SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES

(AUTONOMOUS)

Dr. Visweswaraiah Road, (Bangalore-Tirupathi Bye-pass Road),
Murukambattu,Chittoor – 517127, Andhra Pradesh, India.

B.Tech
Course Structures and Syllabi
Under R18 Regulations

(Applicable for 2018-2019 Regular Students & 2019-2020 Lateral Students)

Department of Mechanical Engineering

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR,

(AUTONOMOUS – NAAC ACCREDITED)

DEPARTMENT OF MECHANICAL ENGINEERING

(ACCREDITED BY NBA)

Institute Vision

To emerge as a Centre of Excellence for Learning and Research in the domains of engineering, computing and management.

Institute Mission

IM1: Provide congenial academic ambience with state -of -art of resources for learning and research.

IM2: Ignite the students to acquire self-reliance in the latest technologies.

IM3: Unleash and encourage the innate potential and creativity of students.

IM4: Inculcate confidence to face and experience new challenges.

IM5: Foster enterprising spirit among students.

IM6: Work collaboratively with technical Institutes / Universities / Industries of National and International repute

Department Vision

To become a Centre of excellence in Mechanical Engineering studies and research.

Department Mission

DM1:Provide congenial academic ambience with necessary infrastructure and learning resources

DM2:Inculcate confidence to face and experience new challenges from industry and society.

DM3:Ignite the students to acquire self reliance in the latest Technologies

DM4:Foster Enterprising spirit among students

Program Educational Objectives (PEOs)

Graduates of Mechanical Engineering shall

PEO1: Have Professional competency through the application of knowledge gained from subjects like Mathematics, Physics, Chemistry, Inter-Disciplinary and core subjects like Manufacturing Engineering, Thermal Sciences, CAD/CAM and Design & Development. **(Professional Competency)**.

PEO2: Excel in one's career by critical thinking towards successful services and growth of the organization or as an entrepreneur or through higher studies. **(Successful Career Goals).**

PEO3: Enhance knowledge by updating advanced technological concepts for facing the rapidly changing world and contribute to society through innovation and creativity. **(Continuing Education and Contribution to Society).**

Program Specific Outcomes (PSO's)

After the completion of the Program, The student shall able to,

PSO1: Apply the knowledge obtained in core areas for the design, analysis and manufacturing of mechanical systems and processes.

PSO2: Exhibit novel concepts on product development with the help of modern CAD/CAM integration, while ensuring best manufacturing practices.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR, (AUTONOMOUS)

ACADEMIC REGULATIONS FOR B.TECH (REGULAR-FULL TIME)

(Effective for the students admitted into I year from the Academic Year 2018-2019 onwards)

1. ELIGIBILITY FOR ADMISSION

Admission of the B.Tech program shall be made subjects to the eligibility qualifications and Specialization prescribed by the University for each Program from time to time. Admission shall be made either on the basis of Merit/ Rank Obtained by the Qualifying candidates in EAMCET/ECET or otherwise specified whichever is relevant.

2. AWARD OF B.TECH. DEGREE

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

i. Pursues a course of study for not less than four academic years and in not more than eight academic years.

ii. For Lateral entry students, shall pursue a course of study for not less than three academic years and in not more than six academic years.

iii. Registers for 160 credits and secure all 160 credits.

iv. Lateral entry students shall register for 126 credits and secure all 126 credits

3. ACADEMIC REQUIREMENTS

Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years (for Regular Entry) / Six academic years (for Lateral entry) from the year of their admission, shall forfeit their seat in B.Tech. Course and their admission stands cancelled.

4. CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Humanities and Social Science (HS), Basic Sciences (BS), Engineering Science (ES), Professional Core (PC), Core Elective (CE), Open Elective (OE), Project Work (PW), Audit Course (AC), On-line Comprehensive Test (OCT).

SUBJECT COURSE CLASSIFICATION

All subjects/ courses offered for the under graduate programme in B.Tech. degree programmes are broadly classified as follows. The Institution has followed almost all the guidelines issued by AICTE/UGC.

S.No	Broad Course Classification	Course Group Category	Course Description
1	Foundation Courses	BS - Basic Sciences	Includes mathematics, physics and chemistry subjects
		ES - Engineering Sciences	Includes fundamental engineering subjects
		HS - Humanities and Social Sciences	Includes subjects related to humanities, social sciences and management
2	Core Courses	PC – Professional Core	Includes core subjects related to the parent discipline/ department / branch of Engineering.
3	Elective Courses	CE - Core Electives	Includes electives subjects related to the parent discipline department branch of engineering
		OE - Open Electives	Elective subjects which include inter disciplinary subjects or subjects in an area outside the parent discipline department branch of engineering
		MOOC – Electives	Online courses which include inter disciplinary subjects or subjects in an area outside the parent discipline department
4	Employability Enhancement Courses	Project Work	B.Tech major project work
		On-line Comprehensive Test	Comprehensive Exams (with one credit)
		Industrial training	Industrial Internship or Industrial visit or Industrial training (non Credit)
		Reasoning and Aptitude	Courses which includes mathematical analysis to understand and Solve the real life problems. (non Credit)
5	Minor Courses	Communication and Soft Skills Lab	Courses which includes improve the communication skills and personality development (with one credit)
6	Audit Course	1.Constitution of India 2.Environmental sciences 3.Professional Ethics	Mandatory Courses (non Credit)

5. INