PE **AI IN HUMAN RESOURCE MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the foundational concepts and significance of Artificial Intelligence in Human Resource Management.
- Explore AI tools and technologies used in key HR functions.
- Study innovations in HRM through AI to enhance learning, development and organizational capabilities.
- Assess the impact of AI on organizational culture, employee experience, and strategic HRM.
- Identify emerging trends, opportunities, and ethical concerns related to the integration of AI in HRM.

UNIT I FOUNDATIONS OF AI IN HRM **9**

Understanding AI in HR - Deploying AI in HR practices - Introduction to AI tools for HR - Leveraging AI for diversity management - Adoption of AI in HR practices: decision making, task automation, Recruitment and Talent acquisition - HR metrics.

UNIT II AI ENABLED HR FUNCTIONS **9**

Role of AI in Performance Management - Application of AI in Onboarding - AI in Person job fit - HR Analytics - People Analytics Using AI - HR administration application - Smart HRM - AI for Employee Retention - AI in Performance Appraisal - AI in Employee Training - AI in Workforce Planning - Ethical concerns in using AI in various functions of HRM.

UNIT III INNOVATIONS IN HUMAN RESOURCE MANAGEMENT **9**

AI in Augmented HRM - Learning and Development Programmes - Disruptive innovation in HRM: Future of HRM - HRM in the era of Generative AI - Building Organizational Capabilities through AI Driven HRM - Metaverse in HRM.

UNIT IV AI IN SHRM AND EMPLOYEE EXPERIENCE **9**

AI in Strategic Human Resource Management (SHRM) – Human Resource Planning (HRP) and HR Chatbots - AI in enhancing employee experience - HR and Company Culture - Adopting AI in Managing Company Culture - Boon or Curse: Co-existence of HR and AI.

UNIT V EMERGING TRENDS AND AI TOOLS IN HR **9**

Challenges of AI adoption in HRM - HRM digitalization Success and Future Opportunities - AI in Career Succession Planning of Employees - AI in Sustaining Green HRM - Emerging trends of AI based HRM - Benefits of Synergizing AI and HRM - AI in Compensation and Benefits - AI in Compliance – AI in Mediated Knowledge Management.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the fundamental concepts of AI and its application in HR practices.
- Select AI tools and techniques to key HR functions such as recruitment, onboarding, and training.
- Develop innovative learning and programmes driven by AI.
- Build the ethical, legal, and cultural implications of AI in various HR functions.
- Apply emerging trends and futuristic applications of AI in strategic HR decision-making.

TEXT BOOKS:

1. Ben Eubanks, "Artificial Intelligence for HR: Use AI to Support and Develop a Successful Workforce", Kogan Page Publishers, 2018
2. Strohmeier, Stefan, "Handbook of Research on Artificial Intelligence in Human Resource Management", Edward Elgar Publishing, 2022

REFERENCES:

1. Aizhan Tursunbayeva, "Augmenting Human Resource Management with Artificial Intelligence: Towards an Inclusive, Sustainable, and Responsible Future", Springer publications, 2024
2. Bessen, James E. AI and Jobs: The Role of Demand. Brookings Institution Press, 2020.
3. Chamorro-Premuzic, Tomas, and Reece Akhtar. The Talent Delusion: Why Data, Not Intuition, Is the Key to Unlocking Human Potential. Piatkus, 2017
4. https://onlinecourses.nptel.ac.in/noc25_mg05/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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CO2	3	1	-	-	2	-	-	-	-	1	1	1	-
CO3	3	2	-	-	2	-	-	-	-	1	1	1	-
CO4	3	2	-	-	2	-	-	-	-	1	1	1	-
CO5	3	2	-	-	2	-	-	-	-	1	1	1	-

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24ME702PE	GREEN SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Know global concepts, regulations, and policies in green electronics.
- Understand knowledge on eco-friendly materials, processes, and waste management.
- Explore knowledge on sustainable product design, assembly, and recycling.
- Familiarize with life-cycle assessment, eco-design tools, and standards.
- Apply sustainable design for environmental management system.

UNIT I INTRODUCTION TO GREEN ELECTRONICS 9

Environmental concerns of the modern society- Overview of electronics industry and their relevant regulations in China, European Union and other key countries- global and regional strategy and policy on green electronics industry. Restriction of Hazardous substances (RoHS) - Waste Electrical and electronic equipment (WEEE - Energy using Product (EuP) and Registration - Evaluation, Authorization and Restriction of Chemical substances (REACH), Reliability of green electronics systems

UNIT II GREEN ELECTRONICS MATERIALS 9

Basics of IC manufacturing and its process – Electronics with Lead (Pb) -free solder pastes, conductive adhesives, Introduction to green electronic materials and products - halogen-free substrates and components. Reuse and recycle of End-of-Life (EOL) electrical and electronic equipment for effective waste management

UNIT III PRODUCTS AND GREEN ELECTRONICS ASSEMBLY 9

Introduction to green electronic products -Substitution of non-recyclable thermosetting polymer based composites with recyclable materials X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products Various processes in assembling electronics components - the life-cycle environmental impacts of the materials used in the processes - substrate interconnects. Components and process equipments.

UNIT IV RECYCLING AND PRODUCT DESIGN 9

Technology and management on e-waste recycle system construction, global collaboration, and product disassembles technology. Stages of product development process in green design: Materials-Manufacturing - Packaging and use - End of Life and disposal - Design for recycling - Life Cycle Assessment (LCA) -Introduction of Green Supply Chain, and Modeling green products from Supply Chain point of view.

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UNIT V SUSTAINABLE ECO-DESIGN 9

Eco-design tools - Environmental management systems, and International standards - Eco-design in electronics industry. A life-cycle assessment for eco-design of Cathode Ray Tube Recycling.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain environmental concerns, regulations, and policies for green electronics.
- Select green materials, lead-free processes, and recycling methods for the sustainable development of Products
- Apply eco-friendly assembly, hazardous substance detection, and e-waste recycling.
- Examine life-cycle assessment and green supply chain in product design.
- Develop eco-design tools, standards, and environmental management systems.

TEXT BOOKS:

1. Green Supply Chain Management, by Charisios Achillas , Dionysis D. Bochtis , Dimitrios Aidonis, Routledge; 1st edition (16 November 2018), ISBN-10 : 1138644617
2. Sammy G. Shina, Green Electronics Design and Manufacturing, McGraw Hill., 2008.

REFERENCES:

1. David Austen, Green Electronic Morning, Ingleby Gallery, 2006.
2. John Hu. Mohammed Ismail, CMOS High Efficiency on – Chip Power Management, Springer Publications 4th edition, 2011.
3. Yuhang yang and Maode Ma, Green Communications and Networks, Springer Publication., 2014.
4. Sanka Ganesan, Michael Pecht, Lead free Electronics, John Wiley & Sons, 2006.
5. Charles A. Harper, Electronic Materials and Processes Hand book, McGraw-Hill, 2010.
6. Sammy G. Shina, Green Electronics Design and Manufacturing, McGraw Hill., 2008

Mapping of COs with POs and PSOs

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CO3	3	2	1	-	-	2	-	-	-	-	1	2	-
CO4	3	2	1	-	-	2	-	-	-	-	1	2	-
CO5	3	2	1	-	-	2	-	-	-	-	1	2	-

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24ME703PE **ENTREPRENEURSHIP** **L T P C**

(COMMON TO CIVIL AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Know the entrepreneurial mind-set and journey
- Understand testing and validate innovative ideas.
- Identify technological innovation to become an entrepreneur.
- Explore the Resource Mobilization and Economical Mobilization.
- Study the impact of entrepreneurship on employment and the national economy.

UNIT I ENTREPRENEURIAL FOUNDATIONS 9

Definition, traits, and types of entrepreneurs – Entrepreneurial mindset – Entrepreneurial process – Successful entrepreneurial journeys, Opportunity identification – Market gaps – Problem framing – User needs – Feasibility study – Business discovery process. Design thinking – Brainstorming methods – Convergent and divergent thinking – MVP development – Rapid prototyping – Iteration cycles.

UNIT II VALIDATION AND COMMERCIALISATION 9

Testing and Lean validation – Customer feedback loops – Pivot or persevere decisions – Business Commercialisation – Go-to-market strategy. Disruptive technologies – Blue ocean strategy – Innovation vs. invention — Risk-taking and agility.

UNIT III TECHNOLOGICAL INNOVATION AND ENTREPRENEURSHIP 9

Role of technology in start-ups – Tech innovation frameworks – Emerging domains: AI, IoT, Block chain. Digital product development – Scalability – Technology adoption curves – Patents and IP.

UNIT IV RESOURCE MOBILIZATION AND ENTREPRENEURSHIP ECOSYSTEM 9

Raising financial resource – Angel investors – Venture capital – Crowdfunding – Government grants – Financial forecasting, Role of academia – Entrepreneurial curriculum – Incubators – Start-ups from universities. Founder transitions – Professional management – Building teams – Leadership succession

UNIT V NATIONAL ENTREPRENEURSHIP CONTEXT 9

Indian ecosystem – Start-up India initiatives – Unicorns from India – Global comparisons, Cultural attitudes towards entrepreneurship – Grassroots innovations – Regional variations – Support networks. Work-life balance – Mental stamina – Passion economics – Sustainable entrepreneurship.
Job creation – Skill-based entrepreneurship – MSMEs – Gig economy – Employment trends, Global and Indian case studies – Failures and successes – Innovation journeys.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the key concepts in entrepreneurship journey and opportunity discovery.
- Demonstrate ideation and validation processes in product and service development.
- Apply the role of disruption and technology in entrepreneurship.
- Develop funding mechanisms and ecosystem support for start-ups.
- Summarize India's entrepreneurial landscape and employment contribution.

TEXT BOOKS:

1. Peter Thiel, 'Zero to One: Notes on Startups, or How to Build the Future', Crown Publishing-September 18, 2014
2. Eric Ries, 'The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses', Crown Publishing - 2017
3. C. B. Rao, 'India as Global Start-up Hub: Mission with Passion', Notion Press. June 2018

REFERENCES:

1. Ashlee Vance, 'Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future', Harper Collins.April 11, 2017
2. Walter Isaacson Great Innovators E-book Boxed Set Steve Jobs, Benjamin Franklin, Einstein, Walter Isaacson, Simon & Schuster, 2011
3. Peter F. Drucker, 'Innovation and Entrepreneurship: Practice and Principles', Harper Business - 2007
4. Clayton M. Christensen, 'The Innovator's Solution', Harvard Business Review Press - 2003
5. https://onlinecourses.nptel.ac.in/noc25_mg81/preview

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	2	2	3	2	2	2
CO3	2	2	-	-	2	2	2	2	2	2	-
CO4	2	2	-	-	-	2	2	2	2	2	-
CO5	2	2	-	-	-	2	-	-	-	2	-

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(BoS / MECH)

24ME704PE	ENGINEERING ECONOMICS	L	T	P	C
	(COMMON TO CIVIL AND MECH)	3	0	0	3
	(Use of Interest Tables is Permitted)				

OBJECTIVES:

The student should be made to:

- Understand the fundamental economic concepts like supply, demand, costs, and their relevance to engineering.
- Know value engineering principles for cost-effective product design and manufacturing.
- Study and compare different investment alternatives using various economic evaluation methods.
- Make economical decisions regarding the maintenance and replacement of equipment.
- Learn methods of depreciation and their effect on asset valuation and project economics.

UNIT I INTRODUCTION TO ECONOMICS **9**

Introduction to Economics- Micro and Macro Economics, Flow in an Economy, Law of Supply and Demand, Elasticity of Demand and Supply, Concept of Engineering Economics – Engineering Efficiency, Economic Efficiency, Technical efficiency, Scope of Engineering Economics – Element of Costs, Marginal Cost, Marginal Revenue, Sunk Cost, Opportunity Cost, Economic Order Quantity, Break-even Analysis - Contribution - PV ratio - Margin of Safety, Elementary Economic Analysis – Material Selection for Product, Design Selection for a Product, Building Material Selection, Process Planning.

UNIT II VALUE ENGINEERING **9**

Make or Buy Decision, Factors and Approaches, Value Analysis, Value Engineering – Types, Aims, Function and Procedure, Interest Formulae and their Applications – Nominal vs Effective Interest Rate, Time Value of Money, Single Payment Compound Amount Factor, Single Payment Present Worth Amount Factor, Equal Payment Series Compound Amount Factor, Equal Payment Series Sinking Fund Factor, Equal Payment Series Payment Present Worth Amount Factor- Equal Payment Series Capital Recovery Amount Factor - Uniform Gradient Series Annual Equivalent Amount Factor, Effective Interest Rate, Examples in all the Methods.

UNIT III CASH FLOW **9**

Methods of Comparison of Alternatives – Present Worth method (Revenue Dominated and Cost Dominated Cash Flow), Future Worth Method (Revenue Dominated and Cost Dominated Cash Flow), Annual Equivalent Method (Revenue Dominated and Cost Dominated Cash Flow), Rate of Return Method, Examples in all the Methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS **9**

Replacement Analysis – Needs of Replacement, Reasons, Failures and Types of Replacement Problem, Determination of Economic Life of an Asset, Replacement of an Asset with a New Asset – Group vs Individual replacement Policy, Capital Recovery with Return - Concept of Challenger and Defender, Maintenance Analysis - Objectives, Functions, Types of Maintenance, Simple Probabilistic Model for Items which Fail Completely.

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UNIT V DEPRECIATION **9**

Depreciation - causes, reasons for providing depreciation, methods - Straight line method of depreciation, Declining balance method of depreciation - Sum of the years digits method of depreciation, Sinking fund method of depreciation, Service output method of depreciation - Evaluation of public alternatives, Inflation adjusted decisions – procedure, types, Effect of inflation in engineering decision, examples on comparison of alternatives and Determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain break-even analysis and cost concepts in engineering decision-making.
- Interpret interest formulas and time value of money concepts to engineering projects.
- Identify projects using present worth, future worth, and annual equivalent methods.
- Analyze the economic life of assets and decide on optimal replacement strategies.
- Examine depreciation using appropriate methods and evaluate engineering decisions under inflation.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2nd Edition 2016.
2. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 7th Edition 2022.

REFERENCES:

1. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 13th Edition 2017.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New, 16th Edition 2019.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	-	2	-
CO2	2	2	1	1	-	-	-	-	-	2	-
CO3	3	2	2	1	-	-	-	-	-	2	-
CO4	3	2	2	1	-	-	-	-	-	2	-
CO5	3	2	2	1	-	-	-	-	-	2	-

CHAIRMAN
(BoS / MECH)

24ME705PE **TOTAL QUALITY MANAGEMENT** **L T P C**

(COMMON TO AGE, BME, ECE, EEE, CIVIL AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Learn the fundamental approaches and philosophy of Total Quality Management (TQM)
- Know the core concepts and principles of TQM
- Equip with knowledge of both traditional and modern quality improvement tools
- Understand the different types of TQM techniques across different industries
- Study the various quality systems, international standards, and procedural frameworks

UNIT I INTRODUCTION **9**

Definition of quality and TQM – basic needs of TQM – contributions of Deming, Juran, Crosby – TQM framework – history review of quality management – dimensions of quality – barriers to TQM – benefits of TQM – quality council – quality statements.

UNIT II TQM PRINCIPLES **9**

Customer satisfaction – customer perception of quality, customer complaints, service quality, Kano Model and customer retention – employee involvement – motivation, empowerment, team and teamwork, recognition and reward, performance appraisal – continuous process improvement – PDSA cycle, 5s and Kaizen – supplier partnership– supplier selection and supplier rating and relationship development.

UNIT III TQM TOOLS **9**

Basic seven tools of quality – new seven management tools – six-sigma – concepts and process – quality costs – BPR - reengineering process – improvement strategies – Taguchi principles – quality loss function – role of IT in TQM.

UNIT IV TQM TECHNIQUES **9**

Benchmarking – reasons, types and process – Failure Mode of Effect Analysis (FMEA) – procedures and types – Quality Function Deployment (QFD) – benefits and process – Total Productive Maintenance (TPM) – process.

UNIT V QUALITY SYSTEMS **9**

Benefits of ISO registration – ISO 9000 series of standards – ISO 9000 requirements and implementation – other sectors specific standards – documentation – audit – ISO 14000 series of standards – concepts, requirements and benefits – quality awards.

TOTAL: 45 PERIODS

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(BoS MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the basic approaches and philosophy of TQM in organizational contexts.
- Interpret the key principles and concepts of Total Quality Management.
- Apply basic and advanced quality tools for process improvement and problem-solving.
- Identify the use of TQM techniques in real-world industrial scenarios.
- Build standardized quality systems and procedures to ensure improved quality assurance

TEXT BOOKS:

1. Dale H Besterfiled, "Total Quality Management", Pearson Education Asia, 5th Edition, 2018.
2. Poonia M P and Sharma S C, "Total Quality Management", Khanna Publication, 1st Edition 2019

REFERENCES:

1. James R Evans and William M Lindsay, "The Management and Control of Quality", South-Western Cengage Learning, 11th Edition, 2020.
2. Vijayan V and Ramakrishnan H "Total Quality Management", S Chand Publication, Pune, 1st Edition, 2014.
3. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 7th Edition, 2011.
4. Poornima M Charantimath, "Total Quality Management", Pearson Education, 4th Edition, 2022.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	2	2	-
CO3	3	2	-	-	2	-	-	-	2	2	-
CO4	3	2	-	-	2	-	-	-	2	2	-
CO5	3	2	-	-	2	-	-	-	2	2	-

CHAIRMAN
(BoS / MECH)

24ME706PE **PROFESSIONAL ETHICS IN ENGINEERING**
(COMMON TO AGE, CIVIL AND MECH)

L	T	P	C
3	0	0	3

OBJECTIVES:
The student should be made to:

- Understand human values, morals, and ethics to promote integrity and social responsibility among engineers.
- Outline the concepts of engineering ethics, moral reasoning, and professional responsibilities.
- Know a social experiment, fostering accountability and ethical decision-making.
- Familiarize with safety, rights, and responsibilities in engineering practice, including legal and professional standards.
- Learn global issues, environmental ethics, and the role of engineers in sustainable and ethical technological development.

UNIT I HUMAN VALUES **9**

Morals, values and ethics - integrity work ethic - service learning - civic virtue - respect for others living peacefully - caring - sharing - honesty - courage - valuing, time - cooperation - commitment-empathy-self-confidence - character-spirituality.

UNIT II ENGINEERING ETHICS **9**

Senses of 'engineering ethics' - variety of moral issues - types of inquiry - moral dilemmas -moral autonomy - Kohlberg's theory and Gilligan's theory-consensus and controversy – models of professional roles - theories about right action-self interest - customs and religion - uses of ethical theories.

UNIT III ENGINEER AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics -balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and risk assessment of safety and risk risk benefit analysis and reducing risk – the three mile island and Chernobyl case studies. Respect for authority collective bargaining - confidentiality conflicts of interest- occupational crime - professional rights-employee rights - Intellectual Property Rights (IPR)-discrimination.

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UNIT V GLOBAL ISSUES **9**

Multinational Corporation (MNC) environmental ethics computer ethics weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors -- moral leadership - code of conduct - corporate social responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the importance of human values, integrity, and ethical behaviour in personal and professional life.
- Analyze moral dilemmas using ethical theories and professional standards.
- Apply the concept of social experimentation to real-world engineering problems.
- Select safety concerns, risk management principles, and professional rights and responsibilities in engineering practice.
- Summarise global engineering issues, environmental ethics, and the engineer's role in corporate social responsibility.

TEXT BOOKS:

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 4th Edition, 2017.
2. Naagarazan R S, "Professional Ethics and Human Values", New Age International Publishers, 1st Edition, 2017

REFERENCES:

1. Govindarajan M, Natarajan S and Senthil Kumar V S, "Engineering Ethics", Prentice Hall of India, New Delhi, 12th Edition, 2011.
2. Charles B Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 4th Edition, 2014.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	2	2	-	-
CO2	-	-	-	-	-	3	3	2	2	-	-
CO3	-	-	-	-	-	3	3	2	2	-	-
CO4	-	-	-	-	-	-	3	2	2	-	-
CO5	-	-	-	-	-	3	3	2	2	-	-

CHAIRMAN
(BoS / MECH)

24ME707PE **PROJECT MANAGEMENT FOR MANAGERS** **L T P C**

(COMMON TO AGE AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Understand core concepts, principles, and scope of project management.
- Build skills in financial evaluation, capital budgeting, and risk analysis.
- Develop abilities in HR management and project scheduling.
- Provide expertise in advanced network analysis and crashing methods.
- Assess capabilities in project monitoring, quality, and procurement management.

UNIT I INTRODUCTION TO PROJECT MANAGEMENT **9**

Introduction of project management - types of structure organizations - project management - stakeholders management - types of projects and project life cycle - project appraisal - methods of project selection - Multi-Criteria Decision Making (MCDM) - market and demand analysis – methods of demand forecasting.

UNIT II PROJECT FINANCIAL EVALUATION **9**

Financial analysis - capital budgeting techniques - financing of projects – risk management – process - stages - control and documentation – techniques for risk analysis - analysis of standalone risk: sensitivity analysis, scenario analysis, break even analysis, hillier model, simulation analysis, decision tree analysis and analysis of contextual risk: corporate risk analysis, market risk analysis - abandonment analysis - product mix and plant capacity analysis.

UNIT III HUMAN RESOURCE AND SCHEDULING IN PROJECTS **9**

Project team building, conflict and negotiation - HRM issues and time management - project time management- project scheduling - numbering of nodes - Program Evaluation and Review Technique (PERT) Networks - Critical Path Method (CPM) - laddering in PERT/CPM.

UNIT IV PROBABILITY MODELS AND NETWORK ANALYSIS **9**

Probability models in networks - simulation of network - slacks and floats - time and cost relationship - crashing of networks - free float method

UNIT V PROJECT MONITORING AND CONTROL **9**

Project Cost Management - Tools and Techniques of cost control - Cost Estimation - Quality Management - Source of variability and Six Sigma - Six Sigma Tools - Procurement Management - Project Termination – elements of project closeout management.

TOTAL: 45 PERIODS

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(BoS / MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals, life cycle phases, and selection methods of projects.
- Apply capital budgeting, risk management, and technical analysis techniques for evaluating projects.
- Utilize human resources effectively and project schedules using PERT and CPM methods.
- Describe the probability models and crashing techniques for optimizing project timelines and resources.
- Implement cost control measures, quality management systems, and procurement processes in project execution.

TEXT BOOKS:

1. K.Nagarajan, " Project Management", New Age International Publishers, New Delhi,, 8th Edition, 2020
2. Prasanna Chandra, " Projects: Planning, Analysis, Selection, Financing, Implementation, and Review", McGraw Hill Education, New Delhi, 9th Edition, 2021.

REFERENCES:

1. Harold Kerzner, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", 13th edition, John Wiley & Sons, Hoboken, 2022.
2. Roderick A. Munro and Govindarajan Ramu and Daniel J. Zrymiak, "The certified six sigma Green Belt Handbook", ASQ Quality Press and Infotech Standards India Pvt. Ltd, 2nd Edition, 2017.
3. Pinto, Jeffrey K. "Project Management: Achieving Competitive Advantage", Pearson Education, 6th Edition, 2023.
4. Meredith, Jack R., Mantel, Samuel J., and Shafer, Scott M," Project Management: A Managerial Approach", Wiley India, 10th Edition, 2021.
5. https://onlinecourses.nptel.ac.in/noc25_mg90/preview

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	2	2	-	1
CO2	3	2	-	-	-	-	-	2	2	-	1
CO3	2	2	-	-	-	-	-	2	2	-	1
CO4	2	2	-	-	-	-	-	2	2	-	1
CO5	3	2	-	-	-	-	-	2	2	-	1

CHAIRMAN
(BoS / MECH)

24ME708PE **PRINCIPLES OF MANAGEMENT** **L T P C**

(COMMON TO AD, AGE, CIVIL, CSE, ECE, IT AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Understand basic concepts and evolution of management.
- Learn planning, forecasting, and decision-making tools.
- Explain organization structures, staffing, and coordination.
- Explore career development and leadership roles.
- Acquire organizational communication and ethics.

UNIT I MANAGEMENT AND EVOLUTION OF MANAGEMENT THOUGHT 8

Management – An Emerging Profession - Definition - Nature - Scope - Purpose - Characteristics, Functions -Roles and Skills of an Effective Mmanager , Evolution of Management Thought: Classical Theory - Scientific Management - Administrative Management /Management Process - Bureaucracy - Behavioural Science Approach - Quantitative Approach - Systems Approach - Contingency Approach - Operational Approach

UNIT II PLANNING, FORECASTING, DECISION-MAKING AND MANAGEMENT BY OBJECTIVES 11

Planning – Types of Plans - Planning Process, Strategic Management – Introduction - Types of Strategies, Understanding Environment of Business: Environmental Appraisal - Industry Analysis - Porter's Model of Competitive Advantage - Analysis of Organizational Resources and Capabilities, Forecasting and Premising: Concept - Components - Determinants - Benefits and Limitations - Forecasting Techniques, Decision-making – Components and Process, Group Decision-making, Creativity Problem-Solving, Management by Objectives (MBO): Concepts - Characteristics - Process - Goal Setting - Action Plan - Review - Benefits and Limitations, Styles of Management: American - Japanese - Indian

UNIT III ORGANIZING, DIRECTING, STAFFING AND COORDINATION 9

Organization Design, Hierarchical Systems, Organization Structures - Types of Organizational Structures, Formal and Informal Organization, Factors Determining Span of Management, Centralization & Decentralization, Span of Control, Understanding Authority and Responsibility, Principles of Delegation, Developing a culture of Innovation and performance, Staffing: HRM Introduction - Recent Trends - Technology in HRM - Workforce Diversity - Economic Challenges, Coordination: Concept - Need - Importance - Principles - Process - Type - Issues and Systems Approach -Techniques

UNIT IV CAREER DEVELOPMENT STRATEGY AND LEADERSHIP 9

Introduction, Concept and Elements of Career, Overview of Career Development - Significance and Advantages - Objectives - Types - Programmes - Different Stages or Cycles of Career Development Process, Career Anchors, Steps in the Career Planning Process, Leadership: Concept - Nature - Importance, Attributes of a Leader - Role of a Leader in Demonstrating Awareness of Legal - Personnel - Strategic Issues Relating to Globalization - Culture and Gender Diversity - Role of Leader in Conflict Resolution and Negotiation

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UNIT V COMMUNICATION, CHANGE AND ETHICS 8

Communication in Organizations: Process - Importance - Barriers - Use of Tone - Styles - Language - Role of Perception in Influencing Communication - Role of Culture, Change Management: Concept - Importance - Causes of Change (Social, Economic, Technological, Organizational) - Developing a Climate for Learning, Concept of Learning Organizations, Challenges of Contemporary Business: Role of Ethics, Corporate Social Responsibility, and Environmental Issues

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain management roles, functions, and theories.
- Summarize strategic planning and MBO in business settings.
  Examine organizing and staffing principles in modern trends of HRM
- Develop leadership and career planning skills in a globalized business environment.
- Apply effective communication and ethical practices to suit professional settings.

TEXT BOOKS:

1. Stephen P. Robbins, David A. Decenzo, 2016. Fundamentals of Management, Pearson Education, 9th Edition
2. Harold Koontz, O'Donnell and Heinz Weihrich, 2012. Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill

REFERENCES:

1. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage. 2014
2. Richard L. Daft, Principles of Management, Cengage Learning. 2009
3. https://onlinecourses.nptel.ac.in/noc25_mg52/preview

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	2	2	-
CO3	3	2	-	-	-	-	-	-	2	2	-
CO4	3	2	-	-	-	-	-	-	2	2	-
CO5	3	2	-	-	-	-	-	-	2	2	-

CHAIRMAN
(BoS / MECH)

VERTICAL 8

Diversified Courses

24ME801PE **EQUIPMENT FOR POLLUTION CONTROL**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand pollution control regulations and standards related to water and wastewater treatment.
- Identify the functions of equipment used for water pollution control.
- Familiarize with working principles of air pollution control equipment.
- Describe the methods and equipment used for solid waste processing.
- Learn the pollution monitoring equipment

UNIT I POLLUTION CONTROL REGULATIONS AND STANDARDS **9**

Pollutants in water and wastewater – sources and impacts- Characteristics and impacts of solid and hazardous wastes - Overview of Indian Environmental Governance Structure and Role of Regulatory Bodies - Environmental Standards under different Environmental legislations - Water Act (1974), Air Act (1981), Environmental Protection Act (1986) and major Notifications, Municipal solid Wastes (Management and Handling) Rules -Bio Medical Wastes (Management and Handling) Rules - Hazardous Wastes (Management and Handling Rules),Environment Impact Assessment Notifications - Unit operations and unit processes in Pollution Control-Selection criteria for Pollution Control Equipment.

UNIT II EQUIPMENT FOR WATER POLLUTION CONTROL **9**

Operational principles and Design criteria of Flash mixers, Flocculators, Clarifiers, Sand Filters, Adsorption Columns, Aerators, Air blowers, Distillation units, Centrifugal and Reciprocating Pumps, Chemical dosing systems, Motors, Pipes, valves and Fittings.

UNIT III EQUIPMENT FOR AIR POLLUTION CONTROL **9**

Operational principles and Design criteria of Cyclone separators, gravity settlers, Wet Scrubbers, Air strippers, Bag Filters, Electrostatic precipitators, Biofilters.

UNIT IV EQUIPMENT FOR SOLID WASTE PROCESSING **9**

Operational principles and Design criteria of Dewatering equipment – centrifuge, Vacuum filter, Filter Press- Size Reduction equipment – shredders, grinders – Trommel and Disc Screens – Air Classifiers - bailing and briquetting – incinerators – Pyrolysis and Gasification Technologies

UNIT V POLLUTION MONITORING EQUIPMENT **9**

Equipment's for sampling of water, solids and air- Sample preservation Equipment – incubators – Cold Storage systems- equipment for analysis of water and air samples- Ambient air and flue gas sampling and monitoring equipment

TOTAL:45 PERIODS

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(BoS / MECH) 17/09/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Interpret the pollution control regulations, standards, and compliance requirements.
- Choose appropriate equipment for controlling the water pollution.
- Identify the parameters with standards in air pollution control systems.
- Apply the different solid waste processing methods and their associated equipments.
- Utilize pollution monitoring instruments for water, air, and solid waste with relevant equipments.

TEXT BOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
2. Metcalf & Eddy, INC, „Wastewater Engineering – Treatment and Reuse, Fourth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2014.

REFERENCES:

1. Rao. C.S, Environmental Pollution and Control Engineering, 2nd Edition, Revised, Wiley Eastern Limited, India, 2006.
2. Shyam Diwan and Armin Rosencranz, Enviromental Law and Policy in India, Oxford, 2001.
3. Noel de Nevers, Air Pollution Control Engg, Mc Graw Hill, New York, 2016.
4. CPCB, Pollution Control Acts, Rules and Notifications issued thereunder, PCL Series- Central Pollution Control Board, Delhi,2021.
5. CPHEEO, Manual on Municipal Solid waste management,Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	2	2	-	-	-	1	2	1
CO2	2	2	1	-	-	2	2	-	-	-	1	2	1
CO3	3	2	2	-	-	2	2	-	-	-	1	2	1
CO4	3	2	2	-	-	2	2	-	-	-	1	2	1
CO5	3	2	2	-	-	2	2	-	-	-	1	2	1

CHAIRMAN
(BoS / MECH)

24ME802PE HYBRID AND ELECTRIC VEHICLE TECHNOLOGY
(COMMON TO EEE AND MECH)

L	T	P	C
3	0	0	3

OBJECTIVES:
The student should be made to:

- Understand the concepts, configurations, and applications of hybrid and electric drive trains.
- Classify the various types of hybrid and electric drive-train topologies and their utilization.
- Compare different types of AC and DC drives used in electric vehicles.
- Identify and select appropriate energy storage systems for electric and hybrid vehicles.
- Explain the fundamentals of energy management strategies and the basics of drive system sizing.

UNIT I INTRODUCTION 9

Basics of vehicle performance, vehicle power source characterization, transmission characteristics, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE TRAINS 9

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies- Introduction of smart hybrid vehicles.

UNIT III CONTROL OF AC & DC DRIVES 9

Introduction to electric components used in hybrid and electric vehicles, Configuration, and control - DC Motor drives, Induction Motor drives, Permanent Magnet Motor drive, and Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Energy storage and its analysis - Battery based, Fuel Cell based, and Super Capacitor based, Hybridization of different energy storage devices.

UNIT V DRIVE SIZING AND ENERGY MANAGEMENT STRATEGIES 9

Fundamentals of Drive System Sizing: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selection of appropriate energy storage technology, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification, and comparison of energy management strategies, Implementation issues.

TOTAL:45 PERIODS

CHAIRMAN
(BoS / MECH) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize hybrid drivetrain requirements for a vehicle.
- Interpret suitable hybrid and electric drive-train systems for various vehicle applications.
- Select appropriate AC and DC drive systems for electric vehicles.
- Identify the optimal energy storage solutions for hybrid and electric vehicles.
- Apply energy management strategies to enhance vehicle economy, performance, and operational efficiency.

TEXT BOOKS:

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, New York CRC Press Taylor & Francis Group, 2022
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

REFERENCES:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons, 1998
3. Hybrid, Electric and Fuel-Cell Vehicles, International Edition by Jack Erjavec ,6 June 2012
4. Energy Management in Hybrid Electric Vehicles using Co-Simulation by Christian Paar ,11 February 2011
5. Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids (MECHANICAL ENGINEERING) by Yangsheng Xu , Jingyu Yan, et al. ,16 December 2013

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	-	-	-
CO2	2	2	1	-	2	2	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-
CO4	3	2	2	-	2	2	-	-	-	-	-
CO5	2	2	2	-	2	2	-	-	-	-	-

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24ME803PE	VEHICLE HEALTH MONITORING, MAINTENANCE AND SAFETY	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the principles, functions, and practices adopted in the maintenance of vehicles.
- Learn the procedures for powertrain maintenance, fault diagnosis, and battery servicing.
- Apply skills in maintenance and service of vehicle systems such as clutch and brake.
- Gain knowledge of vehicle safety concepts and applicable regulations.
- Familiarize with simulation tools for analyzing vehicle safety features.

UNIT I INTRODUCTION **9**

Need for Maintenance – importance, classification of maintenance work-basic problem diagnosis. Maintenance of vehicle systems – power pack, tyres, safety systems. Scheduled maintenance services – service intervals – On Board Diagnostics(OBD), Computerized engine analyzer - OBD and scan tools.

UNIT II POWERTRAIN MAINTENANCE **9**

Exhaust emission test of petrol and diesel engine - Electronic fuel injection and engine management service - fault diagnosis- OBD-III and scan tool, identifying Diagnostic Trouble Code (DTC) and servicing emission controls, Maintenance of Batteries, Starting System, Charging System and Body Electrical -Fault Diagnosis using Scan Tools.

UNIT III VEHICLE SYSTEM MAINTENANCE **9**

Clutch- adjustment and service, Maintenance and Service of Hydraulic brake, Bleeding of brakes, Checking Anti-lock Braking System (ABS) and components. Maintenance and Service of McPherson strut, coil spring, tyre wear, measurement of read depth and tyre rotation, Computerized wheel balancing & wheel alignment, Maintenance and Service of steering linkage, steering column, Rack and pinion steering

UNIT IV VEHICLE SAFETY **9**

Concepts of vehicle safety -Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, air bags, electronic system for activating air bags, bumper design for safety, Active Safety - ABS, Electronic Brake force Distribution (EBD), Cornering Stability Control (CSC), Traction control system, Modern electronic features in vehicles like tyre pressure monitoring, Automatic headlamp ON, Rain sensing wipers.

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UNIT V SIMULATION OF SAFETY CONCEPTS 9

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- Passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact. Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system Interactions.

TOTAL:45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the principles, functions, and practices followed in vehicle maintenance activities.
- Interpret fault diagnosis and maintenance procedures for powertrain systems and batteries.
- Relate Service and inspect vehicle clutch and brake systems for performance and safety compliance.
- Choose vehicle safety concepts and relevant regulatory requirements.
- Apply simulation tools to analyse and evaluate vehicle safety features.

TEXT BOOKS:

1. William Crouse H, Automotive Mechanics, Tata McGraw-Hill Education India Private Limited, 2018.
2. 5th Edition, Advanced Automotive Fault Diagnosis, Automotive Technology: Vehicle Maintenance and Repair By Tom Denton.
3. Safety Management System and Documentation Training Programme Handbook by S. V. Paul ISBN: 9788123923444.

REFERENCES:

1. Joseph Heitner, Automotive Mechanics Principles & Practices, 2015, ISBN:
1. 9788176710152
2. Ed May, "Automotive Mechanics Volume One" and Two, Mc Graw Hill Publications, Tenth edition, 2018
3. Bosch Automotive Handbook, Tenth Edition, 2018
4. Jack Erjavek, "A systems approach to Automotive Technology", Cengage Learning, 5th Edition, 2012

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	1	1	-	-	-	-	1	2	1
CO2	3	2	1	-	1	1	-	-	-	-	1	2	1
CO3	3	2	2	1	1	1	-	-	-	-	1	2	1
CO4	3	2	2	1	1	1	-	-	-	-	1	2	1
CO5	3	2	2	1	1	1	-	-	-	-	1	2	1

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24ME804PE **ENGINEERING FRACTURE MECHANICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the fundamental concepts of Linear and Elastic-Plastic Fracture Mechanics.
- Gain the knowledge about fracture parameters including stress intensity factors, energy release rate, and J-integral.
- Recognize the crack growth mechanisms and models under static and cyclic loading.
- Learn the fracture toughness testing methods and their applications
- Apply the fracture principles to evaluate structural integrity and failure criteria

UNIT I INTRODUCTION **9**

Overview engineering fracture mechanics –Structural failures – Need for fracture mechanics –Linear Elastic Fracture Mechanics (LEFM) - Elastic Plastic Fracture Mechanics (EPFM) – Fatigue crack growth models – importance of fracture analysis in design

UNIT II CRACK GROWTH AND ENERGY METHODS **9**

Crack growth mechanisms – Griffith's theory of brittle fracture – Concept of Energy Release Rate (G) – Stable and unstable crack propagation – Relationship between Energy Release Rate (G) and crack length.

UNIT III STRESS ANALYSIS OF CRACKED BODIES **9**

Theory of elasticity review – Westergaard's approach for Mode I stress and displacement fields – Stress intensity factor (K) – Relationship between K and G – Concept of plastic zone at crack tip.

UNIT IV MIXED MODE FRACTURE AND PLASTICITY MODELS **9**

Mode I, Mode II and Mixed Mode loading – multi-parameter stress fields – Stress Intensity Factor (SIF) for various geometries – Irwin's and Dugdale models – Modeling plastic deformation near crack tip.

UNIT V FRACTURE TOUGHNESS TESTING AND APPLICATIONS **9**

Fracture toughness testing methods – A contour integral used in fracture mechanics for nonlinear materials and its significance – Paris law for fatigue crack growth – Sigmoidal curve – Crack closure phenomena – Failure assessment diagram (FAD) – Mixed mode fracture – Crack arrest and repair methodologies.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the basic fracture concepts and identify failure modes in structures.
- Describe the energy release rate and stress intensity factor in cracked bodies.
- Apply the analytical models for plastic zone and mixed-mode crack behavior.
- Identify fracture toughness evaluations for design and safety analysis.
- Utilize fracture models to assess component integrity and recommend repair methods.

TEXT BOOKS:

1. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005
2. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009.
3. U.C.Jindal, Material Science & Metallurgy, Pearson, 2012

REFERENCES:

1. K. R.Y. Simha, Fracture Mechanics for Modern Engineering Design, Universities Press (India) Limited,2001
2. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, Dordrecht, 1986.
3. K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007.
4. https://onlinecourses.nptel.ac.in/noc25_me109/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	2	2	2
CO2	2	2	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	1	-	-	-	-	-	-	2	2	2
CO4	3	3	2	1	-	-	-	-	-	-	2	2	2
CO5	3	3	2	1	-	-	-	-	-	-	2	2	2

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24ME805PE	FAILURE ANALYSIS AND PREVENTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge of the fundamentals, need and scope of failure analysis and prevention in engineering.
- Utilize the systematic procedures and testing techniques in failure investigation.
- Understand fracture mechanics concepts and their application to welded joint failures.
- Familiarize the causes of failure in castings, forming process
- Explore the causes of failures in gears, steels, aluminium alloys, and weld joints.

UNIT I FUNDAMENTALS OF FAILURE ANALYSIS 9

Need and scope of failure analysis and prevention – Engineering disasters and understanding failures – Fundamental sources of failures – design deficiencies, material selection errors, imperfections in materials – Failures due to improper manufacturing, service and maintenance – Industrial engineering tools – Pareto analysis – fault tree diagram – Reliability in failure analysis – FMEA and Weibull analysis.

UNIT II FAILURE ANALYSIS METHODOLOGY 9

General procedure of failure analysis – steps to proceed – Collection of background information and familiarization with failure cases – Sampling – selection, collection, handling, and preservation – Testing of samples – NDT and DT – Identification of failure modes – Macroscopic and microscopic observation of fracture surfaces – Chemical, metallographic and image analysis techniques in failure investigation

UNIT III FRACTURE MECHANICS AND WELD FAILURES 9

Role of fracture mechanics in failure analysis – Questions/checklists to ensure proper investigation – Analysis, report preparation and recommendation – Failures of welded joints – causes, HAZ, fusion zone – Fracture toughness parameters (K, CTOD, J-integral) – significance and testing – Fatigue failure of weld joints – life estimation using fracture toughness concepts – Failures due to low/high temperature, SCC and intergranular cracking.

UNIT IV FAILURE OF ANALYSIS OF CASTING AND FORMING 9

Casting failures – common causes – cast iron sluice valve, Al-Si alloys, steel castings – Forming failures – forming-related issues, rolling problems, defects in formed components, high-strength steels and their welds

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UNIT V FAILURE OF ANALYSIS OF GEAR AND WELD JOINTS **9**

Gear failures – material, manufacturing, and surface condition related issues – Steel failures – Improper heat treatment and case hardening – Improper heat treatment of PH Aluminium alloys – weld joint failures – carbon steel, Austenitic stainless steels, dissimilar steels – Cracking of steel weld joints and preventive strategies.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand various sources of engineering failures and apply basic tools like Pareto analysis and FMEA.
- Relate sampling, NDT/DT and analytical techniques to identify failure modes.
- Choose fracture toughness parameters and predict fatigue/weld failures under different conditions.
- Solve casting and forming defects and propose preventive measures.
- Identify gear and weld joint failures and recommend suitable preventive

TEXT BOOKS:

1. D.R.H. Jones, "Failure Analysis Case Studies", Elsevier, 2013.
2. Charles R. Brooks, Ashok Choudhury, "Failure Analysis of Engineering Materials", McGraw-Hill, 2002.

REFERENCES:

1. ASM Handbook, Volume 11: Failure Analysis and Prevention, ASM International, 2021
2. S.T. Rolfe and J.M. Barsom, "Fracture and Fatigue Control in Structures", Prentice Hall.
3. Robert A. Cottis, "Shreir's Corrosion", Elsevier, 2010.
4. https://onlinecourses.nptel.ac.in/noc25_me25/preview

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	2	1
CO2	2	2	1	-	-	-	-	-	-	-	-	2	1
CO3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	1	-	-	-	-	-	-	-	2	1
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1

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24ME806PE	BULK MATERIAL TRANSPORT AND HANDLING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand various mining systems and the role of bulk material handling in surface and underground mines.
- Study the construction, operation, and design of bulk transport systems such as conveyors, stackers, reclaimers, and silos.
- Learn selection, design, and troubleshooting of bulk material handling equipment.
- Explore mineral processing plant equipment and associated separation techniques.
- Examine the modern trends, automation, and monitoring of bulk material handling systems.

UNIT I MINING AND BULK MATERIAL HANDLING 9

Classification of mining systems – Bulk material handling systems – Properties of bulk material in relation to handling operations – Fundamentals of mine transport – Capacity and productivity concepts – Bulk material handling in processing plants – Crushing and screening flow charts – Autonomous vehicles for bulk material transport – Belt conveyor: constructional components and developments – Conveyor belting, belt cleaners, and idlers.

UNIT II DESIGN CONSIDERATIONS FOR CONVEYING SYSTEMS 9

Feed and discharge devices – Safety and troubleshooting – Conveyor design calculations: size selection and power calculation – Hydraulic conveying system: principles and applicability – Pneumatic conveying system: principles and applicability – Basic design calculations – Stacking, blending, and reclaiming – Classification and selection criteria of stackers and reclaimers – Comparison of stackers and reclaimers – System layout.

UNIT III MINERAL PROCESSING PLANT EQUIPMENTS 9

Bins, bunkers, and silos – Bulk solids flow properties and design applications – Operational problem case studies – Feeder selection and design – Crushers: classification and selection – Screens: classification and selection – Monitoring and maintenance of processing plant equipment – Gravity concentration – centrifugal concentrators – Size classification – screening, de-sliming, cycloning.

UNIT IV MINERAL SEPARATION TECHNIQUES AND IN-PIT SYSTEMS 9

Froth flotation techniques – Magnetic separation – Jigs and thickeners – Case studies of coal washery equipment and practices – In-pit crushing and conveying systems: classification and selection – Case studies – Transportation machinery for surface mines: off-highway trucks, haul roads, hybrid transportation systems – RopeCon, pipe belt conveyor, aerial ropeways – Basic design

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UNIT V UNDERGROUND TRANSPORT AND AUTOMATION **9**

Transportation machinery for underground mines: rope haulage, locomotives, low-profile dumpers – Cage and skip winding – Winding calculations – Safety and maintenance – Case studies – Automation and monitoring: basic principles – Automation and online monitoring of bulk material handling systems.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain mining systems, bulk material properties, and basic handling operations.
- Summarize conveyor, hydraulic, and pneumatic conveying systems.
- Select and design storage and feeding equipment for bulk solids.
- Apply mineral processing techniques and in-pit conveying solutions.
- Identify automation and monitoring in bulk material handling systems.

TEXT BOOKS:

1. Fruchtbaum, Jacob, Bulk Materials Handling Handbook, Springer.
2. Don McGlinchey (Ed.), Bulk Solids Handling: Equipment Selection and Operation, Google Books.

REFERENCES:

1. Michael Rivkin, Bulk Material Handling: Practical Guidance for Mechanical Engineers, Partridge Publishing Singapore, 2018.
2. Erik Oberg, Franklin D. Jones, Machinery's Handbook, Industrial Press, Inc. 32nd Edition, 2024
3. https://onlinecourses.nptel.ac.in/noc25_mm04/preview

Mapping of COs with POs and PSOs

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CO1	2	2	1	-	-	-	-	-	-	-	-	1	-
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CO3	3	2	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	-

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24ME807PE BIOENERGY CONVERSION TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Familiarize with various types, properties, and assessment methods of biomass.
- Understand the processes and design aspects of biomethanation systems.
- Learn the combustion principles and technologies for biofuels.
- Study thermo-chemical conversion methods such as gasification, pyrolysis, and carbonisation.
- Explore the production, properties, and applications of liquid biofuels.

UNIT I INTRODUCTION **9**

Biomass: types – advantages and drawbacks – typical characteristics – proximate & ultimate analysis – comparison with coal - Indian scenario - carbon neutrality – biomass assessment studies – typical conversion mechanisms - densification technologies

UNIT II BIOMETHANATION **9**

Biomethenation process – influencing parameters – typical feed stocks – Biogas plants: types and design, Biogas appliances – burner, luminaries and power generation systems – Industrial effluent based biogas plants.

UNIT III COMBUSTION **9**

Perfect, complete and incomplete combustion – stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion

UNIT IV GASIFICATION, PYROLYSIS AND CARBONISATION **9**

Chemistry of gasification - types – comparison – typical application – performance evaluation – economics. Pyrolysis - Classification - process governing parameters – Typical yield rates. Carbonization – merits of carbonized fuels – techniques adopted for carbonisation

UNIT V LIQUIFIED BIOFUELS **9**

Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel Vs. Diesel – comparison on emission and performance fronts. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Illustrate biomass resources and evaluate their properties.
- Identify biogas plants using various feedstocks.
- Solve combustion calculations and select suitable biomass combustion technologies.
- Select gasification, pyrolysis, and carbonisation processes for suitable applications.
- Use the biodiesel and alcohol fuels from biomass and evaluate their performance.

TEXT BOOKS:

1. Biomass for Bioenergy and Biomaterials, by Nidhi Adlakha, Rakesh Bhatnagar, Syed Shams Yazdani, CRC Press; 1st edition (22 October 2021), ISBN-10: 0367745550
2. Bioenergy and Biochemical Processing Technologies, by Augustine O. Ayeni, Samuel EshorameSanni, Solomon U. Oranusi, Springer (30 June 2022).

REFERENCES:

1. David Boyles, Bio Energy Technology Thermodynamics and costs, Ellis Hoknood Chichester,1984.
2. Iyer PVR et al, Thermochemical Characterization of Biomass, M N E S
3. Khandelwal KC, Mahdi SS, Biogas Technology – A Practical Handbook, Tata McGraw Hill, 1986

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	1	1	1
CO2	2	2	1	-	-	-	-	-	-	-	1	1	1
CO3	2	2	1	-	-	-	-	-	-	-	1	1	1
CO4	3	2	1	1	-	-	-	-	-	-	1	1	1
CO5	2	2	1	-	-	-	-	-	-	-	1	1	1

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OPEN ELECTIVE - I

Syllabus

24BM101OE **MEDICAL INSTRUMENTS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the principles of biopotential generation and electrode interfaces
- Explore techniques for measuring bioelectrical signals
- Analyze signal conditioning circuits used in biomedical applications
- Examine instrumentation for non-electrical physiological measurements
- Investigate biochemical sensors and biosensing techniques

UNIT I BIOPOTENTIAL ELECTRODES 9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, half-cell potential, Contact impedance, polarization effects of electrode - non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT II BIOPOTENTIAL MEASUREMENTS 9

Bio signals characteristics - frequency and amplitude ranges. ECG - Einthoven's triangle, standard 12 lead system, Principles of vector cardiography. EEG- 10-20 electrode system, unipolar, bipolar and average mode. EMG-unipolar and bipolar mode. Recording of ERG, EOG and EGG.

UNIT III SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers - transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering.

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method. Electromagnetic and ultrasound blood flow measurement.

UNIT V BIOCHEMICAL MEASUREMENT AND BIOSENSORS 9

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analysers - colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyser (simplified schematic description) - Bio Sensors - Principles - amperometry and voltametric techniques.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain the origin of biopotentials and analyze the characteristics of various electrodes and their circuits
- Describe the methods for recording ECG, EEG, EMG, and other biosignals using standard electrode systems
- Design and evaluate bio-amplifier circuits and filtering techniques for accurate biosignal acquisition
- Compare methods for measuring temperature, blood pressure, and cardiac output using various technologies
- Demonstrate the working principles of biosensors and assess their applications in clinical diagnostics

TEXT BOOK:

1. Leslie Cromwell, —Biomedical Instrumentation and measurement|, 2nd edition, Prentice Hall of India, New Delhi, 2015.

REFERENCES:

1. John G. Webster, —Medical Instrumentation Application and Design|, 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technology|, Pearson Education, 2004.
3. Myer Kutz, —Standard Handbook of Biomedical Engineering and Design|, McGraw Hill Publisher, 2003.
4. Khandpur R.S. —Handbook of Biomedical Instrumentation|. 3rd edition. Tata McGraw-Hill New Delhi. 2014.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	1	2	-	-	-	1	-	2
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CO3	3	2	3	2	3	-	-	-	2	1	2
CO4	3	3	2	2	3	2	-	-	2	1	2
CO5	3	2	2	2	3	3	2	-	2	1	3

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24BM102OE **FOOD, NUTRITION AND HEALTH** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the role of food sources and microbiological safety in public health
- Explore the biochemical and physiological roles of macro and micronutrients
- Examine the applications of nanotechnology in food science
- Investigate nutritional disorders and energy balance in relation to diet planning
- Critically assess consumer perspectives and regulatory issues surrounding GM foods

UNIT I FOOD AND MICROBIOLOGY OF HEALTH **9**

Food resources (plant, animal, microbes); Overview of current production systems; constraints and necessity of novel strategies. Functional and "Super" Foods - role in optimal nutrition. Sugar, protein and fat substitutes. Food and behaviour- physiological disturbances in alcoholism, drug abuse and smoking. Food Related Laws: Inspection – Microbial Indicators of product quality – Indicators of food safety – 229 Microbiological safety of foods - control strategies – Hazard Analysis Critical Point System (HACCP concept)- Microbiological criteria.

UNIT II NUTRIENTS AND FOOD ADDITIVES **9**

Macro nutrients- carbohydrates, proteins and lipids. Micronutrients-Minerals: Calcium, Magnesium, Iron, Zinc, Copper and Selenium; Vitamins. Nutritional Physiology: Digestion, absorption, and utilization of major and minor nutrients. Biotechnology of food additives-Bioflavors and colors, microbial polysaccharides, recombinant enzymes in food sector.

UNIT III NANO FOOD TECHNOLOGY **9**

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf-life assessment.

UNIT IV FOOD RELATED NUTRITIONAL DISORDERS AND ENERGY CALCULATION **9**

Type I Disorders-Causes of life style and stress related diseases. Cardio-vascular diseases, hypertension, obesity. Type-II Disorders: Cancer, diabetics, ulcers, electrolyte and water imbalance. Health indices. Preventive and remedial measures. Energy balance and methods to calculate individual nutrient and energy needs. Planning a healthy diet.

UNIT V CONSUMERS ON GM FOODS AND CONTEMPORARY ISSUES **9**

Global perspective of consumers on GM foods: Major concerns of transgenic, foods GM ingredients in food products. (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods, Case studies- GM foods.

TOTAL:45 PERIODS

OUTCOMES:

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

- Identify various food resources and explain microbial indicators used in food safety and HACCP principles
- Analyze the digestion, absorption, and utilization of nutrients and evaluate the role of food additives
- Demonstrate knowledge of nano materials in food packaging and assess their impact on shelf-life and safety
- Diagnose common nutritional disorders and design balanced diets based on individual energy requirements
- Debate ethical concerns and interpret labeling and safety regulations related to GM food products

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BoS/BME

TEXT BOOKS:

1. P.J. Fellows.2009. Food Processing Technology -Principles and Practice (Third Edition). A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition.
2. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin. 2015. Food Biotechnology. CRC Press. Second edition.

REFERENCES:

1. Understanding Nutrition. 2010. Ellie Whitney, Sharon Rady Rolfes, 11e. Thompson Wadsworth.
2. Nutritional Sciences- From Fundamentals to Food.2013. Michelle McGuire, Kathy A. Beerman, second edition, Thompson Wadsworth.
3. Yasmine Motarjemi, Huub Lelieveld. Food Safety Management - A Practical Guide for the Food Industry (2014), 1st Edition, Academic Press, London, UK.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO3	3	2	3	2	3	3	2	-	2	1	3
CO4	3	3	3	2	2	2	-	-	2	2	3
CO5	2	2	1	1	1	3	3	2	3	2	3

Ashok
Chairman
BoS/BME

28.10.25

24CE101OE **INDUSTRIAL WASTE MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the various characteristics of industrial waste water.
- Interpret the process and mechanism of different wastewater treatment process.
- Infer awareness on waste that emits from industries, waste minimization and clean technologies.
- Demonstrate biological waste water treatment process.
- Make use of treatment of sludge and its disposal methods.

UNIT I INTRODUCTION 9

Undesirable waste water characteristics – Characteristics of industrial waste waters – Waste water characteristics – Estimating the organic content – Measuring the efficiency toxicity – In plant waste control and waste reuse – Storm water control.

UNIT II WASTE WATER TREATMENT PROCESSES 9

Pre and primary treatment of waste water – Equalization – Neutralization – Sedimentation – Oil separation-sour water strippers – Floatation – Coagulation, precipitation and metals removal– coagulation – Heavy metals removal – Aeration and mass transfer; mechanism of oxygen transfer – Aeration equipment – Air stripping of volatile organic compounds.

UNIT III POLLUTION FROM MAJOR INDUSTRIES 9

Sources, Characteristics, waste treatment flow from industries such as Textiles, pulp and paper mill wastes breweries and distilleries waste, Tanneries, Pharmaceuticals, Dairy, Sugar mill wastes, Steel plants, oil Refineries, fertilizer plant waste, petrochemical complex waste, corn starch industry waste –Odour and its removal-removal color from waste waters – Waste minimization and clean technologies.

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UNIT IV BIOLOGICAL WASTE WATER TREATMENT PROCESS 9

Lagoons and stabilization basins – Aerated lagoons-activated sludge processes – Trickling filtration – Rotating biological contactors – Anaerobic decomposition- laboratory evaluation of anaerobic treatment – Adsorption – Theory of activated carbon– Sludge quality considerations – Stripping of volatile organics – Nitrification and denitrification.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

Characteristics of sludge for disposal – Aerobic digestion – Gravity thickening – Flotation thickening –Rotatary drum screen – Gravity belt thickener – Centrifugation – Vacuum filtration – Pressure filtration – Belt filter press – Sand bed drying-factors affecting dewatering performance – Land disposal of sludges– Incineration.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize undesirable wastewater characteristics with estimation of organic content.
- Explain various methods dealt with treatment of wastewater.
- Utilize waste minimization and clean technologies to reduce pollution
- Apply biological waste treatment process
- Analyze characteristics of sludge for effective sludge treatment and disposal

TEXT BOOKS:

1. Wesley Eckenfelder W, Jr Industrial Water Pollution Control 3rd Edition, Mc–Graw Hill Book Company, New Delhi, 2000.
2. Stephenson R L and Blackburn J B, Industrial Wastewater Systems Hand book, Lewis Publisher, New York, 1998.

REFERENCES:

1. M.N.Rao&A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication, 1995.
2. H.M. Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	2	2	-	-	-	-
CO2	2	3	-	-	2	2	2	-	-	-	-
CO3	2	2	-	-	-	2	2	-	-	-	-
CO4	2	2	-	-	2	2	2	-	-	-	-
CO5	2	2	-	-	2	2	2	-	-	-	-

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28.10.25

24CE102OE **ECOLOGICAL ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The students should be made to:

- Interpret Principles and Concepts of ecosystem
- Infer the function of ecosystem and its biochemical reaction
- Outline Rehabilitation of ecosystem through ecological Principles
- Organize ecological effects due to industrialization
- Examine the need for environmental sustainability with related case studies.

UNIT I PRINCIPLES AND CONCEPTS 9

Scope- applications of Ecological Engineering - Development - evolution of ecosystems - Principles - concepts pertaining to species - populations - community.

UNIT II ECOSYSTEM FUNCTIONS 9

Biological magnification - diversity - stability - immature - mature systems - Primary productivity - Biochemical cycling of nitrogen - phosphorous - sulphur - carbon dioxide - Habitat ecology - Terrestrial - fresh water - estuarine - marine habitats.

UNIT III ECOLOGICAL ENGINEERING METHODS 9

Bio monitoring - role in evaluation of aquatic ecosystem - Rehabilitation of ecosystems through ecological principles - Step cropping - bio-wind screens - Wetlands - ponds - Root Zone Treatment for wastewater - Reuse of treated wastewater through ecological systems - green building and Bio mimicry.

UNIT IV ECOLOGICAL EFFECTS OF INDUSTRIALISATION 9

Ecological effects of exploration – production- extraction – processing – manufacture - transport - Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods - Stacks Gravitational - Inertial Separation - Settling Chambers -Dynamic Separators - Cyclones - Filtration - Liquid Scrubbing - Electrostatic Precipitators.

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UNIT V CASE STUDIES AND ENVIRONMENTAL SUSTAINABILITY 9

Case studies of integrated ecological engineering systems - Planning -Measuring Sustainability - Carrying Capacity and its limits - Concept of Ecological Foot print.

TOTAL: 45 PERIODS

OUTCOMES:

On Successful completion of this course, the students will be able to:

- Explain the development and evolution of ecosystem.
- Summarize the structure and function of natural ecosystems and biological magnification.
- Utilize ecological engineering principles into sustainable Practices.
- Organize ecological effects of exploration and industrialization.
- Analyze integrated ecological engineering systems.

TEXT BOOKS:

1. Jainul Alam, "Ecological Engineering", Discovery Publishing House, 2025
2. Geoff Gurr, Miguel A Altieri, Steve Wratten, "Ecological Engineering for Pest Management: Advances in Habitat Manipulation for Arthropods", CABI Publishing, 2004.

REFERENCES:

1. Majeti Narasimha Vara Prasad, "Handbook of Ecological and Ecosystem Engineering", Wiley; 1st edition,2021.
2. Theodore Sudia, "Ecological Engineering of the City: The Urban Ecosystem", Forgotten Books, 2018
3. Patrick Kangas, "Ecological Engineering: Principles and Practice", CRC Press Inc, 1st edition, 2003.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	2	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	2	2	-	-	-	-	-
CO4	2	2	-	-	2	-	-	-	-	-	-
CO5	2	2	-	-	-	3	-	-	-	-	-

CHAIRMAN

BoS (CIVIL)

7/10/21

24CS101OE **PYTHON PROGRAMMING FOR DATA SCIENCE (Common to AGE, CIVIL, BME, ECE, EEE & MECH)**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Familiarize with the data science work environment, including IPython and Jupyter.
- Learn the ndarray object for efficient storage and manipulation of dense data arrays in Python using NumPy.
- Explore the DataFrame object for handling labeled/columnar data in Python using Pandas.
- Perform data visualizations in Python using Matplotlib.
- Apply machine learning algorithms in Python using Scikit-Learn.

UNIT I IPYTHON: BEYOND NORMAL PYTHON 9

Shell and Notebook- Help and Documentation in IPython - Keyboard Shortcuts in the IPython Shell - IPython Magic Commands- Input and Output History - IPython and Shell Commands- Errors and Debugging- Profiling and Timing Code.

UNIT II INTRODUCTION TO NUMPY 9

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions – Aggregations - Computation on Arrays - Comparisons, Masks, and Boolean Logic - Fancy Indexing - Sorting Arrays - Structured Data.

UNIT III DATA MANIPULATION WITH PANDAS 9

Installing and Using Pandas- Introducing Pandas Objects- Data Indexing and Selection- Operating on Data in Pandas- Handling Missing Data - Hierarchical Indexing- Combining Datasets - Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series - High-Performance Pandas.

UNIT IV VISUALIZATION WITH MATPLOTLIB 9

General Matplotlib Tips - Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Matplotlib - Three-Dimensional Plotting in Matplotlib - Geographic Data with Basemap - Visualization with Seaborn.

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UNIT V MACHINE LEARNING WITH SCIKIT-LEARN 9

Machine Learning - Introducing Scikit – Learn - Hyper parameters and Model Validation - Feature Engineering - Naive Bayes Classification - Linear Regression - Support Vector Machines - Decision Trees and Random Forests - Principal Component Analysis - k-Means Clustering - Gaussian Mixture Models - Application: A Face Detection Pipeline.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Leverage IPython and Jupyter for streamlined development and interactive data analysis.
- Utilize NumPy's ndarray for optimized storage and manipulation of numerical data.
- Manage and analyze structured datasets effectively using Pandas DataFrame.
- Design clear and impactful data visualizations using Matplotlib in Python.
- Implement machine learning models in Python using Scikit-Learn for analytical problem-solving.

TEXT BOOK:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2023.

REFERENCE:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", 3rd Edition, O'Reilly, 2022.
2. John Paul Mueller, Luca Massaron, Wiley, "Python for data science for dummies", 3rd Edition, 2023.

COs – POs Mapping

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	2	2	1	1	3	1	1	1	1	2	1
2	3	3	2	1	3	1	1	1	1	2	1
3	3	3	2	2	3	1	1	1	2	2	1
4	2	2	2	1	2	2	1	1	2	1	1
5	3	3	3	2	3	2	1	1	2	3	2

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BoS (CSE)

24/10/18

24CS102OE **PROGRAMMING AND DATA STRUCTURES (Common to AGE, CIVIL, BME, ECE, EEE & MECH)**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Explain the basic concepts, syntax, and flow of C programming.
- Apply advanced features of C for problem-solving.
- Demonstrate the concepts and applications of linear data structures.
- Analyze the representation and use of non-linear data structures.
- Illustrate fundamental techniques in searching, sorting, and hashing.

UNIT I C PROGRAMMING BASICS **9**

Structure of C program - Data Types - Storage classes – Variables - Constants - Keywords - Operators - Input/output statements, Assignment statements - Decision making statements - Switch statement - Looping statements - Introduction to Arrays: Declaration, Initialization - One dimensional array - Two dimensional arrays.

UNI II FUNCTIONS, POINTERS AND STRUCTURES **9**

Introduction to functions: Function prototype, function definition, function call, Recursion - Pointers - Pointer operators - Pointer arithmetic - Array of pointers - Parameter passing: Pass by value, Pass by reference. Structure - Nested structures - Pointer and Structures - Array of structures - Self-referential structures - Dynamic memory allocation.

UNIT III LINEAR DATA STRUCTURES **9**

List -Singly Linked lists - Application of List - Polynomial addition - Linked list implementation of Stacks - Applications of Stack - Evaluating arithmetic expressions - Linked list implementation of Queues - Application of Queue.

UNIT IV NON-LINEAR DATA STRUCTURES **9**

Trees - Binary Trees - Binary tree representation and traversals - Binary Search Trees - Applications of trees. Graph and its representations - Graph Traversals - Topological Sort - Applications of graphs.

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UNIT V SEARCHING, SORTING AND HASH TABLE **9**

Linear Search - Binary Search. Bubble Sort - Insertion sort - Merge sort - Quick sort - Hashing functions - Hash tables - Introduction to Overflow handling.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Construct programs using the fundamental concepts of C programming.
- Employ advanced features of C to solve computational problems.
- Select and apply appropriate linear data structures for effective problem solving.
- Design and implement non-linear data structures such as trees and graphs for application development.
- Evaluate and compare various searching, sorting algorithms, and hashing techniques.

TEXTBOOK:

1. Reema Thareja, "Data Structures Using C", Third Edition, Oxford University Press, 2023.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Fourth Edition, Pearson Education, 2013.

COs - POs Mapping

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	2	2	1	-	-	-	1	1	1
2	3	2	3	2	2	-	-	-	1	1	1
3	3	3	3	3	2	-	-	-	1	1	1
4	3	3	3	3	2	-	-	-	1	1	1
5	3	3	3	3	2	-	-	-	1	1	1

C. Saravanath

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BoS (CSE)

24EC101OE **PRINCIPLES OF SIGNAL PROCESSING** **L T P C**
3 0 0 3

OBJECTIVES:
The Student should be made to:

- Understand the basics of signals and systems as a foundation for all engineering-related courses.
- Analyze the fundamental characteristics of Linear Time-Invariant (LTI) systems.
- Gain knowledge of signal transmission requirements and system bandwidth considerations.
- Learn the statistical properties of signals, including correlation and power spectrum concepts.
- Acquire knowledge of noise sources, their characteristics, and impact on system performance.

UNIT I SIGNAL ANALYSIS **9**
Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT II SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS LINEAR SYSTEM **9**
Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

UNIT III SAMPLING THEOREM **9**
Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

UNIT IV TEMPORAL CHARACTERISTICS OF SIGNALS **9**
Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Time Averages and Ergodicity, Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Cross-Correlation Function and Its Properties, Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function.

UNIT V NOISE SOURCES **9**
Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

Understand how to solve the given standard partial differential equations.

- Explain the fundamental concepts of signals, systems, and standard signal functions.
- Apply orthogonal functions, convolution, and correlation techniques to analyze system responses.
- Analyze the characteristics and behavior of Linear Time-Invariant (LTI) systems in time and frequency domains.
- Interpret temporal and statistical properties of signals, including correlation, ergodicity, and power spectral density.
- Identify various noise sources such as thermal, resistive, and arbitrary noise.

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, Reprint 2017
2. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4 th Ed., 2001.

REFERENCES :

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems," 2nd Ed., Pearson Prentice Hall, 2008.
2. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
3. Random Processes for Engineers-Bruce Hajck, Cambridge unipress, 2015
4. Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications, 2003

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	1	2
CO2	3	3	2	2	1	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	2
CO4	2	3	-	3	2	-	-	-	-	-	2
CO5	3	2	-	2	1	2	-	-	-	-	2

CHAIRMAN
BoS (ECE)

29/10/25

24EC102OE CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge of semiconductor devices, logic circuits, and microcontrollers used in consumer electronics.
- Understand the construction and working of audio, video, and display systems in entertainment electronics.
- Familiarize with the technology and functionality of modern home appliances.
- Learn the concepts, sensors, and technologies involved in smart home automation and security.
- Explore the fundamentals of communication systems and recent advancements such as IoT, Li-Fi, and GPS.

UNIT I ELECTRONIC FUNDAMENTALS **9**

Semiconductor Devices: Diodes, Transistors, Logic gates, Integrated Circuits, -Moor's law, ADC ,DAC, Introduction about Microcontroller, microcontroller in consumer electronics.

UNIT II ENTERTAINMENT ELECTRONICS **9**

Audio systems: Construction and working principle of Amplifier, Microphone, Home Theater-Display Systems: CRT, LCD, LED. Video Players: DVD and blue ray. Camera and camcorders.

UNIT III HOME APPLIANCES **9**

Home Enablement Systems - RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Microwave Owen, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks

UNIT IV SMART HOME **9**

Technology involved in Smart home, Home Virtual Assistants-Alexa and Google Home, Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT V COMMUNICATION SYSTEMS **9**

Cordless Telephones, Fax Machines, PDAs-Tablets, Smart Phones and Smart Watches, Introduction to Smart OS-Android and iOS, Video Conferencing Systems-Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

TOTAL: 45 PERIODS

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BoS (ECE)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the working principles of semiconductor devices, logic circuits, and microcontrollers in electronic systems.
- Describe the operation of entertainment electronics such as amplifiers, microphones, home theaters, display systems, and video players.
- Identify and explain the technologies used in home appliances including smart refrigerators, induction stoves, and cleaning robots.
- Analyze the technologies and sensors used in smart home systems, virtual assistants, and home security.
- Summarize the working principles of communication systems and discuss the role of IoT, GPS, Wi-Fi, and Li-Fi in modern consumer electronics.

TEXT BOOKS:

1. Bali S P, Consumer Electronics, Pearson Education Asia Pvt. Ltd., 2008
2. Mitchel E Schultz, Basic Electronics, McGraw Hill Publishers, Tenth Edition, 2017.

REFERENCES:

1. Thomas L Floyd, Electronic Devices, Pearson Education Asia, Tenth Edition, 2018
2. Philp Hoff, Consumer Electronics for Engineers, Cambridge University Press, 1998.
3. Jordan Frith, Smartphones as Locative Media, John Wiley, 2014.
4. Dennis C Brewer, Home Automation Made Easy, Que Publishing, 2013.
5. Thomas M Coughlin, Digital Storage in Consumer Electronics, Springer, 2017.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	1	2
CO2	3	2	-	-	2	-	-	-	-	1	2
CO3	2	2	1	-	2	2	2	-	-	-	2
CO4	2	3	2	2	3	2	2	-	-	-	2
CO5	3	3	2	2	3	2	2	-	-	1	3

CHAIRMAN
BoS (ECE)

24EE101OE **POWER GENERATION SYSTEMS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The students should be made to:

- Understand the working principles and components of steam power plants
- Explain the operation, classification and governing mechanisms of hydroelectric power plants
- Explore the design, operation, effects and safety measures of nuclear power plants
- Examine the working principles, cycles and recent developments in gas turbine and diesel engine power plants
- Evaluate advanced throwaway and scrubber systems for effective pollution control

UNIT I STEAM POWER PLANTS **9**

Introduction – Selection – Steam Flow – Layout – Main Flow Circuits – Main Parts of Steam Power Plant – Cooling of Alternators – Protection of Turbo–Alternators – Excitation and Governing System – Efficiency – Start–up procedure.

UNIT II HYDROELECTRIC POWER PLANTS **9**

Introduction – Selection – Hydrology – Classification of hydroelectric plants – Main Components of Hydroelectric Plants – Classification of Hydro Turbines – Hydro Generators – Pump Storage Plants – Governing of water turbine.

UNIT III NUCLEAR POWER PLANTS **9**

Introduction – Effects of Fossil Fuels – Selection – Components of Nuclear Power Plant – Main Components of Reactors – Types of Reactors – Effect of Radiation – Nuclear waste and its disposal – Safety of Nuclear Power Reactors.

UNIT IV GAS AND DIESEL ENGINE POWER PLANTS **9**

Gas Power plant: Introduction – Simple Gas –Turbine Plant – Open–Cycle and Closed–Cycle Power Generation – Features of Combined Cycle Gas Turbine – IGCC Plants.

Diesel Engine Power plant: Introduction – Advantages and disadvantages – Diesel Engine Power – Equipment – Recent Advances in Diesel Plants.

UNIT V SCRUBBER TECHNOLOGY **9**

Introduction – Throwaway system – Methods – Non conventional wet scrubber – Types – Sealing and corrosion – Non–conventional throwaway scrubber – Advantages and disadvantages – FGD systems – Dry scrubbing system – Sludge disposal.

TOTAL : 45 PERIODS

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BoS (EEE) 28/10/25

COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the working principle and purpose of a steam power plant
- Describe components, processes and efficiency measures for effective plant operation
- Analyze the design, operation, effects and safety measures of nuclear power plants
- Demonstrate knowledge of gas and diesel power plant operation, cycles, equipment and modern advancements
- Assess the effectiveness of advanced throwaway and scrubber systems for pollution control in power generation

TEXT BOOKS:

1. Singh S N, "Electric Power Generation, Transmission and Distribution", Second Edition, PHI Learning Private limited, New Delhi, 2023.
2. Arora S C and Domkundwar S, "Power plant Engineering" Sixth Revised and Enlarged Edition, Dhanpat Rai Publications Private Limited, New Delhi, 2012.

REFERENCES:

1. P K Nag, "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.
2. Nagpal G R, "Power Plant Engineering", Khanna Publishers, 2008.
3. El-Wakil M M, "Power Plant Technology", Tata McGraw – Hill Publishing Company Limited, 2010.
4. Rajput R K, "Power Plant Engineering", Laxmi Publications, 2016.
5. Gilbert M Masters, "Renewable and Efficient Electric Power Systems", Second Edition, Wiley, 2013.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	–	1
CO2	3	3	2	–	–	–	–	–	–	–	1
CO3	3	3	3	–	–	2	–	–	–	–	1
CO4	3	3	2	2	–	–	–	–	–	–	2
CO5	3	2	–	–	–	2	–	–	–	–	1

CHAIRMAN
BoS (EEE)

24EE102OE	ELECTRICAL WIRING AND LIGHTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The students should be made to,

- Understand the fundamentals, classifications and safety regulations of electrical wiring systems
- Learn about protective devices, earthing techniques and safety practices for domestic and industrial installations
- Apply wiring principles to residential, commercial and industrial systems including load calculations and circuit design
- Familiarize with the principles of lighting systems, types of light sources and illumination standards
- Develop skills in designing, estimating, and maintaining wiring and lighting installations

UNIT I FUNDAMENTALS OF WIRING SYSTEMS 9

Electrical wiring – Need, scope, and classifications. Wiring materials and accessories, Wiring tools and practices – Safety regulations (IE rules & ISI standards). Types of wiring systems: CTS, conduit, casing & capping, cleat wiring and their applications.

UNIT II PROTECTIVE DEVICES AND EARTHING 9

Fuses, MCBs, ELCBs, RCCBs, and relays – Earthing: pipe earthing, plate earthing, earth electrodes – Importance of earthing and safety measures – Earthing practices in domestic and industrial installations. Protection against overcurrent, overload and leakage.

UNIT III DOMESTIC AND INDUSTRIAL WIRING 9

Residential building wiring – Single–phase and three–phase systems. Industrial wiring – Bus bar arrangements, distribution boards and industrial accessories. Wiring layout for workshops, factories, and commercial buildings. Design of circuits: load calculation, diversity factor and selection of conductors. Testing of wiring installations.

UNIT IV LIGHTING SYSTEMS 9

Principles of illumination – Lighting terms: luminous flux, luminous intensity, lux, utilization factor, depreciation factor. Light sources: incandescent, fluorescent, LED, HID lamps. Lighting accessories: ballasts, starters, controls. Indoor and outdoor lighting schemes. Energy–efficient lighting systems and standards.

UNIT V DESIGN, ESTIMATION AND MAINTENANCE 9

Design of wiring schemes for residential, commercial and industrial installations – Preparation of wiring diagrams and layouts – Estimation of materials and cost for wiring and lighting projects – Maintenance of wiring installations and lighting systems. Fault detection, troubleshooting and preventive maintenance.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the types of wiring systems, wiring materials, tools and safety standards
- Apply knowledge of wiring methods to residential, commercial and industrial installations
- Understand the fundamentals of residential, commercial and industrial wiring systems
- Explain lighting principles, light sources, accessories and energy-efficient lighting systems
- Design wiring and lighting installations and perform estimation and maintenance

TEXT BOOK:

1. Uppal S L, "Electrical Wiring, Estimation and Costing", Sixth Edition, Khanna Publishers, 2025.

REFERENCES:

1. Raina K B and Bhattacharya S K, "Electrical Design, Estimating and Costing ", Second Edition, New Age International Private Limited, 2017.
2. Gupta J B, "A Course in Electrical Installation Estimating and Costing", Ninth Edition, S K Kataria and Sons, 2022.
3. Giridharan M K, "Electrical Systems Design", Second Edition, I K International Publishing Housing Private Limited, 2016.
4. Sharma Br, "Electrical Estimating and Costing", First Edition, Satya Prakashan Publishers, 2010.
5. National Building Code of INDIA 2016 - Bureau of Indian Standards.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	2	–	–	–	1
CO2	3	3	–	–	–	–	–	–	–	–	1
CO3	3	2	–	–	–	–	–	–	–	–	2
CO4	3	2	–	–	–	2	–	–	–	–	2
CO5	3	3	3	–	–	–	–	–	–	2	2

CHAIRMAN
BoS (EEE)

24AD101OE INTRODUCTION TO ARTIFICIAL INTELLIGENCE L T P C

(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH) 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the concept of intelligent agents and their interaction with environments
- Explore local search approaches in continuous spaces
- Study knowledge engineering approaches within first-order logic
- Examine planning graphs and their role in efficient planning
- Apply the role of knowledge representation in the learning process

UNIT I INTRODUCTION 9

Intelligent Agents - Agents and environments - good behavior - The nature of environments - Structure of agents - Problem Solving - Problem solving agents - Uniformed search strategies - Avoiding repeated states-Searching with partial information.

UNIT II SEARCHING TECHNIQUES 9

Informed search and exploration - Informed search strategies - heuristic function - Local search algorithms and optimization problems - Local search in continuous spaces - Online search agents and unknown environments - Constraint satisfaction problems (CSP) - Backtracking search and Local search for CSP.

UNIT III KNOWLEDGE REPRESENTATION 9

First order logic - Representation revisited - Syntax and semantics for first order logic - Using first order logic - Knowledge engineering in first order logic - Inference in First order logic - Prepositional versus first order logic - Unification and lifting - Forward chaining - Backward Chaining-Ontological Engineering.

UNIT IV PLANNING 9

Planning problem- Planning with state space search - Partial order planning - Planning graphs - Planning with proportional logic - Time, Schedules, and Resources - Hierarchical task Planning - Conditional Planning - Execution monitoring and re planning - Continuous planning.

UNIT V LEARNING 9

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning - Logical formulation of learning - Explanation based learning - Learning using relevant information-Statistical Learning Methods - Case Study on AI-Assisted X-Ray Analysis.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AD)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply the concept of problem-solving agents to real-world problem domains
- Implement local search algorithms to solve optimization
- Demonstrate knowledge engineering processes using FOL
- Utilize planning graphs to represent and solve planning tasks
- Analyze the role of knowledge in supporting effective learning

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 4th Edition, 2023.
2. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 6th Edition, 2021.

REFERENCES:

1. Engene Charniak and Drew Mc Dermott, "Introduction to Artificial Intelligence", Addison Wesley, 2013.
2. Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 2002.
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, Books 3rd Edition, 2000.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	3	1	-	2	2	2	2
CO2	3	2	2	2	3	1	-	1	1	2	2
CO3	3	3	2	2	3	1	-	2	1	2	2
CO4	3	2	3	2	3	1	-	1	2	2	2
CO5	3	2	2	3	3	1	-	2	2	3	3

CHAIRMAN
BoS (AD)

28.10.25

24AD102OE **INTRODUCTION TO DATA SCIENCE** **L T P C**
(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the fundamental concepts of data science, its lifecycle, and applications
- Acquire, preprocess, and manage different types of data
- Apply probability and statistical techniques for analyzing data
- Develop predictive models using regression analysis
- Analyze networks and social data using graph theory

UNIT I FUNDAMENTALS OF DATA SCIENCE 9

Introduction to Data Science - Data Science Lifecycle - Applications of Data Science in Various Domains - Types of Data: Structured, Unstructured, Semi-Structured - Characteristics of Big Data - Roles in Data Science - Challenges in Data Science - Data Ethics and Privacy Issues - Future Trends in Data Science.

UNIT II DATA COLLECTION AND PREPROCESSING 9

Sources of Data - Data Acquisition Methods - Data Integration and Transformation - Handling Missing Values - Identifying and Removing Duplicates - Data Normalization and Standardization - Outlier Detection and Handling - Exploratory Data Analysis (EDA) - Case Study Using EDA.

UNIT III PROBABILITY AND STATISTICS FOR DATA SCIENCE 9

Introduction to Probability - Probability Distributions - Random Variables - Sampling Methods - Central Limit Theorem - Hypothesis Testing - Confidence Intervals - Correlation and Regression - Statistical Significance - Applications of Statistics in Data Science

UNIT IV REGRESSION ANALYSIS 9

Regression Analysis, Regression: Linear Regression Simple Linear Regression, Multiple & Polynomial Regression, Sparse Model - Unsupervised Learning, Clustering, Similarity and Distances, Quality Measures of Clustering - Case Study.

UNIT V NETWORK ANALYSIS 9

Network Analysis - Graphs - Social Networks - Centrality - Drawing centrality of Graphs - PageRank - Ego-Networks - Community Detection.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AD)

OUTCOMES:

On Successful completion of this course, the students will be able to,

- Perform Exploratory Data Analysis to summarize data and gain insights
- Apply probability, statistical methods, and hypothesis testing to solve data-related problems
- Build and evaluate regression models for prediction and analysis
- Implement clustering techniques and evaluate clustering quality for unsupervised learning tasks
- Analyze complex networks and social graphs using centrality measures, PageRank, and community detection techniques

TEXT BOOK:

1. Foster Provost & Tom Fawcett, "Data Science for Business" 1st Edition, O'Reilly Media, 2013.

REFERENCES:

1. Wes McKinney "Python for Data Analysis" , 2nd Edition, O'Reilly, 2017.
2. Peter Bruce, Andrew Bruce "Practical Statistics for Data Scientists", 2017.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining 2nd Edition, Pearson, 2019.
4. Albert-László Barabási, "Network Science" – Cambridge University Press, 2016.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	1	2	2	-	1	2	3
CO2	3	3	2	3	2	2	2	-	1	2	3
CO3	3	3	3	3	2	2	2	-	-	2	3
CO4	3	3	-	3	3	2	1	-	2	2	3
CO5	2	2	3	2	3	2	1	-	2	2	2

CHAIRMAN
BoS (AD)

24AG101OE **BASICS OF AGRICULTURE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn how biological and environmental factors affect crop growth
- Understand proper plant spacing and nursery techniques for better crop establishment
- Plan and manage water, nutrients, crop protection, fertigation and harvesting effectively
- Identify the main causes of post-harvest losses in cereals, pulses and oilseeds
- Evaluate cleaning and grading equipment based on their efficiency and performance for different crops

UNIT I AGRICULTURE AND CROP PRODUCTION **9**

Introduction to agriculture and its crop production sub-sectors – field crop production and Horticulture – Factors affecting crop growth and production: genetic (internal) and environmental (external) factors – Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices.

UNIT II CROP SELECTION AND ESTABLISHMENT **9**

Regional and seasonal selection of crops – Systems of crop production – Competition among crop plants – Spacing and arrangement of crop plants – Establishment of an adequate crop stand and ground cover – including selection and treatment of seed and nursery growing.

UNIT III CROP MANAGEMENT **9**

Crop water Management – Crop nutrition management – need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling – Integrated methods of managing water, nutrients and plant protection – Types and methods of harvest.

UNIT IV POST HARVESTING **9**

Post harvest technology – introduction – objectives – post harvest losses of cereals, pulses and oilseeds – importance – optimum stage of harvest. Threshing – traditional methods mechanical threshers – types - principles and operation - moisture content.

UNIT V CLEANING AND GRADING **9**

Principles – air screen cleaners – adjustments – cylinder separator – spiral separator – magnetic separator – colour sorter – inclined belt separator – length separators – effectiveness of separation and performance index.

TOTAL: 45 PERIODS

V. Gope

CHAIRMAN
BoS (AGE) 28.10.25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand genetic and environmental factors influencing crop growth
- Apply engineering knowledge for crop selection, spacing and cropping system design
- Develop integrated water, nutrient and plant protection management for sustainability
- Solve agricultural problems using research, experiment design and data analysis
- Analyze cleaning and grading equipment based on efficiency and performance indices

TEXT BOOK:

1. Rajendra Prasad, "Textbook of Field Crops Production Volume 1 and 2", Indian Council of Agricultural Research, New Delhi, 2017
2. Reddy S R, "Principles of Agronomy", Kalyani Publishers, New Delhi, 2018
3. Chakraverty A, "Post harvest technology for Cereals, Pulses and oil seeds", Oxford & IBH publication Pvt Ltd, New Delhi, 3rd Edition, 2019

REFERENCES:

1. Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore, 2020
2. Kumar N, "Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants", Oxford and IBH Publishing Co. Pvt. Ltd, 2nd Edition, 2018
3. Rathore N S, Mathur G K and Chasta S S, "Post-Harvest Management and Processing of Fruits and Vegetables", ICAR, The Energy and Resources Institute, India, 2012

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	1

V. Gopal

CHAIRMAN
BoS (AGE)

24AG102OE **FARM MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the classification of tractors and the operation of tractor engines
- Identify the concepts and functions of various engine systems
- Apply the principles and methods of operation for sowing and fertilizing equipment
- Analyze the types and performance of equipment used for weeding and plant protection
- Examine the working principles and operational efficiency of harvesting machinery

UNIT I TRACTORS **9**

Classification of tractors – Tractor engines – construction of engine blocks, cylinder head and crankcase – features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers - Electronics and Guidance System of Tractor.

UNIT II ENGINE SYSTEMS **9**

Valves – inlet and outlet valves – valve timing diagram. Air cleaner – exhaust – silencer. Cooling systems – lubricating systems – fuel system – governor – electrical system.

UNIT III SOWING AND FERTILIZING EQUIPMENT **9**

Crop planting – methods – row crop planting systems – Devices for metering seeds – furrow openers – furrow closers – types – Types of seed drills and planters – calibration-fertilizer metering devices – seed cum fertilizer drills – paddy transplanters – nursery tray machines.

UNIT IV WEEDING AND PLANT PROTECTION EQUIPMENT **9**

Weeding equipment – hand hoe – long handled weeding tools – dry land star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders. Sprayers – types – classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.

UNIT V HARVESTING MACHINERY **9**

Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses.

TOTAL: 45 PERIODS

V. Gopal

CHAIRMAN
BoS (AGE) 28.10.25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand tractor engine components, electronics and guidance systems
- Apply knowledge of engine operation, valves and electrical systems
- Operate and maintain sowing and fertilizing equipment through seed/fertilizer metering and calibration
- Evaluate weeding and plant protection equipment based on atomization, droplet size and spray parameters
- Analyze efficiency and performance of harvesting machinery

TEXT BOOK:

1. Jain S C and Rai C R, "Farm Tractor Maintenance and Repair", Standard Publishers and Distributors, New Delhi, 3rd Edition,2 013
2. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publishers Distributors, New Delhi, 2020
3. Michael and Ohja, "Principles of Agricultural Engineering volume-1", Jain brothers, New Delhi, 14th Edition, 2021

REFERENCES:

1. Black P O, "Diesel Engine Manual", D B Taraporevala Sons & Co Pvt Ltd, Mumbai, 1996
2. Kepner RA, "Principles of Farm Machinery", CBS Publishers and Distributers, New Delhi, Kindle Edition, 2018
3. Harris Pearson Smith, "Farm machinery and equipment", Tata McGraw-Hill publication, New Delhi, Kindle Edition, 2017

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	1	-	-	-	-	-	1
CO2	3	2	1	-	1	-	-	-	-	-	1
CO3	3	2	1	-	1	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	1

V. Gopal

CHAIRMAN
BoS (AGE)

08/10/25

24IT101OE FUNDAMENTALS OF SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Understand various software engineering life cycle models to real-world projects.
- Perform software requirements analysis and develop clear, structured specifications.
- Acquire knowledge of system analysis and design concepts.
- Understand software testing strategies, maintenance approaches, and quality assurance practices.
- Explore project management techniques, including scheduling using modern tools.

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering - Software Process - Perspective and Specialized - Process Models - Introduction to Agility - Agile Process - Extreme Programming - XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Requirement Analysis and Specification - Requirements Gathering and Analysis - Software Requirement Specification - Formal System Specification - Finite State Machines - Petri Nets - Object Modeling using UML: Use Case Model - Class Diagrams - Interaction Diagrams - Activity Diagrams - State Chart Diagrams - Functional Modeling - Data Flow Diagram.

UNIT III SOFTWARE DESIGN 9

Software Design: Design Process - Design Concepts - Coupling - Cohesion - Functional Independence - Design Patterns: Model View Controller - Publish - Subscribe - Adapter - Command - Strategy - Observer - Proxy - Facade - Architectural Styles - Layered - Client Server - Tiered - Pipe and Filter- User Interface Design.

UNIT IV SOFTWARE TESTING AND MAINTENANCE 9

Testing: Unit Testing - Black box testing - White box Testing - Integration and System Testing - Regression Testing - Debugging: Program Analysis - Symbolic Execution - Model Checking - Case Study.

CHAIRMAN
BoS (IT)

UNIT V PROJECT MANAGEMENT 9

Software Project Management - Software Configuration Management - Project Scheduling - DevOps: Motivation - Cloud as a Platform - Operations - Deployment Pipeline: Overall Architecture Building and Testing - Deployment - Tools - Case Study.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Compare and select appropriate Software Development Lifecycle Models
- Evaluate project management approaches as well as cost and schedule estimation strategies.
- Perform formal analysis on software specification.
- Use UML diagrams effectively for system analysis and design.
- Design software systems using architectural styles and design patterns.

TEXT BOOKs:

1. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, 1st Edition, McGraw-Hill, 2014.
2. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: Using UML, Patterns and Java. 3rd Edition, Pearson Education, 2009.

REFERENCES:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd Edition, PHI Learning Pvt. Ltd., 2010.
2. Len Bass, Ingo Weber and Liming Zhu, - DevOps: A Software Architect's Perspective, Pearson Education, 2016.
3. Rajib Mall, Fundamentals of Software Engineering, 3rd Edition, PHI Learning Pvt. Ltd., 2009.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	2	2	1	2	2	-	-	-	1	1	2
2	3	3	2	3	2	-	-	-	2	3	2
3	3	3	2	2	1	-	-	-	2	3	2
4	2	3	2	1	3	-	-	-	2	3	2
5	2	3	1	1	2	-	-	-	-	-	1

CHAIRMAN
BoS (IT)

28/10/25

24IT102OE **WIRELESS SENSOR NETWORKS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Understand the concepts of wireless sensor networks.
- Get exposure on WSN environment.
- Know the layered approach in sensor networks.
- Understand the use of suitable protocol for WSN.
- Explore knowledge on performance analysis of WSN.

UNIT I INTRODUCTION TO WIRELESS SENSOR NETWORKS 9

Data Communications - Networks - Networks Types - Network Models: TCP/IP Protocol suite - The OSI Model. Digital-to-Digital Conversion: Line coding - Line Coding Schemes - Transmission Modes - Transmission media: Guided - Unguided media.

UNIT II WSN ARCHITECTURE 9

Data Dissemination - Flooding and Gossiping - Data Gathering Sensor Network Scenarios - Optimization Goals and Figures of Merit - Design Principles for WSNs - Gateway Concepts - Need for Gateway - WSN and Internet Communication - WSN Tunneling.

UNIT III MEDIA ACCESS CONTROL 9

Fundamentals of MAC protocols - Low Duty Cycle Protocols and Wakeup Concepts - Contention Based Protocols - Schedule-based Protocols - SMAC - BMAC - Traffic -Adaptive Medium Access Protocol - IEEE 802.15.4 MAC Protocol.

UNIT IV TRANSPORT LAYER 9

Circuit Switching - Packet Switching - Concept of IPV4 - IPV6 - 6LOWPAN and IP - IP based WSN - 6LOWPAN based WSN - IOT.

UNIT V TOOLS FOR WSN 9

TinyOS: Introduction - NesC - Interfaces - Modules - Configuration - Programming in TinyOS using NesC - TOSSIM - Contiki - Structure - Communication Stack - Simulation environment - Cooja simulator - Programming.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (IT)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explore the fundamentals of wireless sensor network models.
- Explore knowledge in devising layers in WSN.
- Able to design energy efficient WSNs.
- Design application dependent suitable for infrastructure-less networks.
- Implement various protocols in TinyOS and Contiki.

TEXT BOOKs:

1. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks. 1st Edition, John Wiley & Sons, New Jersey, 2011.
2. Jun Zheng, Abbas Jamalipour, Wireless Sensor Networks: A Networking Perspective. 1st Edition, Wiley-IEEE Press, 2014.

REFERENCES:

1. Waltenegus W. Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice. 1st Edition, John Wiley & Sons, 2014.
2. Ian F. Akyildiz, Mehmet Can Vuran, Wireless Sensor Networks. 1st Edition, John Wiley & Sons, 2011.
3. Zach Shelby, Carsten Bormann, 6LoWPAN: The Wireless Embedded Internet. 1st Edition, John Wiley & Sons, 2009.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	3	2	-	-	-	-	-	-	-
2	3	2	3	2	-	3	-	-	-	-	-
3	3	3	3	3	-	3	3	-	2	2	-
4	3	3	3	3	-	3	3	3	2	2	2
5	3	3	3	3	3	3	-	-	2	2	-

CHAIRMAN
BoS (IT)

OPEN ELECTIVE - II

Syllabus

28.05

24BM201OE **TRADITIONAL INDIAN FOODS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the historical and cultural significance of food in human societies
- Compare traditional and modern food processing techniques
- Explore regional food patterns and their transformation
- Examine commercial production and marketing of traditional foods
- Assess the health and environmental impacts of traditional foods

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES 9

Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING 9

Traditional methods of milling grains – rice, wheat and corn – equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sundrying, osmotic drying, brining, pickling and smoking.

UNIT III TRADITIONAL FOOD PATTERNS 9

Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods.

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS 9

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS OF TRADIONAL FOODS 9

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe the evolution of food production systems and explain the cultural symbolism of food across contexts
- Analyze traditional methods of milling, oil extraction, and preservation, and evaluate their efficiency
- Identify traditional food items from various Indian regions and assess their globalization and IPR concerns

Ashok.T.
Chairman
BoS/BME

- Illustrate the role of SHGs, SMEs, and corporations in scaling traditional food products for mass markets
- Compare traditional and fast foods in terms of nutrition, safety, and sustainability; recommend healthier options

TEXT BOOKS:

1. Sen, Colleen Taylor "Food Culture in India" Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	1	3	2	-	2	1	2
CO2	3	3	2	2	2	2	-	-	2	1	2
CO3	2	2	2	1	2	3	3	-	2	2	3
CO4	2	2	3	2	2	3	2	2	3	3	3
CO5	3	3	2	2	2	3	2	-	3	2	3

Ashok. A.

Chairman
BoS/BME

24BM202OE FUNDAMENTALS OF CELL AND MOLECULAR BIOLOGY

L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the structural and evolutionary aspects of cells and microorganisms
- Explore the molecular organization and functions of cellular organelles
- Examine membrane structure and transport mechanisms
- Investigate the cell cycle and mechanisms of cellular communication
- Apply the central dogma and scientific reporting techniques

UNIT I INTRODUCTION TO CELL 9

Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution, Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria, mycoplasma and prions.

UNIT II CELL ORGANELLES 9

Molecular organisation, biogenesis and function Mitochondria, endoplasmic reticulum, Golgi apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.

UNIT III BIO-MEMBRANE TRANSPORT 9

Physiochemical properties of cell membranes. Molecular constitute of membranes, asymmetrical organisation of lipids and proteins. Solute transport across membrane's-fick's law, simple diffusion, passive-facilitated diffusion, active transport- primary and secondary, group translocation, transport ATPases, membrane transport in bacteria and animals. Transport mechanism- mobile carriers and pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell respiration.

UNIT IV CELL CYCLE 9

Cell cycle- Cell division by mitosis and meiosis. Comparison of meiosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signalling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.

UNIT V CENTRAL DOGMA 9

Overview of Central dogma DNA replication: Meselson & Stahl experiment, bi–directional Proof reading a report – Avoiding Typographical Errors – Bibliography in required Format – Font – Spacing – Checking Tables and Illustrations – Presenting a Report Orally – Techniques.

TOTAL:45 PERIODS

OUTCOMES:

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

- Differentiate between prokaryotic and eukaryotic cells and classify viruses, bacteria, and prions.
- Describe the biogenesis and roles of organelles and explain the concept of compartmentalization.
- Analyze membrane composition and compare various transport processes including diffusion and active transport.
- Illustrate stages of mitosis and meiosis, and explain cell signalling, adhesion, and checkpoint regulation.
- Explain DNA replication and demonstrate skills in scientific documentation and oral presentation

Chairman
BoS/BME

REFERENCES:

1. Gerson and Gerson - Technical Communication: Process and Product, 7th Edition, Prentice Hall (2012)
2. Virendra K. Pamecha - Guide to Project Reports, Project Appraisals and Project Finance (2012)
3. Daniel Riordan - Technical Report Writing Today (1998)
4. Darla-Jean Weatherford - Technical Writing for Engineering Professionals (2016) Penwell Publishers

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	2	2	-	-	2	1	2
CO2	3	2	2	2	2	2	-	-	2	1	2
CO3	3	3	2	2	3	2	-	-	2	1	2
CO4	3	3	2	3	2	2	-	-	2	1	2
CO5	3	2	2	2	2	2	-	-	3	2	3

Chairman
BoS/BME

28.10.25

24CE201OE GLOBAL WARMING AND CLIMATE CHANGE

L	T	P	C
3	0	0	3

OBJECTIVES:

The students should be made to:

- Understand earth system and climate change impact.
- Infer basics of climate parameters and climate change causing elements
- Interpret atmosphere with its composition.
- Develop impact of climate change on various sectors.
- Make use of weather and climate parameters measuring instruments.

UNIT I CLIMATOLOGY 9

Introduction to earth system - Hydrosphere - lithosphere - cryosphere - atmosphere and biosphere - Climatology - Climate change impact in different sectors - Climate change mitigations and adaptations - Climate change negotiations - Earth system - hydrological cycle and carbon cycle - Paleoclimatology - Agriculture - Climate change Organization and programmes - Mitigation measures

UNIT II CLIMATOLOGY PROXIES 9

Earth system- cryosphere and biosphere - Climatology proxies - Forestry – IPCC - Intergovernmental Panel on Climate Change and assessment report highlights - Use of renewable resources- solar energy- Importance of earth system and climate - Indian climate system and their classification - Fishery - IPCC Assessment Report 1- Wind energy

UNIT III ATMOSPHERE AND ITS COMPOSITION 9

Atmosphere and its composition - Role of land and ocean to regulate climate- Socio economic impact – tourism - IPCC Assessment Report 2- different strata of atmosphere and temperature profile - Role of ice and wind to regulate climate - industries and business - IPCC Assessment Report

UNIT IV WEATHER AND CLIMATE 9

Weather and Climate - Causes of climate change - Milankovitch theory (change Natural cause) - Acid rain and human health impact - IPCC Assessment Report 4 - Climate parameter - temperature - atmospheric pressure - Milankovitch theory and climate - Sea surface temperature increases and aquatic organisms impact - IPC-Assessment Report 5 - Concept of sustainable development.

CHAIRMAN
BoS (CIVIL)

UNIT V ATMOSPHERIC HUMIDITY AND RAINFALL 9

Atmospheric humidity and rainfall - Human induced climate change (anthropogenic causes) - Weather and climate parameters measuring instruments - UNEP - United Nations Environment Programme - Concept of Carbon sequestration - Wind circulation - Global radiance balance of climate system – thermometer - hygrometer or psychomotor WMO - World Meteorological Organization - Terrestrial sequestration.

TOTAL: 45 PERIODS

OUTCOMES:

On Successful completion of this course, the students will be able to:

- Explain the importance of earth system and climate change adaptations mitigations
- Summarize climate parameters and their impact due to human activities.
- Demonstrate the impact of climate change in various sectors.
- Organize different protocol related to climate change with its causes and impact.
- Analyze projects related to atmospheric humidity and rainfall.

TEXT BOOKS:

1. Dr. Zeena Flavia D Souza, Dr. Arpan Ray, Dr. Sayantan Dutta and Dr. Komala H.K., "Global Warming-Climate Change", Kiwi International Publishing House, Madurai, 2025.
2. Dr. Md. Shahnawaz, "Global Warming and Climate Change Problem Policies and Politics", Generic Publishing, 2017.

REFERENCES:

1. Wallace J.M and Hobbs P.V, "Atmospheric Science", Elsevier, Academic Press,2006.
2. Bates B.C, Kundzewicz Z.W, Wu S and Palutikof J.P, "Climate Change and Water Technical Paper of the Intergovernmental Panel on Climate Change", IPCC Secretariat, 2008.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	2	-	-	-	-	1
CO2	2	-	-	-	-	2	-	-	-	-	1
CO3	2	-	-	-	-	3	2	-	-	-	1
CO4	2	-	-	-	-	3	3	-	-	-	1
CO5	2	-	-	-	2	2	2	-	-	-	1

CHAIRMAN
BoS (CIVIL)

28.10.25

24CE202OE **BUILDING SERVICES**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand comfortable and safe construction with the services designed and installed.
- Infer knowledge on basis of electrical wiring system and telecommunication.
- Summarize importance of principles of illumination in buildings.
- Develop awareness on various principles of refrigerant and heat recovery devices.
- Organize fire safety installation and electric alarm circuits.

UNIT I MACHINERIES 9

Introduction of lifts and Escalators – Special features required for lifting arrangement and installation – Travelators – Controls – Machine room and equipments.

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 9

Basics of electricity distribution – Earthing systems and bonding – Electrical wiring – Industrial installations – Lighting controls – Light sources, Lamps, Lighting design – Telecommunication installations.

UNIT III PRINCIPLES OF ILLUMINATION 9

Ventilation requirements – Mechanical ventilation – Fans and types – Boilers and types – Water treatments – Solar heating of water – Hot water storage cylinders.

UNIT IV REFRIGERATION PRINCIPLES 9

Heat emitters – Expansion facilities of heating system – Energy management system – Factors affecting fuels – Oil sand properties of natural gas – Air conditioning, principles and applications – Refrigerant and system characteristics – Heat recovery devices.

CHAIRMAN
BoS (CIVIL)

UNIT V FIRE SAFETY INSTALLATION 9

Fire prevention and control systems – Fire alarms – Electrical alarm circuits – Smoke extraction and ventilation – Gas extinguishers – Types of detectors – Gas installation and components.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to:

- Explain the special features in installation of lifts and escalators.
- Demonstrate electricity distribution earthing systems and bonding in buildings.
- Outline requirements of ventilation and principles of illumination.
- Utilize air conditioning and energy management system in buildings.
- Analyze need for fire detection and protection in working environment.

TEXT BOOKS:

1. Roger Greeno and Fred Hall, “Building Services Handbook”, Elsevier Publishers 4th Edition, 2007.
2. Rao S and P Saluja H L,“Electrical Safety, Fire Safety Engineering and Safety Management”, Khanna Publishers, 1st Edition, 2016.

REFERENCES:

1. Steffy G, “Architectural Lighting Design”, John Wiley and Sons, 3rd Edition, 2008.
2. Killinger J and Killinger L, “Heating and Cooling Essentials”, Goodheart Wilcox Publishers, 2003.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	2	2	2	-	-	-	1
CO2	2	-	-	-	2	2	3	-	-	-	1
CO3	2	-	-	-	2	3	3	-	-	-	1
CO4	2	-	-	-	2	3	3	-	-	-	[illegible]
CO5	2	-	-	-	2	2	2	-	-	-	1

CHAIRMAN
BoS (CIVIL)

24CS201OE FUNDAMENTALS OF OPERATING SYSTEMS (Common to AGE, CIVIL, BME, ECE, EEE & MECH)

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Illustrate the fundamental concepts and functions of operating systems.
- Discuss the management of processes and threads.
- Examine process synchronization, inter-process communication, and deadlock situations.
- Implement memory management strategies, including virtual memory.
- Assess file systems, disk scheduling, and I/O management techniques.

UNIT I INTRODUCTION 9

Introduction to Operating Systems - Operating System Operations - Resource Management - Operating System Services – Virtualization - User and Operating System Interface - System Calls - Operating System Structures - Building and Booting an Operating System.

UNIT II PROCESSES AND THREADS 9

Process Concept - Process Scheduling - Operations on Processes - Interprocess Communication - IPC in Shared - Memory Systems - IPC in Message - Passing Systems - Examples of IPC Systems - Threads - Overview - Multithreading models - Pthreads

UNIT III PROCESS MANAGEMENT AND SYNCHRONIZATION 9

Basic Concepts of CPU Scheduling - Scheduling Criteria - Scheduling Algorithms - The Critical - Section Problem - Peterson's Solution - Synchronization Hardware - Mutex Locks - Semaphores - Classic Problems of Synchronization - Monitors - Deadlocks - Prevention - Avoidance – Detection - Recovery

UNIT IV MEMORY MANAGEMENT 9

Contiguous Memory Allocation - Paging - Structure of the Page Table - Segmentation - Swapping - Example Architectures - Demand Paging - Page Replacement - Allocation of Frames - Thrashing

UNIT V STORAGE MANAGEMENT 9

File Concept - Access Methods - Directory Structure - Protection - Directory Implementation - Allocation Methods – Free - Space Management – Mass - Storage Structure - HDD Scheduling

TOTAL: 45 PERIODS

C. [signature]

CHAIRMAN
BoS (CSE)

Mech

OUTCOMES:

Upon completion of the course, the students will be able to

- Understand the structure, services, and basic functionalities of operating systems.
- Analyze process and thread creation, management, and inter-process communication.
- Design scheduling algorithms and apply synchronization and deadlock handling techniques.
- Evaluate and compare memory management schemes like paging and segmentation.
- Analyze file systems, disk scheduling, and I/O management in storage systems.

TEXT BOOKS:

1. Abraham Silberschatz, Greg Gagne and Peter B. Galvin. "Operating System Concepts", 10th Edition, John Wiley & Sons Inc., 2018.

REFERENCES:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. D. M. Dhamdhere. ""Operating Systems: A Concept– Based Approach"", 3rd Edition, Tata McGrawHill, 2017.
3. William Stallings. "Operating Systems: Internals and Design Principles", 9th Edition, Pearson, 2017.
4. Andrew S. Tanenbaum, Herbert Bos. "Modern Operating Systems", 5th Edition, Pearson, 2023.
5. Douglas Comer, "Operating System Design: The Xinu Approach", 2nd Edition, CRC Press, 2023.

COs - POs Mapping

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	1	3	2	2	3	1	2	-	2	3
2	3	3	3	2	2	2	1	2	-	2	3
3	3	3	3	2	2	2	1	2	-	2	3
4	3	3	3	2	1	2	1	2	-	2	3
5	3	3	3	2	1	2	1	2	-	2	3

CHAIRMAN
BoS (CSE)

24CS202OE **INTRODUCTION TO DATABASE** **L T P C**

(Common to AGE, CIVIL, BME, ECE, EEE & MECH) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Describe the fundamentals of database systems and conceptual data modeling.
- Use the principles of the relational model to construct SQL queries.
- Develop database applications and design relational schemas.
- Examine transaction processing, concurrency control, and recovery mechanisms.
- Assess the role of Distributed Databases and NoSQL systems in modern applications.

UNIT I INTRODUCTION TO DATABASE SYSTEMS **9**

Introduction to Databases - File System Vs Database System - Data Models - Schemas and Instances - DBMS Architecture - Centralized - Client Server - Database Applications - ER Models - ER to Relational Mapping

UNIT II RELATIONAL MODELS **9**

Relational Model - Constraints - Keys - Dependencies - Relational Algebra - Unary, Binary, Set and Extended Relational Algebra operations - SQL - Data Definition - Data Manipulation and Retrieval Queries - Nested Queries - Joins - Views - Cursors - Procedures - Functions - Triggers - Embedded and Dynamic SQL

UNIT III RELATIONAL DATABASE DESIGN **9**

Database Design - Functional Dependencies - Normalization - 1 NF - 2 NF - 3 NF - BCNF - Multivalued Dependency (4 NF) - Join Dependency (PJNF)

UNIT IV TRANSACTIONS AND RECOVERY **9**

Transaction processing concepts - Need for concurrency control and recovery - ACID Properties - Recoverability - Serializability - Concurrency Control - Two phase locking Techniques - Timestamp based protocol - Graph based protocol - Deadlock handling - Log based recovery - Two Phase Commit Protocol

UNIT V QUERY PROCESSING AND ADVANCED DATABASES **9**

Indexing and Hashing Techniques - Query Processing and Optimization - Sorting and Joins - Database Tuning - Introduction to Spatial and Temporal Databases - OO Databases - NoSQL.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (CSE)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the basic database concepts and construct ER models for simple applications.
- Formulate SQL queries to manage and retrieve data from relational databases.
- Apply programming and design techniques to enhance database structure through normalization.
- Implement transactions using concurrency control and recovery methods.
- Analyze and evaluate Distributed and NoSQL databases for varied application needs.

TEXT BOOKS:

1. Jagdish Chandra Patni, Hitesh Kumar Sharma, Ravi Tomar, Avita Katal, "Database Management System An Evolutionary Approach", 2022.

REFERENCES:

1. Narain Gehani and Melliyal Annamalai, "The Database Book: Principles and Practice Using the Oracle Database System", Universities Press, 2012.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson/Addison, Wesley, 2016.
4. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2019.
5. Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management", First Edition 2019.

COs - POs Mapping

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	3	3	3	2	-	2	-	1	3
2	3	3	3	3	3	2	-	2	-	1	2
3	3	3	3	3	2	2	-	3	-	1	3
4	3	3	3	3	3	2	-	1	-	1	2
5	3	3	3	2	3	2	-	2	-	1	3

C. Somanath

CHAIRMAN
BoS (CSE)

24EC201OE **BASICS OF VIRTUAL INSTRUMENTATION** **L T P C**

3 0 0 3

OBJECTIVES:

The Students Should be made to

- Introduce the concept and evolution of virtual instrumentation and its advantages over conventional systems.
- Familiarize students with the architecture, programming techniques, and data-flow concepts used in graphical programming environments.
- Enable students to understand various interfacing standards and data acquisition techniques for instrumentation systems.
- Develop skills to design and implement virtual instruments for real-time and embedded applications.
- Expose students to the available toolsets for signal processing, image processing, motion control, and control design.

UNIT I INTRODUCTION **9**

Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II PROGRAMMING TECHNIQUES **9**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, mathscript.

UNIT III INTERFACE REQUIREMENTS **9**

Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI, VISA and IVI, Data Acquisition Hardware.

UNIT IV APPLICATION OF VIRTUAL INSTRUMENTATION **9**

Application of Virtual Instrumentation: Instrument Control using RS-232C and IEEE488, Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming, Publishing measurement data in the web.

UNIT V TOOLSETS **9**

Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control.

TOTAL:45 PERIODS

CHAIRMAN

BoS (ECE) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to

- Explain the architecture and fundamental concepts of virtual instrumentation systems..
- Develop and debug virtual instruments using graphical programming techniques.
- Interface virtual instruments with hardware using standard communication and bus interfaces.
- Design real-time and embedded virtual instruments for industrial and research applications.
- Utilize advanced toolsets for control design, DSP, image processing, and motion control applications.

TEXT BOOK:

1. Gary Johnson. "LabVIEW Graphical Programming" 2nd edition, McGraw Hill, New York, 1997.
2. Lisa K. wells & Jeffrey Travis, "LabVIEW for everyone", Prentice Hall, New Jersey, 1997.

REFERENCES:

1. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.
2. Rick Bitter, "LabVIEW Advanced Programming Technique", 2nd Edition, CRC Press, 2005
3. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1st Edition, PHI, 2001.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	-	-	-	-	-	1	2
CO2	2	3	3	2	2	-	-	-	-	2	3
CO3	2	2	3	2	3	-	-	-	-	2	3
CO4	2	3	3	2	3	-	1	-	-	2	3
CO5	2	2	3	2	3	-	1	-	-	2	3

CHAIRMAN
BoS (ECE)

24EC202OE **TELECOMMUNICATIONS FOR SOCIETY** **L T P C**

3 0 0 3

OBJECTIVES:

The Students Should be made to

- Introduce the basic structure and functioning of telecommunication systems and networks.
- Provide an understanding of various types of connectivity, numbering, routing, and switching used in telecommunications.
- Explain the concept of Quality of Service (QoS) for voice, data, and image transmission and the factors affecting it.
- Describe the transmission aspects of voice telephony and video communication systems.
- Familiarize students with television and CATV systems, their evolution, transmission standards, and digital implementation.

UNIT I INTRODUCTORY TO TELECOMMUNICATIONS **9**

End-Users, Nodes, and Connectivities, Telephone Numbering and Routing, Use of Tandem Switches in a Local Area Connectivity, Introduction to the Busy Hour and Grade of Service, Simplex, Half-Duplex, and Full Duplex, One-Way and Two-Way Circuits, Network Topologies, Variations in Traffic Flow, Quality Of Service, Standardization in Telecommunications, The Organization of the PSTN in the United States, Points of Presence.

UNIT II QUALITY OF SERVICE **9**

Objective, Quality of Service: Voice, Data, and Image, Signal-to-Noise Ratio, Voice Transmission, Data Circuits, Video (Television), The Three Basic Impairments and How They Affect the End-User, Amplitude Distortion, Phase Distortion, Noise Level, Typical Levels, Echo and Singing.

UNIT III TRANSMISSION ASPECTS OF VOICE TELEPHONY **9**

Definition of the Voice Channel, Operation of the Telephone Subset, Subscriber Loop Design, Design of Local Area Wire-Pair Trunks (Junctions), VF Repeaters (Amplifiers).

UNIT IV TELEVISION TRANSMISSION **9**

Background and Objectives, An Appreciation of Video Transmission, Critical Video Parameters, Video Transmission Standards (Criteria for Broadcasters), Methods of Program Channel Transmission, The Transmission of Video Over LOS Microwave, TV Transmission by Satellite Relay, Digital Television, Conference Television, Brief Overview of Frame Transport for Video Conferencing.

UNIT V COMMUNITY ANTENNA TELEVISION **9**

Objective and Scope, The Evolution of CATV, System Impairments and Performance Measures, Hybrid Fiber-Coax (HFC) Systems, Digital Transmission of CATV Signals, Two-Way CATV Systems, Two-Way Voice and Data over CATV Systems Based on the DOCSIS 2.0 Specification, Subsplit / Extended Subsplit Frequency Plan, Other General Information.

TOTAL:45 PERIODS

CHAIRMAN
BoS (ECE) 28/10/25

OUTCOMES:

On successful completion of this course, the students will be able to

- Explain the fundamental components and connectivity structures in telecommunication networks.
- Analyze the impact of Quality-of-Service parameters on voice, data, and image transmission.
- Illustrate the transmission aspects of voice telephony including subscriber loops, trunks, and repeaters.
- Describe the principles and standards used in television and video transmission systems.
- Evaluate the design and performance of CATV and digital cable transmission systems.

TEXT BOOK:

1. Roger L. Freeman, "Fundamentals of Telecommunications" 2nd Edition, John Wiley & Sons Publications 2005.
2. Annabel Z. Dodd, "The Essential Guide to Telecommunications", 5th Edition, Prentice Hall 2012.

REFERENCES:

1. Jyrki T. J. Penttinen, "The Telecommunications Handbook" John Wiley & Sons Publications 2015.
2. Prof. Dr. Muhammad EL-SABA, "Telecommunications systems and data networks", 3rd Edition 2015.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	-	-	-	-	1	-
CO2	2	3	2	3	3	-	1	-	-	2	1
CO3	3	3	3	2	3	-	-	-	-	2	1
CO4	2	2	3	2	3	-	-	-	-	2	2
CO5	2	3	3	3	3	-	1	-	-	2	2

CHAIRMAN
BoS (ECE)

24EE201OE **ENERGY AUDIT AND MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The Students should be made to:

- Understand the knowledge of energy basics, energy accounting and audit processes
- Learn strategies for energy management in electric motors and cogeneration systems
- Familiarize with lighting systems and their optimization for energy efficiency
- Describe the principles and techniques of metering for effective energy management in various electrical systems
- Apply economic analysis and modeling to justify energy management decisions

UNIT I INTRODUCTION **9**

Basics of Energy – Need for energy management – Energy accounting – Energy monitoring, targeting and reporting – Energy audit process.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION **9**

Energy management for electric motors – Transformer and reactors – Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT III LIGHTING SYSTEMS **9**

Energy management in lighting systems – Task and the working space – Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT **9**

Metering for energy management – Units of measure – Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location versus requirements, metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS **9**

Economic analysis – Economic models – Time value of money – Utility rate structures – Cost of electricity – Loss evaluation and load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL: 45 PERIODS

CHAIRMAN
BoS(EEE) 28/10/25

COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the need for energy management, energy accounting and auditing techniques
- Apply energy management practices to motors, transformers and cogeneration systems
- Analyze lighting systems with respect to energy consumption, power factor and harmonics
- Interpret metering instruments, transformer burdens and metering techniques for energy management
- Develop and justify economic models for energy projects including demand-side management and HVAC systems

TEXT BOOK:

1. Barney L Capehart, Wayne C Turner and William J Kennedy, "Guide to Energy Management", Eighth Edition, River Publishers, 2016.

REFERENCES:

1. Stephen A Roosa, Steve Doty, Wayne Turner, "Energy Management Handbook", Ninth Edition, River Publishers, 2018.
2. Witte L C, "Industrial energy management and utilization", Washington: Hemisphere Publication Corporation. 2023.
3. Dale R Patrick, Stephen W Fardo, Ray E Richardson, Steven R Patrick, "Energy Conservation guide book", Second Edition, CRC Press, 2007.
4. Albert Thumann and William J Younger, "Handbook of Energy Audits", Ninth Edition, Fairmont Press, 2012.
5. Web/Digital resources: https://beeindia.gov.in/content/energy-auditors.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	–	–	–	–	1
CO2	3	3	2	–	–	–	–	–	–	–	1
CO3	3	3	2	–	–	–	–	–	–	–	2
CO4	3	2	2	–	–	–	–	–	–	–	2
CO5	3	3	3	–	–	–	–	–	–	–	2

CHAIRMAN
BoS(EEE)

24EE202OE **ELECTRIC VEHICLES** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

The students should be made to:

- Identify the basic components, historical development and environmental impact of electric and hybrid vehicles
- Summarize the principles of vehicle motion, propulsion requirements and the mechanics of tire-road interaction
- Discuss the characteristics of various electric and hybrid vehicle architectures and transmission systems
- Interpret the configuration and control methods of electric motor drives used in hybrid and electric vehicles
- Explain different energy storage technologies and the process of selecting and sizing propulsion motors

UNIT I INTRODUCTION **9**

Electric and Hybrid Electric Vehicles – Components – History of hybrid and electric vehicles – Social and environmental importance of hybrid and electric vehicles – Impact of modern drive–trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance – Vehicle power source characterization – Transmission characteristics – Mathematical models to describe vehicle performance.

UNIT II VEHICLE MECHANICS **9**

Roadway fundamentals – Vehicle kinetics – Dynamics of vehicle motion – Propulsion power – Velocity and acceleration: Constant F_{TR} level road, Non-constant F_{TR} general acceleration – Tire-road force mechanics – Propulsion system design.

UNIT III VEHICLE ARCHITECTURE **9**

Electric Vehicle Architecture – Hybrid Electric Vehicle Architecture: Hybrids based on Architecture, Hybrids based on transmission assembly – Hybrids based on degree of hybridization – Plug in hybrid electric vehicle. Mountain bike – Motor cycle.

UNIT IV ELECTRIC PROPULSION UNIT **9**

Introduction to electric components used in hybrid and electric vehicles – Configuration and control – DC motor drives, Induction motor drives, Permanent magnet drives and Switched reluctance drives.

UNIT V ENERGY STORAGE AND SIZING **9**

Introduction to energy storage requirements in Hybrid and Electric vehicles, Energy storage and analysis – Battery, Fuel, Super Capacitor, Hybridization of different energy storage devices, Power electronic converter for battery charging. Sizing of propulsion motor.

TOTAL: 45 PERIODS

CHAIRMAN

BoS (EEE) 28/10/25

COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the components, history and environmental significance of electric and hybrid vehicles
- Explain the fundamentals of vehicle motion, propulsion power and tire-road force mechanics
- Examine different electric and hybrid vehicle architectures and their transmission assemblies
- Summarize the configuration of various electric motor drives used in hybrid and electric vehicles
- Analyse various energy storage techniques and the sizing of propulsion motors for hybrid and electric vehicles

TEXT BOOKS:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", Second Edition, CRC Press, 2003.
2. Ali Emadi, "Advanced Electric Drive Vehicles", First Edition, CRC Press, 2017.

REFERENCES:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. James Larminie and John Lowry, "Electric Vehicle Technology Explained", John Wiley and Sons, 2003.
3. Seth Leitman and Bob Brant, "Build Your Own Electric Vehicle", Third Edition, McGraw Hill, 2013.
4. Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe and Kari Tammi, "Heavy-duty Electric Vehicles from Concept to Reality", Elsevier Science, 2021.
5. Rabiul Islam Md, Rakibuzzaman Shah Md and Hasan Ali Mohd, "Emerging Power Converters for Renewable Energy and Electric Vehicles: Modeling, Design and Control", First Edition, CRC Press, 2021.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	–	–	–	–	1
CO2	3	2	2	–	–	–	–	–	–	–	1
CO3	3	3	2	–	–	–	–	–	–	–	2
CO4	3	3	2	–	–	–	–	–	–	–	2
CO5	3	3	3	–	–	–	–	–	–	–	2

CHAIRMAN
BoS (EEE)

28.10.25

24AD201OE **BASICS OF VISUALIZATION TOOLS** **L T P C**

(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH) **3 0 0 3**

OBJECTIVES:

The student should be made to:

- Gain a comprehensive understanding of the core concepts in data visualization
- Learn the operational principles of different information visualization tools
- Identify and address common issues encountered in data representation
- Master the use of Tableau for effective data visualization
- Develop expertise in creating real-time, interactive visualization systems

UNIT I INTRODUCTION 9

Context of data visualization - Definition, Methodology, Visualization design objectives - Key Factors - Purpose, visualization function and tone, visualization design options - Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tool - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs

UNIT II VISUALIZATION TECHNIQUES FOR TIME-SERIES, TREES & GRAPHS 9

Mapping - Time series - Connections and correlations - Indicator-Area chart - Pivot table - Scatter charts, Scatter maps - Tree maps, Space filling and non-space filling methods - Hierarchies and Recursion - Networks and Graphs - Displaying Arbitrary Graphs-node link graph - Matrix representation for graph s - Info graphics

UNIT III TEXT AND DOCUMENT VISUALIZATION 9

Acquiring data - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder ,Asynchronous Image Downloads, Web Techniques, Parsing data - Levels of Effort, Tools for Gathering Clues, Text Markup Languages, Regular Expressions, Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV INTERACTIVE DATA VISUALIZATION 9

Drawing with data - Scales - Axes - Updates, Transition and Motion - Interactivity - Layouts - Geo-mapping - Exporting, Framework - D3.js, Tableau Dashboards.

UNIT V SECURITY IN DATA VISUALIZATION 9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization - Attacking and defending visualization systems - Creating secured visualization system.

TOTAL: 45 PERIODS

OUTCOMES:

CHAIRMAN
BoS (AD)

On successful completion of this course, the students will be able to,

- Apply mathematics and basic science knowledge for designing information visualizing System
- Collect data ethically and solve engineering problem in visualizing the information.
- Implement algorithms and techniques for interactive information visualization
- Conduct experiments by applying various modern visualization tool and solve the space layout problem
- Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams

TEXT BOOKS:

1. Robert Spence, "Information Visualization an Introduction", Third Edition, Pearson Education, 2014.
2. Colin Ware, "Information Visualization Perception for Design", Third edition, Margon Kaufmann Publishers, 2012.
3. Robert Spence, "Information Visualization Design for Interaction", Second Edition, Pearson Education, 2006.
4. Benjamin B. Bederson and Ben Shneiderman, "The Craft of Information Visualization", Morgan Kaufmann Publishers, 2003.

REFERENCES:

1. Thomas Strothotte, "Computational Visualization: Graphics, Abstraction and Interactivity" , Springer, 1998.
2. Matthew O. Ward, George Grinstein, Daniel Keim, "Interactive Data Visualization: Foundation, Techniques and Applications" , Second Edition, A. K. Peters/CRC Press, 2015.
3. Joerg Osarek, "Virtual Reality Analytics" , Gordon' s Arcade, 2016.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	3	1	-	1	2	2	2
CO2	2	3	3	2	3	3	-	2	2	3	2
CO3	3	3	3	3	3	2	-	1	2	2	2
CO4	3	3	3	3	3	2	-	2	2	1	3
CO5	3	3	2	2	3	2	-	3	3	2	3

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28.10.24

24AD202OE **FOUNDATIONS OF MACHINE LEARNING** **L T P C**

(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand mathematical foundations relevant to machine learning (linear algebra, statistics, VC dimension, PAC learning)
- Grasp different supervised learning algorithms, their assumptions, strengths, and weaknesses
- Learn how ensemble methods and unsupervised learning work and when they are useful
- Understand neural networks in depth: from basic architecture to deep learning practices, and the challenges involved
- Design, perform, and analyse machine learning experiments properly, including model evaluation and statistical comparison

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning - Introduction and motivation for machine learning - Examples of machine learning applications - Vapnik-Chervonenkis (VC) dimension - Probably Approximately Correct (PAC) learning - Hypothesis spaces - Inductive bias - Generalization - Bias-variance trade-off.

UNIT II SUPERVISED LEARNING 9

Linear Regression Models - Least squares, single & multiple variables - Bayesian linear regression - gradient descent. Linear Classification Models: Discriminant function - Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model - Naive Bayes - Maximum margin classifier - Support vector machine - Decision Tree - Random Forests.

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners - model combination schemes, voting - Ensemble Learning - bagging, boosting, stacking - Unsupervised learning: K-means; Instance Based Learning: KNN - Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS 9

Multilayer perceptron - activation functions - network training - gradient descent optimization - stochastic gradient descent - error backpropagation from shallow networks to deep networks - Unit saturation (aka the vanishing gradient problem) - ReLU - hyperparameter tuning - batch normalization - regularization; dropout.

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UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments; Cross Validation (CV) and resampling - K-fold CV, bootstrapping - measuring classifier performance - assessing a single classification algorithm and comparing two classification algorithms - *t* test, McNemar's test, K-fold CV paired *t* test.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concepts of hypothesis spaces, inductive bias, generalization, and bias-variance trade-off in machine learning.
- Implement linear regression, logistic regression, SVM, decision trees, and random forests, and evaluate their performance.
- Apply unsupervised learning techniques like K-means and Gaussian mixture models and use ensemble methods (bagging, boosting, stacking).
- Design neural network models, tune hyperparameters, apply regularization methods, and handle training issues like vanishing gradients.
- Plan and conduct experiments using cross-validation, bootstrapping; compare classifier performance using statistical tests like *t* test and McNemar's test.

TEXT BOOK:

1. Tom M. Mitchell, "Machine Learning", First Edition, McGraw-Hill Education, Latest Reprint 2023.

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning", Fourth Edition, MIT Press, 2020.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", 2nd Edition, MIT Press, 2023.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Third Edition, O'Reilly Media, 2023.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2023 (Corrected reprint).
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, Latest Reprint 2024.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	2	1	2	1	2	2
CO2	2	3	3	3	2	2	1	2	1	2	2
CO3	2	3	3	3	2	2	2	2	2	2	2
CO4	2	2	3	3	2	1	2	2	2	2	1
CO5	1	2	2	2	3	1	2	2	2	2	1

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24AG201OE **INTRODUCTION TO ORGANIC FARMING**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Explain the basic concepts, principles and components of organic farming
- Demonstrate the use of organic nutrient sources
- Implement organic pest and disease management using botanical pesticides
- Compare crop management practices in organic and conventional farming
- Evaluate quality standards, certification and marketing of organic products

UNIT I INTRODUCTION TO ORGANIC FARMING 9

Organic farming: Introduction – Concepts and principles of organic farming – Components of organic farming – Types of farming – Cropping systems and its types.

UNIT II SOURCES OF NUTRIENTS IN ORGANIC FARMING 9

Input management; Organic manure – FYM / Rural compost and city composts – Oil cakes – Animal wastes – Vermicompost – Green manure – Green leaf manure – Other nitrogen contributing plants – Biofertilizers.

UNIT III ORGANIC PEST AND DISEASE MANAGEMENT 9

Different types of pests and their classification – Botanical pesticides and its types – Integrated pest management – Inorganic pesticides, disadvantages of their use – Control of pests and diseases of important crops / vegetables.

UNIT IV ORGANIC CROP MANAGEMENT 9

Introduction to organic crop management – Organic vegetable crop management – Organic field crop management – Organic plantation crop management – Organic meat production.

UNIT V QUALITY OF ORGANIC PRODUCTS 9

Quality of organic food – Natural resources of antioxidants for health care – Antioxidants capacity of fruits and vegetables – Organic food and Human health – Organic standards – Organic certification process – Operation structure of organic certification – Marketing of organic products.

TOTAL: 45 PERIODS

V. Gopi

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BoS (AGE) 28.10.25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the principles of organic farming for sustainable agriculture
- Apply organic nutrients for sustainable crop production
- Implement organic pest and disease management using botanical pesticides and IPM approaches
- Analyze and compare organic crop and livestock management practices
- Evaluate organic food quality and certification for health and sustainability

TEXTBOOKS:

1. Sharma A, "Hand book of Organic Farming", Agrobios, 2016
2. Somasundram E D, Udhaya Nandhini and Meyappan M, "Principles of Organic farming (Theory and Practical)", CRC press, 1st Edition, 2021

REFERENCES:

1. Gupta S K, "Organic vegetable production", Rajat Publications, New Delhi, 2008
2. Singh S K, R B Yadav, Jagdish singh and Bijendra singh, "Organic Farming in Vegetables", ICAR Technical Publication, New Delhi, 2017

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	1	-	-	-	-	1
CO2	2	2	-	-	-	1	-	-	-	-	1
CO3	2	2	-	-	-	1	-	-	-	-	1
CO4	2	2	-	-	-	1	-	-	-	-	1
CO5	2	2	-	-	-	1	-	-	-	-	1

V. Gopal

CHAIRMAN
BoS (AGE)

24AG202OE **INTRODUCTION TO GREEN HOUSE TECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Know the importance, types and uses of greenhouses
- Use land survey and foundation methods in greenhouse design
- Practice installation of greenhouse structures and coverings
- Check and analyze maintenance needs of greenhouse structures
- Evaluate safety measures and emergency procedures in greenhouse operation

UNIT I **GENERAL CONCEPTS OF GREEN HOUSE** **9**

Introduction to green house – Scope and Importance – Types of Green houses – Potential crop for green house.

UNIT II **GREEN HOUSE DESIGN AND LAYOUT** **9**

Land survey and levelling – Assessment of structural strength, foundation specifications.

UNIT III **INSTALLATION OF GREEN HOUSE** **9**

Erection of greenhouse structures – Covering with nets and shades – Types of glazing material and its characteristics – Checking of gutters.

UNIT IV **MAINTENANCE OF GREEN HOUSE** **9**

Maintenance of erected structures – Maintenance of operational elements of the greenhouse for periodic checking, tightening, greasing etc.

UNIT V **HEALTH AND SAFETY** **9**

Understanding about basic safety checks – Operation of all machinery and vehicles and hazards – Render appropriate emergency procedures.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the scope, importance, types of greenhouses and their suitable crops
- Apply foundation principles for greenhouse design and layout
- Demonstrate installation of greenhouse structures, including glazing, nets and shades
- Analyze maintenance needs of greenhouse structures and operations for efficiency
- Evaluate safety measures and emergency procedures in greenhouse management

V. Gopal

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28.10.25

TEXTBOOKS:

1. Prasad S and Kumar U, "Greenhouse Management of Horticultural Crops, Agrobios, 2nd Edition", 2010
2. Bose T K and Som G M, "Vegetable Crops in India", Naya Prokash, Kolkata, 1986

REFERENCES:

1. Roger Marshall, "The Greenhouse Gardener's Manual", Timber press, 2014

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	1	-	-	-	-	1

V. Gopal

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28/10/25

24IT201OE **INTRODUCTION TO WEB DEVELOPMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn the fundamentals of Internet, World Wide Web, protocols, browsers, and web servers.
- Understand design structured, interactive, and user-centric web pages using HTML, CSS, and JavaScript.
- Explore skills to manipulate the DOM and implement client-side scripting for dynamic web content.
- Familiarize with XML, PHP, and integration of PHP with databases using MySQL.
- Acquire knowledge to plan, implement, and publish complete web applications.

UNIT I WEB BASICS AND DESIGN **9**

Introduction: Concept of WWW - Internet Vs. WWW - HTTP Protocol - Request and Response - Web Browsers and Web Servers - Features of Latest Version of Web. Web Design: Concepts of Effective Web Design - Browser Compatibility - Bandwidth - Cache - Display Resolution: Look and Feel of the Website - Page Layout - and Linking - User-centric Design: Sitemap - Planning and Publishing a Website.

UNIT II HTML AND CSS **9**

HTML: Basics of HTML - Text Formatting - Fonts - Commenting Code - Colors - Hyperlinks - Lists - Tables - Images - Forms - XHTML - Meta Tags - Character Entities - Frames and Frame sets - Browser Architecture and Website Structure - Overview of Latest HTML version Features. CSS: Need - Introduction - Syntax and Structure - Backgrounds - Colors - Text Styling - Fonts - Borders - Boxes - Margins -Padding - Lists.

UNIT III JAVASCRIPT AND DHTML **9**

JavaScript: Client-side scripting - Variables - Functions - Conditional Statements - Loops and Repetition - Pop-up boxes and alerts - Advanced JavaScript: Objects - JavaScript's Built-in Objects - DOM - Web Bowser Environments - DOM manipulation - Forms - Validations.

UNIT IV XML AND PHP BASICS **9**

XML: Introduction - Uses - Simple XML - Key Components - DTD and Schema - XML with applications - Transforming XML using XSL and XSLT.

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PHP: Introduction and basic syntax - Decision-making and looping - PHP and HTML integration - Arrays and Functions - Browser control and detection - Strings, - Form Processing - File Handling - Advanced features: Cookies and Sessions.

UNIT V PHP AND MYSQL 9

PHP - MySQL integration: Basic commands - Connection to server - Creating Databases and Tables - Selecting Databases - Listing Databases and Table Names - Insertion - Update - Delete data and Tables - Handling Database Errors - Database Management - Case Study.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Able to explain web fundamentals, protocols, browsers, and server concepts.
- Design structured, interactive, and user-centric web pages using HTML and CSS.
- Implement dynamic client-side functionality using JavaScript and DHTML.
- Develop server-side scripts using PHP and integrate them with XML and MySQL databases.
- Implement and publish functional web applications using PHP-MySQL.

TEXT BOOKs:

1. HTML 5 Black Book - Web Technologies: HTML, XHTML, CSS, XML, JavaScript, AJAX, PHP and MySQL, 2nd Edition, Dreamtech Press, 2016.

REFERENCES:

1. Ivan Bayross, Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl, CGI, PHP, and MySQL, BPB Publications, 2020.
2. Achyut S. Godbole & Atul Kahate, Web Technologies: TCP/IP to Internet Application Architectures, McGraw Hill, 2018.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	-	1	-	-	-	-	-	2
2	2	2	3	-	2	1	-	1	2	-	2
3	2	2	3	-	3	-	-	1	2	-	2
4	3	3	3	2	3	1	-	1	2	1	3
5	3	3	3	2	3	1	1	2	3	2	3

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24IT202OE **PRINCIPLES OF MULTIMEDIA**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Provide an understanding of multimedia systems, applications, and underlying principles.
- Introduce various multimedia data types such as text, audio, image, video, and animation.
- Explain data compression techniques for efficient storage and transmission.
- Familiarize students with multimedia authoring tools, software, and design principles.
- Explore applications of multimedia in communication, education, entertainment, and the web.

UNIT I INTRODUCTION TO MULTIMEDIA 9

Multimedia: Introduction - Definitions - Components - Text - Audio - Video - Graphics and Animation - Multimedia Applications: Education, Entertainment - Training - Kiosks and Presentations - Multimedia System Architecture - Multimedia Hardware: Input/ Output Devices - Storage Devices - Multimedia Software: Authoring Tools - Presentation Tools - Virtual Reality and Multimedia.

UNIT II TEXT, AUDIO AND IMAGE 9

Text: Types of Text - Unicode Standards - Text Compression Techniques - Audio: Acoustics - Digital Representation of Sound - Waveform and MIDI Audio - Audio Compression Techniques - Audio Standards - Image: Digital Image Representation - Color Models - Sampling and Quantization - Image Formats - Image Compression Standards.

UNIT III VIDEO AND ANIMATION 9

Video: Analog and Digital Video - Video Formats - Characteristics of Video Signals – Digitization - Video Compression Standards - Animation: Types of Animation - Principles of Animation - Animation Techniques - Morphing - Motion Capture - Animation Software Tools.

UNIT IV MULTIMEDIA DATA COMPRESSION 9

Need for compression - Lossless Compression Techniques: Run Length Encoding - Huffman Coding - Arithmetic Coding - Dictionary Based Compression - Lossy Compression Techniques: Transform coding - JPEG, MPEG Compression - Comparison of Compression Techniques and their Applications in Multimedia Systems.

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UNIT V MULTIMEDIA TOOLS AND APPLICATIONS 9

Multimedia Authoring Tools: Authoring Metaphors - Card-Based - Timeline-Based - Icon-Based and Object-Oriented Authoring - Multimedia Databases - Multimedia Applications in Education - Business - Entertainment and the Web - Designing Multimedia Applications - Multimedia and the Internet - Future Trends in Multimedia Technology.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the fundamentals, architecture, and applications of multimedia systems.
- Understand representation, storage, and processing of text, audio, and images.
- Explain video and animation concepts with related standards and techniques.
- Apply compression algorithms for efficient multimedia storage and transmission.
- Use authoring tools to design simple multimedia applications for real-world domains.

TEXT BOOKs:

1. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Springer, 2nd Edition, 2021.

REFERENCES:

1. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, Pearson Education, 2019.
2. Tay Vaughan, Multimedia: Making It Work, 9th Edition, McGraw Hill, 2018.
3. Prabhat K. Andleigh and Kiran Thakrar, Multimedia Systems Design, PHI, 2020.
4. Fred T. Hofstetter, Multimedia: Basics, Technology, and Future, Pearson, 2019.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	-	1	1	-	-	-	-	2
2	3	2	2	1	2	-	-	-	-	-	2
3	2	2	3	-	2	1	-	-	-	-	2
4	3	3	2	2	3	-	-	-	-	-	2
5	2	2	3	1	3	1	1	2	2	2	3

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BoS (IT)

Minor Degree

VERTICAL 1

Fintech and Block Chain

28/10/25

24M101 **FINANCIAL MANAGEMENT** **L T P C**

(Common to all Branches) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the knowledge of the decision areas in finance.
- Learn the various sources of Finance.
- Study about capital budgeting and cost of capital.
- Learn on how to construct a robust capital structure and dividend policy.
- Study about the tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANGEMENT 9

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization - Time Value of money - Risk and Return Concepts.

UNIT II SOURCES OF FINANCE 9

Long Term Sources of Finance - Equity Shares - Debentures - Preferred Stock - Features - Merits and Demerits - Short Term Sources - Bank Sources - Trade Credit – Overdrafts - Commercial Papers - Certificate of Deposits - Money Market Mutual Funds.

UNIT III INVESTMENT DECISIONS 9

Investment Decisions: Capital Budgeting - Need and Importance - Techniques of Capital Budgeting - Payback - ARR - NPV - IRR - Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity - Preferred Stock - Debt - Reserves - Concept and Measurement of Cost of Capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION 9

Operating Leverage and Financial Leverage - EBIT - EPS Analysis. Capital Structure - Determinants of Capital Structure - Designing an Optimum Capital Structure. Dividend Policy - Aspects of Dividend Policy - Practical Consideration - Forms of Dividend Policy - Determinants of Dividend Policy.

UNIT V WORKING CAPITAL DECISION 9

Working Capital Management: Working Capital Management - Concepts - Importance - Determinants of Working Capital - Cash Management: Motives for Holding Cash - Objectives and Strategies of Cash Management - Receivables Management: Objectives - Credit Policies.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain about the decision areas in finance.
- Discuss about the various sources of Finance.
- Work on capital budgeting and cost of capital.
- Construct a robust capital structure and dividend policy.
- Handle the tools on Working Capital Management.

TEXT BOOKs:

1. M.Y. Khan and P.K.Jain, Financial management, Text, Tata McGraw Hill, Ltd.
2. M. Pandey, Financial Management, Vikas Publishing House Pvt. Ltd.

REFERENCES:

1. James C. Vanhorne, Fundamentals of Financial Management, PHI Learning.
2. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	2	1	-	-	-	1	-	-	3	3	2
2	2	1	-	-	-	1	2	-	3	3	2
3	2	1	-	-	-	1	-	--	3	3	2
4	2	1	-	-	-	1	2	-	3	3	2
5	2	1	-	-	-	1	-	-	3	3	2

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24M102 **FUNDAMENTALS OF INVESTMENT** **L T P C**

(Common to all Branches) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Study about the investment environment in which investment decisions are taken.
- Acquire knowledge on how to Value bonds and equities.
- Learn the various approaches to value securities.
- Study on how to create efficient portfolios through diversification.
- Learn the mechanism of investor protection in India.

UNIT I THE INVESTMENT ENVIRONMENT 9

Investment Decision Process - Types of Investments - Commodities - Real Estate and Financial Assets - Indian Securities Market - Market Participants and Trading of Securities - Security Market Indices - Sources of Financial Information - Concept of Return and Risk - Impact of Taxes and Inflation on Return.

UNIT II FIXED INCOME SECURITIES 9

Bond Features - Types of Bonds - Estimating Bond Yields - Bond Valuation Types of Bond Risks - Default Risk and Credit Rating.

UNIT III APPROACHES TO EQUITY ANALYSIS 9

Introduction to Fundamental Analysis - Technical Analysis and Efficient Market Hypothesis - Dividend Capitalization Models - Price-Earnings Multiple Approach to Equity Valuation.

UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9

Portfolio and Diversification - Portfolio Risk and Return - Mutual Funds - Introduction to Financial Derivatives - Financial Derivatives Markets in India.

UNIT V INVESTOR PROTECTION 9

Investor Grievances and their Redressal System - Insider Trading - Investors' Awareness and Activism.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the investment environment in which investment decisions are taken.
- Explain how to Value bonds and equities.
- Explain the various approaches to value securities.
- Create efficient portfolios through diversification.
- Discuss the mechanism of investor protection in India.

TEXT BOOKs:

1. Charles P. Jones - Gerald R. Jensen, Investments: analysis and management. Wiley - 14th Edition - 2019.

REFERENCES:

1. Chandra, Prasanna, Investment analysis and portfolio management. McGraw-hill education, 5th Edition, 2017.
2. Rustagi R. P, Investment Management Theory and Practice. Sultan Chand & Sons - 2021.
3. ZviBodie, Alex Kane, Alan J Marcus , PitabusMohanty, Investments - McGraw Hill Education (India), 11th Edition, 2019.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	-	-	2	-	-	-	-	-	1
2	3	3	-	2	2	-	-	-	-	-	-
3	3	3	2	-	2	-	-	-	-	-	-
4	3	-	-	2	2	-	-	-	-	-	1
5	-	-	-	-	-	2	-	3	-	-	1

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24M103 **BANKING, FINANCIAL SERVICES AND INSURANCE** **L T P C**

(Common to all Branches) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Study about the Banking system in India.
- Understand knowledge on how banks raise their sources and how they deploy it.
- Learn the development in banking technology.
- Study about the financial services in India.
- Acquire knowledge about the insurance Industry in India.

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM 9

Overview of Banking System - Structure - Functions - Banking System in India - Key Regulations in Indian Banking Sector - RBI - Relationship between Banker and Customer - Retail and Wholesale Banking - Types of Accounts - Opening and Operation of Accounts.

UNIT II MANAGING BANK FUNDS / PRODUCTS 9

Liquid Assets - Investment in Securities - Advances - Loans - Negotiable Instruments - Cheques - Bills of Exchange - Promissory Notes - Designing Deposit Schemes - Liability Management - NPA's - Current Issues on NPA's - M &A's of Banks into Securities Market.

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY 9

Payment System in India - Paper Based - E-Payment - Electronic Banking - Plastic Money - E-Money - Forecasting of Cash Demand at ATM's - Information Technology Act, 2000 in India - RBI's Financial Sector Technology Vision Document - Security Threats in E-Banking - RBI's Initiative.

UNIT IV FINANCIAL SERVICES 9

Introduction - Need for Financial Services - Financial Services Market in India - NBFC - Leasing and Hire Purchase - Mutual Funds - Venture Capital Financing - Bill Discounting - Factoring - Merchant Banking.

UNIT V INSURANCE 9

Insurance - Concept - Need - History of Insurance Industry in India - Insurance Act, 1938 - IRDA - Regulations - Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy - Revival - Settlement of Claim.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the Banking system in India.
- Discuss how banks raise their sources and how they deploy it.
- Explain the development in banking technology.
- Discuss about the financial services in India.
- Explain the insurance Industry in India.

TEXT BOOKs:

- Padmalatha Suresh and Justin Paul, Management of Banking and Financial Services, Pearson, Delhi, 2017.

REFERENCES:

1. Meera Sharma, Management of Financial Institutions - with emphasis on Bank and Risk Management, PHI Learning Pvt. Ltd., New Delhi, 2010.
2. Peter S. Rose and Sylvia C. and Hudgins, Bank Management and Financial Services, Tata McGraw Hill, New Delhi, 2017.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	1	-	-	2	-	-	-	1	-
2	2	3	-	-	-	-	-	-	-	3	-
3	3	3	2	-	-	-	-	-	-	-	-
4	2	3	2	3	-	-	-	-	-	-	3
5	3	2	-	-	3	2	-	-	-	-	-

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BoS (IT)

28/10/25

24M104 **INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS** **(Common to all Branches)**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Study about the introduction of blockchain technology.
- Acquire knowledge on the usage of Cryptocurrency.
- Learn about the concept of Ethereum technology.
- Study about the Web3 and Hyperledger concepts .
- Acquire knowledge about the emerging trends related to blockchain technology.

UNIT I INTRODUCTION TO BLOCKCHAIN **9**

Blockchain: Growth of Blockchain Technology - Distributed Systems - History of Blockchain and Bitcoin - Features of a Blockchain - Types - Consensus: Consensus Mechanism - Types - Consensus in Blockchain - Decentralization: Decentralization using Blockchain - Methods of Decentralization - Routes to Decentralization - Blockchain and Full Ecosystem Decentralization - Smart Contracts - Decentralized Organizations - Platforms for Decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY **9**

Bitcoin - Digital Keys and Addresses - Transactions - Mining - Bitcoin Networks and Payments - Wallets - Alternative Coins - Theoretical Limitations - Bitcoin Limitations - Name Coin - Prime Coin - Zcash - Smart Contracts - Ricardian Contracts - Deploying Smart Contracts on a Blockchain.

UNIT III ETHEREUM **9**

Introduction - Ethereum Network - Components of the Ethereum Ecosystem - Transactions and Messages - Ether Cryptocurrency / Tokens - Ethereum Virtual Machine - Ethereum Development Environment: Test Networks - Setting up a Private Net - Starting up the Private Network.

UNIT IV WEB3 AND HYPERLEDGER **9**

Introduction to Web3 - Contract Deployment - POST Requests - Development Frameworks - Hyperledger as a Protocol - Reference Architecture - Hyperledger Fabric - Distributed Ledger - Corda.

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UNIT V EMERGING TRENDS **9**

Kadena - Ripple - Rootstock - Quorum - Tendermint - Scalability - Privacy - Other Challenges - Blockchain Research - Notable Projects - Miscellaneous Tools.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain about the introduction of blockchain technology.
- Discuss about the usage of Cryptocurrency.
- Elaborate about the concept of Ethereum technology.
- Discuss about the Web3 and Hyperledger concepts.
- Discuss about the emerging trends related to blockchain technology.

TEXT BOOKs:

1. Imran. Bashi, Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained, Packet Publishing, 2nd Edition, 2018.

REFERENCES:

1. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018
2. ArshdeepBahga, Vijay Madisetti, Blockchain Applications: A Hands On Approach, VPT, 2017.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	1	2	1	1	1	1	–	2
2	3	3	2	2	2	2	1	1	2	1	2
3	3	3	3	3	3	1	1	2	2	2	3
4	2	2	3	3	3	2	2	2	3	3	3
5	2	3	3	3	3	3	2	3	3	3	3

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24M105	FINTECH PERSONAL FINANCE AND PAYMENTS (Common to all Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Student should be made to:

- Study about the currency exchange and payment
- Acquire knowledge on the concept of digital finance and alternative finance.
- Learn about the concept of insurtech.
- Study about the process of peer to peer lending
- Acquire knowledge about the various regulatory issues related to finance.

UNIT I CURRENCY EXCHANGE AND PAYMENT **9**

Understand the Concept of Crypto Currency - Bitcoin and Applications - Cryptocurrencies and Digital Crypto Wallets - Types of Cryptocurrencies - Applications - Block Chain - Artificial Intelligence - Machine Learning - Fintech Users - Individual Payments - RTGS Systems - Immediate Page 54 of 90 Payment Service (IMPS) - Unified Payments Interface - Legal and Regulatory Implications of Cryptocrrencies - Payment Systems and their Regulations - Digital Payments Smart Cards - Stored-Value Cards - EC Micropayments - Payment Gateways - Mobile Payments - Digital and Virtual Currencies - Security - Ethical - Legal - Privacy - Technology Issues.

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE **9**

History of Financial Innovation - Digitization of Financial Services - Crowd funding - Charity and Equity - Introduction to the Concept of Initial Coin Offering.

UNIT III INSURETECH **9**

InsurTech Introduction - Business Model Disruption AI/ML in InsurTech - IoT and InsurTech - Risk Modeling - Fraud Detection Processing Claims - Underwriting Innovations in Insurance Services.

UNIT IV PEER TO PEER LENDING **9**

P2P - Marketplace Lending - New Models - New Products in Market Place Lending P2P Infrastructure - Technologies - Concept of Crowdfunding - Architecture and Technology - Crowdfunding Unicorns and Business Models - SME/MSME Lending: Unique Opportunities and Challenges - Solutions and Innovations.

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UNIT V REGULATORY ISSUES **9**

FinTech Regulations: Global Regulations - Domestic Regulations - Evolution of RegTech - RegTech Ecosystem: Financial Institutions - RegTech Ecosystem: Startups RegTech - Startups: Challenges - RegTech Ecosystem: Regulators - Use of AI in Regulation - Fraud Detection.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain about the currency exchange and payment.
- Discuss on the concept of digital finance and alternative finance.
- Elaborate about the concept of insurtech.
- Discuss about the process of peer to peer lending.
- Explain about the various regulatory issues related to finance.

TEXT BOOKs:

- Swanson Seth, Fintech for Beginners: Understanding and utilizing the power of technology, Createspace Independent Publishing Platform, 2016.

REFERENCES:

- Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019.
- Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016.
- Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016.
- IIBF, Digital Banking, Taxmann Publication, 2016.
- Jacob William, Financial Technology, Create space Independent Pub, 2016.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	2	2	3	2	1	2	1	2	1
2	3	3	3	2	2	2	2	2	1	2	1
3	3	3	3	3	3	2	2	2	2	2	1
4	3	3	3	3	3	3	2	2	2	2	1
5	3	3	2	3	2	3	3	3	2	2	2

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BoS (IT)

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24M106 **INTRODUCTION TO FINTECH** **(Common to all Branches)**

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn about history, importance and evolution of Fintech.
- Acquire the knowledge of Fintech in payment industry.
- Acquire the knowledge of Fintech in insurance industry.
- Learn the Fintech developments around the world.
- Study about the future of Fintech.

UNIT I INTRODUCTION TO FINTECH **9**

Fintech - Definition - History - Concept - Meaning - Architecture - Significance - Goals - Key Areas in Fintech - Importance of Fintech - Role of Fintech in Economic Development - Opportunities and Challenges in Fintech - Evolution of Fintech in Different Sectors of the Industry - Infrastructure - Banking Industry - Startups and Emerging Markets.

UNIT II PAYMENT INDUSTRY **9**

Fintech in Payment Industry - Multichannel Digital Wallets - Applications Supporting Wallets - Onboarding and KYC Application - Fintech in Lending Industry - Formal Lending - Informal Lending - P2P Lending - POS Lending - Online Lending.

UNIT III INSURANCE INDUSTRY **9**

Fintech in Wealth Management Industry - Financial Advice - Automated Investing - Socially Responsible Investing - Fractional Investing - Social Investing - Fintech in Insurance Industry - P2P Insurance - On-Demand Insurance - Consultation - Customer Engagement through Quote to Sell - Policy Servicing - Claims Management - Investment Linked Health Insurance.

UNIT IV FINTECH AROUND THE GLOBE **9**

Fintech Developments - US - Europe - UK - Germany - Sweden - France - China - India - Regulatory and Policy Assessment for Growth of Fintech - Fintech as Disruptors - Financial Institutions Collaborating with Fintech Companies - New Financial World.

UNIT V FUTURE OF FINTECH **9**

How Emerging Technologies Will Change Financial Services - Future of Financial Services - Banking on Innovation through Data - Why Fintech Banks will Rule the World - Fintech Supermarket - Banks Partnering with Fintech Start-Ups - Rise of Banktech - Fintech Impact on Retail Banking - Future without Money - Ethics in Fintech.

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TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain about history, importance and evolution of Fintech.
- Discuss about the process of Fintech in payment industry.
- Discuss about the process of Fintech in insurance industry.
- Handle the process of the various Fintech around the world.
- Discuss about the future of Fintech.

TEXT BOOKs:

- Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015

REFERENCES:

- Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016.
- Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016.
- Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018.
- Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020.

COs – POs Mapping

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	2	2	2	2	1	2	1	2	1
2	3	3	3	3	3	2	2	2	1	2	1
3	3	3	3	3	3	3	2	2	2	2	1
4	3	3	3	3	3	3	3	3	2	3	2
5	3	3	2	3	3	3	3	3	2	3	2

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BoS (IT)

Minor Degree

VERTICAL 2

Entrepreneurship

24M201 **FOUNDATIONS OF ENTREPRENEURSHIP**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the concepts, skills, traits, and factors influencing entrepreneurship.
- Integrate the concepts of business ownership, environmental factors, and functional areas of management for effective business decision-making.
- Study the concepts, principles, and characteristics of technopreneurship along with its societal, economic, and employment impacts.
- Explore technology-driven entrepreneurship, intrapreneurship, and global practices with focus on launching and managing tech-based ventures.
- Know effective business management strategies across diverse entrepreneurial forms and emerging trends at local, national, and global levels.

UNIT I INTRODUCTION TO ENTREPRENEURSHIP **9**

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development

UNIT II BUSINESS OWNERSHIP & ENVIRONMENT **9**

Types of Business Ownership – Business Environmental Factors – Political-Economic-Sociological-Technological-Environmental-Legal aspects – Human Resources. Mobilisation-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration.

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP **9**

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP **9**

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship - Success Stories of Technopreneurs - Case Studies.

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UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP 9

Effective Business Management Strategies for Franchising - Sub-Contracting - Leasing-Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Learn the different types of entrepreneurs and assess the contribution of entrepreneurship to economic development.
- Choose business environments, management principles in HR, finance, marketing, and production systems for efficient administration.
- Solve the emerging trends in technopreneurship and its role in creating innovations, job opportunities, and economic growth.
- Apply entrepreneurial practices in technology ventures, and assess success stories and case studies of technopreneurs.
- Analyze franchising, subcontracting, leasing, and new entrepreneurial models and assess their impact on recent entrepreneurial developments.

TEXT BOOKS:

1. Khanka S S, "Entrepreneurial Development", S.Chand & Co. Ltd., New Delhi, 2021.
2. Donal F Kuratko, "Entrepreneurship Theory, Process, Practice" Cengage Learning, 11th Edition, 2022.

REFERENCES:

1. Daniel Mankani, "Technopreneurship: The successful Entrepreneur in the new Economy", Prentice Hall, 2003.
2. Edward Elgar, "Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe", Wiley Publications, 2014.
3. Dennis Posadas, "JumpStart: A Technopreneurship Fable", Pearson Prentice Hall, 2009.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	2	-
CO2	2	2	1	-	-	1	1	1	1	2	-
CO3	2	2	1	-	-	1	1	1	1	2	-
CO4	2	2	1	-	1	1	1	1	1	2	1
CO5	2	2	1	-	1	2	1	1	1	2	1

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(BoS / MECH)

24M202 **TEAM BUILDING AND LEADERSHIP MANAGEMENT FOR BUSINESS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Describe the concepts of team dynamics, formation, and development.
- Integrate the leadership roles and strategies for building effective, high-performance teams.
- Interpret the attributes, traits, and power dimensions of effective leadership.
- Compare various leadership theories, models, and styles within organisational contexts.
- Know the behavioural aspects of leadership and challenges like conflict, negotiations

UNIT I INTRODUCTION TO MANAGING TEAMS **9**

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams

UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS **9**

Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III INTRODUCTION TO LEADERSHIP **9**

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT IV LEADERSHIP IN ORGANISATIONS **9**

Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of Ethics and Values in Organisational Leadership.

UNIT V LEADERSHIP EFFECTIVENESS **9**

Leadership Behaviour - Assessment of Leadership Behaviours - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Differentiate the various types of teams and teamwork practices.
- Apply mentoring, coaching, and trust-building techniques in team development.
- Solve the interrelationship between leader, follower, and situational factors.
- Apply ethical and value-based approaches to leadership practice.
- Analyze the strategies for effective leadership in global and multicultural environments.

TEXT BOOKS:

1. Hughes R L, Ginnett R C, and Curphy G J, "Leadership: Enhancing the Lessons of Experience", McGraw Hill Education, India, 9th Edition, 2019.
2. Katzenback J R and Smith D K, "The Wisdom of Teams: Creating the High Performance Organizations", Harvard Business Review Press, 2015.

REFERENCES:

1. Haldar U K, "Leadership and Team Building", Oxford University Press, 2010.
2. Daft R L, "The Leadership Experience", Cengage, 2023.
3. Daniel Levi, "Group Dynamics for Teams", Sage Publications, 4th Edition, 2014.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	-	-	-	1	2	2	-
CO2	2	1	-	-	2	2	-	1	2	2	2
CO3	2	1	-	-	-	-	-	1	2	2	-
CO4	2	2	1	1	2	2	-	1	3	2	2
CO5	2	1	1	1	2	2	-	1	3	2	2

CHAIRMAN
(BoS MECH)

24M203	CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the concepts, forms, and qualities of creativity along with the role of environment and personality.
- Know the concepts of traits, training methods, and barriers associated with creative intelligence.
- Study levels, types, and sectoral characteristics of innovation.
- Learn the concepts of innovation and entrepreneurship
- Explore entrepreneurial mindset, motivation, and opportunity analysis.

UNIT I CREATIVITY **9**

Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment-Creative Technology- - Creative Personality and Motivation.

UNIT II CREATIVE INTELLIGENCE **9**

Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training- Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

UNIT III INNOVATION **9**

Innovation: Definition- Levels of Innovation- Incremental vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators- Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity- Design Thinking and Innovation-Innovation as Collective Change-Innovation as a system.

UNIT IV INNOVATION AND ENTREPRENEURSHIP **9**

Innovation and Entrepreneurship: Entrepreneurial Mindset, Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding - Entrepreneurial Opportunities-Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit.

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UNIT V INNOVATIVE BUSINESS MODELS **9**

Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Learn the differentiate between various forms of creativity and factors influencing creative performance.
- Apply creative tools, strategies, and techniques to overcome blocks to creativity.
- Solve theories of innovation and design thinking for practical application.
- Formulate the applications of innovation in building successful ventures
- Design responsible and sustainable business models for entrepreneurship.

TEXT BOOKS:

1. Khanka S S., "Creativity and Innovation in Entrepreneurship", Sultan Chand & Sons, 2021.
2. Pradip N Khandwalla, "Lifelong Creativity, An Unending Quest", Tata Mc Graw Hill, 2004.

REFERENCES:

1. Paul Trott, "Innovation Management and New Product Development", 4th Edition, Pearson, 2018.
2. Vinnie Jauhari and Sudanshu Bhushan, "Innovation Management", Oxford Higher Education, 2014.
3. Krishnamacharyulu C S G and Lalitha R, "Innovation Management"., Himalaya Publishing House, 2017.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	2	2	-	-	-	-	-
CO2	2	2	-	-	2	2	-	-	-	-	-
CO3	2	2	-	-	2	2	-	-	-	-	-
CO4	2	2	1	-	2	2	2	2	2	2	-
CO5	2	2	1	-	2	2		2	2	2	3

CHAIRMAN
(BoS / MECH)

24M204	PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Realise the functions and orientations of marketing along with the traditional and modern marketing mix.
- Recognize the techniques of environmental scanning and the role of marketing research and information systems.
- Know the product life cycle strategies, product mix decisions, and branding practices.
- Investigate integrated marketing communication tools, personal selling process, and distribution channels.
- Learn modern practices like CRM, e-marketing, and services marketing in business contexts.

UNIT I INTRODUCTION TO MARKETING MANAGEMENT **9**

Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.

UNIT II MARKETING ENVIRONMENT **9**

Introduction - Environmental Scanning - Analysing the Organisation's Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

UNIT III PRODUCT AND PRICING MANAGEMENT **9**

Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.

UNIT IV PROMOTION AND DISTRIBUTION MANAGEMENT **9**

Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics Management- Introduction to Retailing and Wholesaling.

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UNIT V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT **9**

Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing - E-Marketing or Online Marketing.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Illustrate the application in developing an effective marketing strategy.
- Compare micro and macro environment factors affecting marketing decisions.
- Formulate suitable pricing strategies for national and global markets.
- Explain the effective promotion and distribution strategies for various market segments..
- Apply strategies for managing customer loyalty, buyer–seller relationships, and online marketing initiatives.

TEXT BOOKS:

1. Sherlekar S A, "Marketing Management", Himalaya Publishing House, 2016.
2. Philip Kotler and Kevin Lane Keller, "Marketing Management", 15th Edition, Pearson, 2015.

REFERENCES:

1. Vijay Prakash Anand, "Marketing Management: An Indian Perspective", Biztantra, 2nd Edition, 2016.
2. Ramaswamy V S and Namakumari S, "Marketing Management: Global Perspective, Indian Context", Macmillan Publishers India, 5th Edition, 2015.
3. Dr. Gupta C B and Dr. Rajan Nair N, "Marketing Management: Text and Cases", 17th Edition, 2016.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	1	-	-	-	3	-	-
CO2	2	1	-	-	2	-	-	2	3	-	-
CO3	2	1	-	-	2	-	-	2	3	3	2
CO4	2	1	-	-	2	-	-	2	3	3	2
CO5	2	1	-	-	2	-	-	2	3	3	2

CHAIRMAN
(BoS / MECH)

24M205	HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Describe the concepts, scope, and evolution of HRM along with the roles and challenges of HR managers.
- Understand the tools, methods, and recent trends in human resource planning and career management.
- Know the different sources, techniques, and processes of recruitment and selection in domestic and global contexts.
- Discover training types, compensation practices, and sustainable HR initiatives like Green HRM.
- Evaluate performance appraisal systems, grievance redressal methods, and employee relations practices.

UNIT I INTRODUCTION TO HRM **9**

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

UNIT II HUMAN RESOURCE PLANNING **9**

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III RECRUITMENT AND SELECTION **9**

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT **9**

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices.

UNIT V CONTROLLING HUMAN RESOURCES **9**

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the Evolution of HRM and Challenges faced by HR Managers
- Apply HRIS and computer-based approaches in HR planning.
- Interpret employee engagement practices in relation to recruitment and selection.
- Apply effective training and development programs to enhance employee performance.
- Formulate HR strategies for conflict resolution, promotion, and union–management relations.

TEXT BOOKS:

1. Gary Dessler and Biju Varkkey, "Human Resource Management", Pearson, 16th Edition, 2020.
2. Mathis and Jackson, "Human Resource Management", Cengage Learning, 15th Edition, 2017.

REFERENCES:

1. David A Decenzo, Stephen P Robbins, and Susan L Verhulst, "Human Resource Management", Wiley, International Student Edition, 2014.
2. Aswathappa K, Sadhna Dash, "Human Resource Management - Text and Cases", McGraw Hill, 10th Edition, 2023.
3. Luis R Gomez-Mejia, David B Balkin, Robert L Cardy, "Managing Human Resource", PHI Learning, 2012

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	2	-	-	2	-
CO2	2	2	-	-	2	-	2	-	-	2	-
CO3	2	2	-	-	2	-	2	2	2	2	3
CO4	2	2	1	1	2	-	2	2	2	2	3
CO5	2	2	1	1	2	-	2	3	2	3	3

CHAIRMAN
(BoS / MECH)

24M206 **FINANCING NEW BUSINESS VENTURES**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the requirements, scope, and institutional support for setting up new ventures.
- Study the concepts, types, and challenges of venture financing
- Discuss the instruments and credit facilities involved in debt financing.
- Summarize the various equity-based funding options such as subsidies, angel investment, and venture capital.
- Explain the investor decision-making process and criteria for fund raising.

UNIT I ESSENTIALS OF NEW BUSINESS VENTURE **9**

Setting up new Business Ventures – Need - Scope - Franchising - Location Strategy, Registration Process - State Directorate of Industries- Financing for New Ventures - Central and State Government Agencies - Types of loans – Financial Institutions - SFC, IDBI, NSIC and SIDCO.

UNIT II INTRODUCTION TO VENTURE FINANCING **9**

Venture Finance – Definition – Historic Background - Funding New Ventures- Need – Scope – Types - Cost of Project - Means of Financing - Estimation of Working Capital - Requirement of funds – Mix of Debt and Equity - Challenges and Opportunities.

UNIT III SOURCES OF DEBT FINANCING **9**

Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments – Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit Facilities - Cash Credit - Over Draft.

UNIT IV SOURCES OF EQUITY FINANCING **9**

Own Capital, Unsecured Loan - Government Subsidies, Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowd funding- Venture Capital.

UNIT V METHODS OF FUND RAISING FOR NEW VENTURES **9**

Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds - Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Classify different types of financing agencies and loan facilities available.
- Calculate project cost, working capital, and mix of debt–equity for financing..
- Select appropriate debt sources to manage capital and working capital needs.
- Construct financing plans using equity-based funding alternatives.
- Develop strategies for approaching and negotiating with potential investors.

TEXT BOOKS:

1. Brealey and Myers., "Principles of Corporate Finance", McGraw Hill Education (India) Private Limited, 12^{th} Edition, 2018.
2. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw Hill Education India Pvt Ltd, New Delhi, 2019.

REFERENCES:

1. Brad Feld and Jason Mendelson., "Venture Deals", John Wiley & Sons, Inc., 3^{rd} Edition, 2016.
2. Josh Lerner, Ann Leamon, and Felda Hardymon, "Venture Capital, Private Equity, and The Financing of Entrepreneurship", 2023.
3. Thomas Byers, "Technology Ventures: From Idea to Enterprise", McGraw Hill Higher Education, 2025.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	-	-	-	1	2	2	2
CO3	2	2	-	-	1	1	2	1	2	2	2
CO4	2	2	-	-	1	1	2	1	2	2	2
CO5	2	2	1	1	1	1	2	1	2	2	2

CHAIRMAN
(BoS / MECH)

Minor Degree

VERTICAL 3

Public Administration

24M301 PRINCIPLES OF PUBLIC ADMINISTRATION (COMMON TO ALL BRANCHES) **L T P C 3 0 0 3**

OBJECTIVES:

The Student should be made to:

Understand the nature of public administration.

- Learn the different functions of administration.
- Learn the different relationships and approaches.
- Understand the Bureaucratic and ecological approaches.
- Know about the leadership approaches, communication types and decision making process

UNIT-I INTRODUCTION TO PUBLIC ADMINISTRATION **9**

1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration as a discipline
4. Public Administration and Governance

UNIT-II ADMINISTRATIVE THEORIES AND APPROACHES **9**

1. Classical Approach – Henry Fayol, Luther Gulick
2. Scientific Management Approach – F.W. Taylor
3. Human Relations Approach – Elton Mayo
4. Bureaucratic Approach – Max Webe

UNIT-III RELATIONSHIP AND CONTEXT **9**

1. Relationship of Public Administration with Political Science, History, Sociology, and Economics
2. Ecological Approach – F.W. Riggs
3. Comparative Public Administration
4. Role of Public Administration in Developing Countries

UNIT-IV NEW TRENDS IN PUBLIC ADMINISTRATION **9**

1. New Public Administration (NPA)
2. New Public Management (NPM)
3. Governance and E-Governance
4. Public and Private Administration – Comparative Study

UNIT-V LEADERSHIP, COMMUNICATION AND DECISION MAKING **9**

1. Leadership – Meaning, Styles and Theories
2. Communication – Types, Process, Barriers, Effective Communication in Administration
3. Decision Making – Concepts, Techniques and Models (Simon's Model, Rational and Participative Approaches)

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the nature. scope. and importance of public administration.
- Illustrate the evolution and various approaches to public administration.
- Analyze relationships of administration with other social sciences.
- Interpret the principles of leadership. communication, and decision making.
- Assess the new trends in public administration and their practical implications.

TEXT BOOKS:

1.Avasthi. A. and Maheshwari. S.R.. "Public Administration." Lakshmi Narain Agarwal. 18th Edition. 2022.

2.Nicholas Henry. "Public Administration and Public Affairs." Routledge. 14th Edition. 2023.

3.M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice." Kitab Mahal. 2021.

REFERENCES:

1. Avasthi and Maheswari: Public Administration in India. Agra:Lakshmi Narain Agarwal.2013.
2. Ramesh K Arora: Indian Public Administration. New Delhi: Wishwa Prakashan. 2012.
3 R.B. Jain: Public Administration in India.21st Century Challenges for Good Governance, NewDelhi: Deep and Deep. 2002.
4. Rumki Basu: Public Administration:Concept and Theories. New Delhi:Sterling. 2013.
5. R. Tyagi. Public Administration, Atma Ram & Sons. New Delhi, 1983.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	2	2	–	–	–	3	2	2	-	2	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	–	–	3	3	3	2	3	3

CHAIRMAN
BOS/ECE

24M302 **ELEMENTS OF PUBLIC ADMINISTRATION** **L T P C**

(COMMON TO ALL BRANCHES) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the nature and role of public administration and the principles of good governance.
- Explore the interdisciplinary nature of public administration and key administrative approaches.
- Learn the foundational principles of organizational structure and administration.
- Understand administrative processes, leadership, and factors affecting organizational performance.
- Introduce personnel administration and the role of civil services in governance.

UNIT I ADMINISTRATION IN MODERN SOCIETY **9**

Administration in Modern Society; Pubic and Private administration; Evolution of the study of Public Administration. Concept of good governance.

UNIT II PUBLIC ADMINISTRATION AS A SOCIAL SCIENCE **9**

Public Administration as a social science; Relationship with other Social Sciences: Political Science, Economics. Sociology, Law and Psychology. Approaches to the study of Public Administration : Classical and Human Relation

UNIT III PRINCIPLES OF ORGANIZATION **9**

Principles of Organisations : Hierarchy, Unity of command, Span of control, Coordination, Centralisation, Decentralisation, Authority and Responsibility; Formal and Informal Organisation.

UNIT IV ADMINISTRATIVE PROCESSES **9**

Chief Executive, Line and Staff, Supervision, Delegation, Leadership, Communication, Decision making , Morale and Motivation .

UNIT V PERSONNEL ADMINISTRATION **9**

Personnel Administration : Meaning and nature of Bureaucracy; Civil Services and their role in a developing society; Classification. Recruitment. Training, Promotion, Disciplinary action, code of conduct..

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Differentiate between public and private administration.
- Analyze the interdisciplinary aspects of public administration.
- Apply principles of organization in administrative systems.
- Evaluate administrative processes including leadership, communication, and decision-making.
- Explain personnel administration, civil services, and ethical responsibilities.

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TEXT BOOKS

1. Avasthi. A. and Maheshwari. S.R.. "Public Administration." Lakshmi Narain Agarwal. 18th Edition. 2022.
2. M.P. Sharma and B.L. Sadana. "Public Administration in Theory and Practice." Kitab Mahal. 2021.
3. Nicholas Henry. "Public Administration and Public Affairs." Routledge. 14th Edition. 2023.

REFERENCES:

1.F.W. Riggs. "Ecology of Public Administration." Asia Publishing House. 2021.
Peter Self. "Administrative Theories and Politics." Routledge. 2nd Edition. 2019.
2. Dwivedi. O.P. and Gow. J.I.. "From Bureaucracy to Public Management." Broadview Press. 2020.
3. L.D. White. "Introduction to the Study of Public Administration." Macmillan. Reprint Edition. 2020.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	2	2	–	–	–	3	2	2	-	2	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	–	–	3	3	3	2	3	3

CHAIRMAN
BOS/ECE

24M303	PUBLIC PERSONNEL ADMINISTRATION (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the concept, scope, and significance of personnel administration in public administration.
- Learn the structure and functioning of civil services and bureaucracy.
- Study recruitment, training, promotion, and disciplinary mechanisms in public service.
- Understand the role of ethics, code of conduct, and accountability in personnel administration.
- Examine contemporary issues, challenges, and reforms in personnel management in government.

UNIT-I INTRODUCTION TO PUBLIC PERSONNEL ADMINISTRATION **9**

1. Meaning, Nature, and Scope of Personnel Administration
2. Importance and Functions of Personnel Administration
3. Relationship between Personnel Administration and Public Administration
4. Principles of Effective Personnel Management

UNIT-II BUREAUCRACY AND CIVIL SERVICES **9**

1. Bureaucracy: Meaning, Nature, and Features
2. Role of Civil Services in Governance and Development
3. Classification of Civil Services: Central and State Services
4. Functions and Responsibilities of Civil Servants

UNIT-III RECRUITMENT AND TRAINING **9**

1. Recruitment: Methods and Procedures in Public Services
2. Selection Process and Entry-Level Requirements
3. raining and Development Programs for Civil Servants
4. Performance Appraisal and Career Development

UNIT-IV PROMOTION, DISCIPLINE AND ACCOUNTABILITY **9**

1. Promotion Policies and Procedures in Public Services
2. Disciplinary Action: Principles and Procedures
3. Code of Conduct for Civil Servants
4. Accountability and Transparency in Public Personnel Administration

UNIT-V CONTEMPORARY ISSUES AND REFORMS **9**

1. Challenges in Public Personnel Administration
2. Recruitment Reforms and Modernization of Civil Services
3. E-Governance and Digitalization in Personnel Management
4. International Best Practices and Comparative Perspectives

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the nature, scope, and functions of public personnel administration
- Describe the role of bureaucracy and civil services in governance
- Analyze recruitment, training, and career development processes
- Evaluate promotion, disciplinary measures, and accountability mechanisms
- Assess contemporary challenges, reforms, and digitalization in personnel administration

TEXT BOOKS

1. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.
2. Avasthi, A. and Maheshwari, S.R., "Public Administration," Lakshmi Narain Agarwal, 18th Edition, 2022.
3. Nicholas Henry, "Public Administration and Public Affairs," Routledge, 14th Edition, 2023.

REFERENCES:

1. F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.
2. Peter Self, "Administrative Theories and Politics," Routledge, 2nd Edition, 2019.
3. Dwivedi, O.P., "Bureaucracy and Civil Services in India," Sterling Publishers, 2020.
4. L.D. White, "Introduction to the Study of Public Administration," Macmillan, Reprint Edition, 2020.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	3	2	-	–	–	2	2	2	-	2	3
CO3	2	3	2	–	–	3	2	3	-	3	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

CHAIRMAN
BOS/ECE

24M304	**ADMINISTRATIVE THEORIES**	**L T P C**
	(COMMON TO ALL BRANCHES)	**3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the historical development and evolution of administrative thought.
- Learn classical, behavioral, and modern approaches to administration.
- Examine the contributions of key theorists in administrative theory.
- Understand organizational principles, processes, and structures.
- Analyze contemporary trends and emerging theories in public administration.

UNIT I INTRODUCTION TO ADMINISTRATIVE THEORIES **9**

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration

UNIT II CLASSICAL APPROACHES **9**

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

UNIT III BEHAVIORAL APPROACHES **9**

Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.

UNIT IV MODERN AND CONTEMPORARY APPROACHES **9**

Systems Theory, Contingency Approach, Total Quality Management (TQM), New Public Administration (NPA) and New Public Management (NPM)

UNIT V ORGANIZATIONAL THEORY AND EMERGING TRENDS **9**

Organizational Culture and Climate, Network Governance and E-Governance, Knowledge Management in Administration, Comparative Public Administration and Global Practices.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the evolution and significance of administrative theories
- Compare classical administrative approaches and their relevance

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- Evaluate behavioral approaches including human relations and decision-making
- Analyze modern administrative theories and management techniques
- Assess organizational theories, emerging trends, and global practices

TEXT BOOKS:

1. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.
2. Avasthi, A. and Maheshwari, S.R., "Public Administration," Lakshmi Narain Agarwal, 18th Edition, 2022.
3. Nicholas Henry, "Public Administration and Public Affairs," Routledge, 14th Edition, 2023.

REFERENCES:

1.F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.
2.Peter Self, "Administrative Theories and Politics," Routledge, 2nd Edition, 2019.
3.Dwivedi, O.P., "Bureaucracy and Civil Services in India," Sterling Publishers, 2020.
4. L.D. White, "Introduction to the Study of Public Administration," Macmillan, Reprint Edition.2020.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	2	2	–	–	2	2	3	-	3	3
CO3	2	3	2	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

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BOS/ECE

24M305 **INDIAN ADMINISTRATIVE SYSTEM** **L T P C**
(COMMON TO ALL BRANCHES) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the structure, functions, and evolution of the Indian Administrative System.
- Learn about the Union and State governments, their institutions, and functioning.
- Understand the roles, powers, and responsibilities of civil servants in India.
- Examine administrative processes, decision-making, and accountability mechanisms in governance.
- Explore reforms, contemporary issues, and challenges in Indian administration.

UNIT I INTRODUCTION TO INDIAN ADMINISTRATIVE SYSTEM **9**

Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II UNION GOVERNMENT AND ADMINISTRATION **9**

Structure and Functions of the Union Government, President, Prime Minister, Council of Ministers: Powers and Responsibilities, Parliament and its Role in Administration, Ministries and Departments: Functions and Coordination

UNIT III STATE GOVERNMENT AND ADMINISTRATION **9**

Structure and Functions of State Governments, Governor, Chief Minister, State Council of Ministers: Powers and Responsibilities, State Legislature and Administrative Machinery, Local Self-Government: Panchayati Raj and Urban Local Bodies

UNIT IV CIVIL SERVICES IN INDIA **9**

Bureaucracy: Meaning, Features, and Role in Governance, Union and State Civil Services: IAS, IPS, and Other Services, Recruitment, Training, Promotion, and Performance Evaluation, Accountability, Ethics, and Conduct of Civil Servants.

UNIT V REFORMS AND CONTEMPORARY ISSUES **9**

Administrative Reforms: Recommendations and Implementation, E-Governance, Digital India, and Transparency Initiatives, Challenges in Indian Administration: Corruption, Red-Tapism, and Policy Implementation, Comparative Administrative Practices and Global Perspectives

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the evolution and constitutional basis of Indian administration
- Describe the structure, roles, and responsibilities of Union Government institutions
- Analyze state government structures and local self-governance mechanisms
- Explain the role, recruitment, and accountability of civil services in India
- Evaluate administrative reforms, e-governance, and contemporary challenges

TEXT BOOKS

1. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.
2. Avasthi, A. and Maheshwari, S.R., "Public Administration," Lakshmi Narain Agarwal, 18^{th} Edition, 2022.
3. Laxmikanth, M., "Public Administration," McGraw-Hill, 2022.

REFERENCES:

1. Subhash Kashyap, "Indian Administration," National Book Trust, 2020.
2. Peter Self, "Administrative Theories and Politics," Routledge, 2nd Edition, 2019.
3. F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.
4. Vig, N., "Indian Civil Services and Governance," Sage Publications, 2021.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	3	2	-	–	–	2	2	2	-	2	2
CO3	2	3	2	-	-	3	2	3	2	3	3
CO4	3	2	2	-	-	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

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BOS/ECE

24M306 **PUBLIC POLICY ADMINISTRATION** **L T P C**
(COMMON TO ALL BRANCHES) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the concepts, nature, and scope of public policy and its role in governance.
- Learn the stages of policy formulation, implementation, and evaluation.
- Examine the role of institutions, bureaucracy, and leadership in policy-making.
- Analyze the tools and techniques for effective policy implementation.
- Evaluate contemporary policy issues, reforms, and challenges in governance

UNIT-I INTRODUCTION TO PUBLIC POLICY **9**

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Publicpolicy relationship with social sciences especially with political science and Public Administration.

UNIT-II POLICY FORMULATION **9**

Actors in Policy-Making: Government, Bureaucracy, Interest Groups, and Media- Stages of Policy Formulation: Agenda Setting, Policy Design, and Decision Making- Tools and Techniques for Policy Formulation- Challenges in Policy Formulation

UNIT-III POLICY IMPLEMENTATION **9**

Bureaucracy and Policy Implementation- Administrative Structures and Coordination- Leadership and Decision-Making in Implementation- Obstacles to Effective Implementation: Red-Tapism, Corruption, and Resource Constraints

UNIT-IV POLICY EVALUATION AND CONTROL **9**

Methods and Techniques of Policy Evaluation- Performance Measurement and Monitoring-Feedback Mechanisms and Policy Adjustments- Role of Legislative, Judicial, and Executive Oversight

UNIT-V CONTEMPORARY ISSUES IN PUBLIC POLICY **9**

Social Policy: Health, Education, and Welfare Programs- Economic Policy: Fiscal, Monetary, and Industrial Policies- Environmental Policy and Sustainable Development- Policy Reforms, E-Governance, and Global Best Practices

TOTAL: 45 PERIODS

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BOS/ECE
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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the nature, scope, and significance of public policy
- Analyze the stages and actors in policy formulation
- Describe policy implementation mechanisms and challenges
- Evaluate policy outcomes using methods and feedback mechanisms
- Assess contemporary policy issues, reforms, and best practices

TEXT BOOKS:

1. Thomas R. Dye, "Understanding Public Policy," Pearson, 15th Edition, 2020.
2. DeLeon, Public Policy: Theory and Practice, Routledge, 2nd Edition, 2019.
3. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.

REFERENCES:

1. James E. Anderson, "Public Policy: An Introduction to the Theory and Practice," Cengage, 9th Edition, 2021.
2. Subhash Kashyap, "Public Policy and Governance in India," National Book Trust, 2020.
3. Peter Hupe and Michael Hill, "Implementing Public Policy," Sage Publications, 2019.
4. F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.

MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	3	2	2	-	-	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

CHAIRMAN
BOS/ECE

Minor Degree

VERTICAL 4

Business Data Analytics

24M401 **STATISTICS FOR MANAGEMENT** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand basic probability and common types of distributions
- Learn how to take samples and estimate values for a population
- Use statistical tests like z-test, t-test, and ANOVA to test idea
- Know about different tests for analytics
- Find and explain relationships between two or more variable

UNIT I INTRODUCTION 9

Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9

Introduction to sampling distributions, Central limit theorem and applications, sampling techniques. Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS 9

Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS 9

Chi-square tests for independence of attributes and goodness of fit, Kolmogorov-Smirnov - test for goodness of fit, Mann - Whitney U test and Kruskal Wallis test.

UNIT V CORRELATION AND REGRESSION 9

Correlation - Rank Correlation - Regression - Estimation of Regression line - Method of Least Squares - Standard Error of estimate.

TOTAL: 45 PERIODS

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BoS (AD) 16/10/25

OUTCOMES:

On successful completion of this course, the students will be able to,

- Facilitate objective solutions in distribution techniques
- Estimate population values from samples
- Test hypotheses using parametric methods
- Develop skill-set that is in demand in both the research and business environments
- Measure correlation and build regression lines

TEXT BOOKS:

1. Richard I Levin, David S Rubin, Masood H Siddiqui, Sanjay Rastogi, "Statistics for Management", Pearson Education, 8th Edition, 2017.
2. Ken Black, "Applied Business Statistics", 7th Edition, Wiley India Edition, 2012.

REFERENCES:

1. Prem S Mann, "Introductory Statistics", Wiley Publications, 9th Edition, 2015.
2. Srivastava T N and Shailaja Rego, "Statistics for Management", Tata McGraw Hill, 3rd Edition 2017.
3. David R Anderson, Dennis J Sweeney, Thomas A Williams, Jeffrey D Camm, James J Cochran, "Statistics for business and economics", 13th Edition, Thomson (South – Western) Asia, Singapore, 2016.
4. Vohra N D, "Business Statistics", Tata McGraw Hill, 2017.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	2	2	2	-	2	2
CO2	2	2	2	-	-	2	1	1	-	2	2
CO3	2	2	1	-	-	2	-	2	-	2	2
CO4	2	2	2	-	-	1	1	1	-	2	2
CO5	2	2	2	-		1	-	2	-	1	2

CHAIRMAN
BoS (AD)

24M402 DATA MINING FOR BUSINESS INTELLIGENCE **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of data mining and warehousing
- Learn different data mining processes and models
- Explore data visualization and time series methods
- Study techniques to group and classify data
- Understand key AI techniques used in data mining

UNIT I INTRODUCTION 9

Data mining, Text mining, Web mining, Data ware house.

UNIT II DATA MINING PROCESS 9

Data mining process - KDD, CRISP-DM, SEMMA Prediction performance measures.

UNIT III PREDICTION TECHNIQUES 9

Data visualization, Time series - ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES 9

Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI 9

Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm Optimization

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify the uses of data mining, text mining, web mining, and data warehouses
- Describe KDD, CRISP-DM, and SEMMA with prediction performance measures
- Apply ARIMA and Winter's method for time-based predictions
- Use classification, association, and clustering methods in data analysis
- Develop and implement machine learning algorithms

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TEXT BOOKS:

1. Ralph Kimball and Richard Merz, "The data warehouse toolkit", John Wiley, 3rd Edition, 2013.
2. Galit Shmueli, Nitin R Patel and Peter C Bruce, "Data Mining for Business Intelligence-Concepts, Techniques and Applications", Wiley, India, 2010.

REFERENCES:

1. Jaiwei Ham and Micheline Kamber, "Data Mining concepts and techniques", Kauffmann Publishers2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, "Business Intelligence", Prentice Hall, 2008.
3. Inmon W H, "Building the Data Warehouse", fourth Edition Wiley India pvt. Ltd. 2005.
4. Michel Berry and Gordon Linoff, "Mastering Data mining", John Wiley and Sons Inc, 2nd Edition, 2011.
5. Michel Berry and Gordon Linoff, "Data mining techniques for Marketing", Sales and Customer support, John Wiley, 2011.
6. Gupta G K, "Introduction to Data mining with Case Studies", Prentice hall of India, 2011
7. Giudici, "Applied Data mining – Statistical Methods for Business and Industry", John Wiley, 2009.
8. Elizabeth Vitt, Michael Luckevich Stacia Misner, "Business Intelligence", Microsoft, 2011.
9. Michalewicz Z, Schmidt M Michalewicz M and Chiriac C, "Adaptive Business Intelligence", Springer Verlag, 2007.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	3	2	-	2	2	2	2
CO2	3	2	2	2	3	1	-	1	1	2	2
CO3	3	2	2	2	3	2	-	2	1	2	2
CO4	3	2	1	2	3	1	-	1	2	2	2
CO5	3	2	1	1	3	1	-	2	2	1	2

CHAIRMAN
BoS (AD)

24M403 **HUMAN RESOURCE ANALYTICS** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the role of people analytics and HR metrics in business impact
- Learn key recruitment metrics and their use in hiring analysis
- Understand how to measure and evaluate training effectiveness
- Study analytics for employee engagement and internal career movement
- Explore metrics for workforce diversity and structure analysis

UNIT I INTRODUCTION TO HR ANALYTICS 9

People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business - HR metrics and KPIs.

UNIT II HR ANLYTICS I: RECRUITMENT 9

Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

UNIT III HR ANALYTICS - TRAINING AND DEVELOPMENT 9

Training & Development Metrics: Percentage of employees trained- Internally and externally trained-Training hours and cost per employee - ROI.

UNIT IV HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION 9

Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover - grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index- Rotation index - Career path index.

UNIT V HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics: Employees per manager - Workforce age profiling - Workforce service profiling - Churn over index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain stages of HR analytics maturity and identify key HR KPIs
- Calculate and interpret metrics like time to hire, cost per hire, and quality of hire
- Apply training metrics such as training hours, cost per employee, and ROI
- Use metrics like retention index, promotion index, and career path index
- Analyze diversity using gender mix, churn rate, and age/service profilin

TEXT BOOKS:

1. Edwards M R., & Edwards K, "Predictive HR Analytics: Mastering the HR Metric", London: Kogan Page, 2016.
2. Dipak Kumar Bhattacharyya, "HR Analytics Understanding Theories and Applications", SAGE Publications India, 2017.

REFERENCES:

1. Jac Fitzenz, "The New HR Analytics", AMACOM, 2010.
2. "Human Resources kit for Dummies", 3rd Edition, Max Messmer, 2003.
3. Sesil J C, "Applying advanced analytics to HR management decisions: Methods for selection, developing incentives, and improving collaboration, Upper Saddle River", New Jersey: Pearson Education, 2014.
4. Pease G. & Beresford B, "Developing Human Capital: Using Analytics to Plan and Optimize Your Learning and Development Investments", Wiley, 2014.
5. Phillips J, & Phillips P P, "Making Human Capital Analytics Work: Measuring the ROI of Human Capital Processes and OUTCOME", McGraw-Hill, 2014.
6. "HR Scorecard and Metrices", HBR, 2001.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	2	-	1	2	2	2	2
CO2	2	2	2	2	1	-	1	1	1	2	2
CO3	2	1	2	1	1	-	1	2	1	2	2
CO4	2	1	1	2	1	-	1	1	2	2	2
CO5	2	1	2	1	1	-	1	2	2	1	2

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24M404 MARKETING AND SOCIAL MEDIA WEB ANALYTICS **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand key marketing performance metrics and data analysis tools
- Learn how social media evolved and how it supports community engagement
- Understand social media ethics, privacy, and tracking methods
- Explore tools and methods for analyzing web data and business KPIs
- Study techniques to analyze and optimize online search and user behavior

UNIT I MARKETING ANALYTICS 9

Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

UNIT II COMMUNITY BUILDING AND MANAGEMENT 9

History and Evolution of Social Media - Understanding Science of Social Media - Goals for using Social Media - Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages - Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS 9

Social Media Policies - Etiquette, Privacy - ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS 9

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V SEARCH ANALYTICS 9

Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Use techniques like market basket analysis and geo-mapping to interpret marketing data
- Identify social media goals, audiences, influencers, and promotional strategies
- Apply social media policies and measure platform performance responsibly
- Collect, interpret, and report web data to support digital strategy decisions
- Apply SEO, traffic analysis, and data visualization to improve online performance

TEXT BOOKS:

1. Takeshi Moriguchi, "Web Analytics Consultant Official Textbook", 7th Edition, 2016.
2. Christian Fuchs, "Social Media a critical introduction", SAGE Publications Ltd, 2014.

REFERENCES:

1. Shrivastava K M, "Social Media in Business and Governance", Sterling Publishers Private Limited, 2013.
2. Bittu Kumar, "Social Networking", V & S Publishers, 2013.
3. Avinash Kaushik, "Web Analytics An Hour a Day", Wiley Publishing, 2007.
4. Ric T Peterson, "Web Analytics Demystified", Celilo Group Media and Café Press 2004.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	3	1	-	2	2	2	2
CO2	3	2	2	2	2	1	-	1	1	1	1
CO3	3	3	2	2	2	1	-	2	1	2	2
CO4	3	2	3	2	2	1	-	1	2	2	2
CO5	3	2	2	1	2	1	-	2	2	1	1

CHAIRMAN
BoS (AD)

24M405 OPERATION AND SUPPLY CHAIN ANALYTICS **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand types of analytics and their role in supply chains
- Learn models and methods for warehouse location and layout
- Study inventory models and risk management in supply chains
- Explore optimization algorithms for transportation and scheduling
- Understand multi-criteria decision-making techniques

UNIT I INTRODUCTION 9

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains - Basics, transforming supply chains.

UNIT II WAREHOUSING DECISIONS 9

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III INVENTORY MANAGEMENT 9

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV TRANSPORTATION NETWORK MODELS 9

Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.

UNIT V MCDM MODELS 9

Analytic Hierarchy Process (AHP), Data Envelopment Analysis (DEA), Fuzzy Logic and Techniques, the analytical network process (ANP), TOPSIS.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain descriptive. predictive. and prescriptive analytics and their application in supply chain transformation
- Apply P-Median. LP. and heuristic approaches for warehouse space and layout decisions
- Implement lot sizing, multi-echelon inventory, and risk pooling strategies
- Solve problems using shortest path, maximal flow, traveling salesman, and scheduling algorithms
- Apply AHP, DEA, Fuzzy Logic, ANP, and TOPSIS in supply chain decisions

TEXT BOOKS:

1. Gerhard J Plenert, "Supply Chain Optimization through Segmentation and Analytics", CRC Press, Taylor & Francis Group, 2014.
2. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, "Analytics in Operations/Supply Chain Management", I.K. International Publishing House Pvt. Ltd., 2016.

REFERENCES:

1. Nada R Sanders, "Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence", Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, "Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain", Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H Masoumi, Ladimer S Nagurney, "Networks Against Time: Supply Chain Analytics for Perishable Products", Springer, 2013.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	-	-	-	2	1	2	2
CO2	2	2	2	2	-	-	-	1	1	2	2
CO3	2	2	1	2	-	-	-	1	1	2	1
CO4	2	2	1	2	-	-	-	1	1	1	1
CO5	2	2	1	1	-	-	-	1	1	1	1

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24M406 **FINANCIAL ANALYTICS** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand financial modeling and capital budgeting techniques
- Learn risk and return estimation using time series models
- Explore portfolio management and option pricing models
- Use charting and indicators to predict stock prices
- Understand credit risk evaluation techniques

UNIT I CORPORATE FINANCE ANALYSIS 9

Basic corporate financial predictive modeling - Project analysis - cash flow analysis - cost of capital, Financial Break even modelling, Capital Budget model - Payback, NPV, IRR.

UNIT II FINANCIAL MARKET ANALYSIS 9

Estimation and prediction of risk and return (bond investment and stock investment) - Time series examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS 9

Portfolio Analysis - capital asset pricing model, Sharpe ratio, Option pricing models - binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS 9

Prediction using charts and fundamentals - RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

UNIT V CREDIT RISK ANALYSIS 9

Credit Risk analysis - Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this course, the students will be able to,

- Perform cash flow analysis and apply payback, NPV, and IRR methods
- Analyze bond and stock investments using ARMA, ARCH, GARCH models and Value at Risk
- Apply CAPM, Sharpe ratio, binomial and Black-Scholes models in portfolio analysis
- Analyze share prices using RSI, MACD, moving averages, and simulate trading strategies
- Build and evaluate credit risk models using decision trees and logistic regression

TEXT BOOKS:

1. Yuxing Yan, "Python for Finance", Paperback - Import, 30 Jun 2017.
2. James Ma Weiming "Mastering Python for Finance Paperback", Import, 29 Apr 2015.

REFERENCES:

1. Mark J Bennett, Dirk L Hugen, "Financial analytics with R", Cambridge University Press.
2. Pavel Ryzhov, "Haskell Financial Data Modeling and Predictive Analytics", Paperback – Import, 25 Oct 2013.
3. Edward E Williams, John A Dobelman "Quantitative Financial Analytics: The Path to Investment Profits Paperback", Import, 11 Sep 2017.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	-	-	-	2	2	1	2
CO2	2	2	2	2	-	-	-	1	1	2	2
CO3	2	2	2	1	-	-	-	2	1	1	1
CO4	2	2	1	1	-	-	-	1	2	1	2
CO5	2	1	2	2	-	-	-	2	2	1	1

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BoS (AD)

Minor Degree

VERTICAL 5

Environment and Sustainability

28.10.25

24M501 SUSTAINABLE INFRASTRUCTURE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge on sustainable development goals and practices.
- Understand the concepts involved in sustainable infrastructure planning.
- Acquire knowledge on design, construction practices and techniques in construction.
- Explore the construction materials required for sustainable construction.
- Assess various measures for sustainable maintenance of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS 9

Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING 9

Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES 9

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics –

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Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings

UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS 9

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS 9

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the environment sustainability goals at global and Indian scenario.
- Recognize risks in development of projects and suggest mitigation measures.
- Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
- Explain Life cycle analysis and life cycle cost of sustainable construction materials.
- Explore the new technologies adopted for maintenance of infrastructure projects.

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REFERENCES:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4thEdition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
5. New Building Materials and Construction World magazine.
6. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
7. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009.
8. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union; 2010.
9. Greger Lundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-
CO4	2	-	2	-	-	2	-	-	-	-	-
CO5	2	-	-	-	-	2	-	-	-	2	-

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28.10.25

24M502 **SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the issues of sustainability in agro ecology, agro ecosystem.
- Study soil health, soil erosion, control measures and suggest the management practices to improve soil nutrition.
- Explore the techniques needed for water management which leads to efficient storage system.
- Identify types and sources of agricultural wastes and suggest the suitable technologies for its sustainable management.
- Evaluate proper techniques adopted for sustainable food production.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS **9**

Ecosystem definition - Biotic *Vs.* abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT **9**

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT **9**

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

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UNIT IV ENERGY AND WASTE MANAGEMENT **9**

Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS **9**

Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explore the knowledge about the concepts, principles and advantages of sustainable agriculture.
- Discuss the sustainable ways in managing soil health, nutrients, pests and diseases.
- Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources.
- Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas.
- Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem.

REFERENCES:

1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer,2020
3. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
4. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. &Fereres, E., Springer, 2016
5. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021
6. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	3	-	-	-	-	-
CO2	2	-	-	-	-	3	-	-	-	1	-
CO3	2	-	-	-	-	3	-	-	-	1	-
CO4	2	-	-	-	-	3	-	-	-	1	-
CO5	2	-	-	-	-	3	-	-	-	-	-

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08 10.24

24M503 **SUSTAINABLE BIO MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart knowledge on biomaterials and their properties.
- Recognize the fundamentals aspects, types of biopolymers and its applications.
- Learn about the properties of bio ceramics and bio composites.
- Discuss biomedical metals, with its types, properties and applications.
- Understand the significance of bionanomaterials and its applications.

UNIT I INTRODUCTION TO BIOMATERIALS 9

Introduction: Definition of biomaterials, requirements & classification of biomaterials- Types of Biomaterials- Degradable and resorbable biomaterials- engineered natural materials-Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types- crystal structure-imperfection in crystalline structure- surface properties and adhesion of materials –strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials

UNIT II BIO POLYMERS 9

Molecular structure of polymers -Molecular weight - Types of polymerization techniques– Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Polymethylmethacrylate (PMMA-Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers – Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications.

UNIT III BIO CERAMICS AND BIOCOMPOSITES 9

General properties- Bio ceramics -Silicate glass - Alumina (Al_2O_3) -Zirconia (ZrO_2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites- Polymer Matrix Composite (PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)– glass ceramics - Orthopedic implants-Tissue engineering scaffolds

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UNIT IV METALS AS BIOMATERIALS 9

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys- Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V NANOBIOMATERIALS 9

Meatllic nanobiomaterials– Nanopolymers –Nanoceramics - Nanocomposites -Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize- nanofibres -Nano and micro features and their importance in implant performance-Nanosurface and coats-Applications nanoantibiotics - Nanomedicines- Biochips – Biomimetics - BioNEMs -Biosensor- Bioimaging/Molecular Imaging - challenges and future perspective.

TOTAL : 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Impart knowledge on surface properties, adhesion and performance of biomaterials.
- Analyze an overview of polymerization techniques, reactions of various biopolymers.
- Enhance the importance and properties of different bio ceramics and bio composite materials.
- Acquire knowledge on metals as biomaterials.
- Apply nano biomaterials in biomedical and other applications.

REFERENCES:

1. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad "Functional Bionanomaterials" springer, 2020.
2. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani "Introduction to Biomaterials Basic Theory with Engineering Applications" Cambridge University Press, 2014.
3. Donglu shi "Introduction to Biomaterials" Tsinghua University press, 2006.
4. Joon Park, R.S.Lakes "Biomaterials An Introduction" third edition, Springer 2007.
5. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh "Characterization of Biomaterials" Wood head publishing, 2013.
6. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science "An Introduction to Material in Medicine" Third Edition, 2013.
7. Leopoido Javier Rios Gonzalez. "Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process" Apple academic press, 2021.
8. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.

Mapping of COs with POs

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CO2	3	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	2	3	-	-	-	-	-
CO4	3	-	-	-	2	3	-	-	-	-	-
CO5	3	-	-	-	2	3	-	-	-	-	-

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10.25

24M504	MATERIALS FOR ENERGY SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the challenges and demands of sustainable energy sources.
- Gain fundamental knowledge about electrochemical devices and materials.
- Classify the various types of fuel cells.
- Illustrate the novel materials and their usage in photovoltaic application.
- Identify the basic principles of various types of supercapacitors and types of nano composites used in SC electrodes.

UNIT I SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO2, LiFePO4, LiMn2O4) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based).

UNIT III FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Fuel utilization – electrolyte membrane (proton conducting and anion conducting)– Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flowfield plate, current conductors, bipolar plates and monopolar plates).

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UNIT IV PHOTOVOLTAICS **9**

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells – thin film silicon solar cells – multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se2 solar cells – Cadium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials - copper-phthalocyanine and perylenetetracarboxylicbis -benzine – fullerenes - boron subphthalocyanine- tin (II) phthalocyanine).

UNIT V SUPERCAPACITORS **9**

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell- parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Acquire knowledge about various sources of energy sustainability.
- Understand the principles of different electrochemical devices.
- Examine the working principle of fuel cells and their applications.
- Summarize the various photovoltaic applications and the materials used.
- Gain knowledge on different types of supercapacitors and the performance of various materials.

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REFERENCES:

1. Electrode Materials for Supercapacitors: A Review of Recent Advances, Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, catalysts 2020.
2. Recent advances, practical challenges, and perspectives of intermediate temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and Venkataraman Thangadurai, J. Mater. Chem. A, 2022.
3. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
4. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.
5. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
6. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
7. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh
8. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, Materials Today: Proceedings, 2022.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	1	3	-	-	-	-	-
CO2	3	-	-	-	1	2	-	-	-	-	-
CO3	3	-	-	-	1	2	-	-	-	-	-
CO4	3	-	-	-	1	2	-	-	-	-	-
CO5	3	-	-	-	1	2	-	-	-	-	-

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28.10.2

24M505 **GREEN TECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Acquire knowledge on green chemistry and its applications.
- Identify the types of pollution and its sources.
- Classify solvents, green reagents and study the design process of chemical and microwave methods.
- Interpret the real time analysis for prevention of pollution and to provide green engineering solutions to reduce carbon foot print.
- Infer knowledge on nano materials and green nano technology.

UNIT I PRINCIPLES OF GREEN CHEMISTRY 9

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES 9

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS 9

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES 9

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention.

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UNIT V GREEN NANOTECHNOLOGY 9

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the principles of green engineering and technology.
- Learn different types of waste, chemical, physical and biochemical methods of waste minimization.
- Modify processes and products to make them green and safe through green synthesis and green reagents.
- Design safe products through green process to prevent pollution using green technology.
- Apply advanced green nanotechnology in green synthesis to reduce environmental impacts.

TEXT BOOKS:

1. Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, 1997
2. Green Chemistry – An introductory text - M. Lancaster, RSC, 2016.
3. Green chemistry metrics - Alexi Lapkin and david Constable (Eds) ,Wiley publications,2008

REFERENCES:

1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	2	3	-	-	-	-	-

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28.10.25

24M506 **ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the concepts of environmental monitoring and standards.
- Study the complexity of the environmental parameters through monitoring programme.
- Analyze the organic pollutants and quality through environmental analysis and monitoring by proper methods.
- Evaluate environmental monitoring programme and risk assessment.
- Identify the automated data acquisition for process monitoring and control.

UNIT I ENVIRONMENTAL MONITORING AND STANDARDS 9

Introduction- Environmental Standards- Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India- Ambient air quality standards- water quality standard- Environmental Monitoring-Need for environmental monitoring- Concepts of environmental monitoring- Techniques of Environmental Monitoring.

UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS 9

Current Environmental Issues- Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.

UNIT III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING 9

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

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UNIT IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT 9

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol - Process of risk assessment- hazard identification-exposure assessment- dose-response assessment - risk characterization.

UNIT V AUTOMATED DATA ACQUISITION AND PROCESSING 9

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers-data acquisition system- types of data acquisition systems- data management and quality control - regulatory overview.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand environmental quality standards in India.
- Analyze current environmental issues, sampling methods and monitoring techniques.
- Identify the various instrumental methods and their principles for environmental monitoring.
- Enrich the significance of environmental standards through environmental monitoring programme.
- Study types and systems of data acquisition systems and processing.

TEXTBOOKS:

1. Environmental monitoring Handbook, Frank R. Burden, 2002 by The McGraw-HillCompanies, Inc.
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / Pradyot Patnaik, 1997 by CRC Press, Inc

REFERENCES:

1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.
2. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
3. Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	2	-	-	-	-
CO2	2	-	-	-	1	2	-	-	-	-	-
CO3	2	-	-	-	1	2	-	-	-	-	-
CO4	2	-	-	-	-	2	-	-	-	-	-
CO5	2	2	-	-	-	2	-	-	-	-	-

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28.10.25

24M507	INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Create awareness on the energy scenario of India with respect to world.
- Understand the fundamentals of energy sources, energy efficiency and environmental standards.
- Familiarization on the concept of sustainable development goal and its benefits.
- Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development.
- Identify the suitable energy policies for sustainable development.

UNIT I ENERGY SCENARIO 9

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT 9

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III REMEDIAL OPTIONS 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG) -Social development: Poverty, conceptual issues and measures, impact of poverty. Globalization and Economic growth - Economic development: Economic inequalities, Incomeand growth.

UNIT IV RENEWABLE ENERGY TECHNOLOGY 9

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits.

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UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

National & State Energy Policy - National solar mission - Framework of Central Electricity Authority- National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Road map for ethanol blending, Energy Efficiency and Energy Mix

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the world and Indian energy scenario.
- Analyse energy projects, its impact on environment and suggest control strategies.
- Recognise the need of sustainable development and its impact on human resource development
- Apply renewable energy technologies for sustainable development.
- Categorize energy policies and planning for sustainable development.

REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at http://www.emea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Robert Ristirer and Jack P. Kraushaar, "Energy and the environment", Willey, 2005.
3. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012
4. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.
5. Dhandapani Alagiri, Energy Security in India Current Scenario, The ICFAI University Press,2006.
6. M.H. Fulekar, Bhawana Pathak,R K Kale, "Environment and Sustainable Development" Springer,2016
7. https://www.niti.gov.in/verticals/energy

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-
CO5	2	-	-	-	-	2	2	-	-	-	-

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28.10.24

24M508	ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the types of energy sources, energy efficiency and environmental implications of energy utilization.
- Create awareness on energy audit and its impacts.
- Categorize the techniques adopted for performance evaluation of energy efficiency in thermal utilities.
- Familiarize on the procedures adopted for energy conservation in electrical utilities.
- Identify the concepts of attaining sustainable development and social development goals.

UNIT I ENERGY AND ENVIRONMENT 9

Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING 9

Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9

Energy conservation avenues in steam generation and utilization, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermo compression.

UNIT IV ENERGY CONSERVTION IN ELECTRICAL UTILITIES 9

Demand side management - Power factor improvement – Energy efficient transformers – Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

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UNIT V SUSTAINABLE DEVELOPMENT **9**

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG).Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Gain knowledge on the prevailing energy scenario.
- Familiarise on energy audits and its relevance.
- Apply the concept of energy efficiency on thermal utilities.
- Identify the energy efficient conservation techniques in various electrical utilities.
- Explore sustainable development and its impact on human resource development.

REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at http://www.emea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4th Edition, Wiley,2022
3. Eastop. T.D& Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, ISBN-0-582-03184, 1990
4. W.R. Murphy and G. McKay "Energy Management" Butterworths, London 1987
5. Pratap Bhattacharyya, "Climate Change and Greenhouse Gas Emission", New IndiaPublishing Agency- Nipa,2020
6. Matthew John Franchetti, Defne Apul "Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies" CRC Press,2012
7. M.H. Fulekar, Bhawana Pathak, R K Kale, "Environment and Sustainable Development" Springer,2016
8. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	2	-	-	-	-	-
CO2	3	-	-	-	-	2	3	-	-	-	-
CO3	3	-	-	-	-	2	-	-	-	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-
CO5	3	-	-	-	-	2	-	-	-	-	-

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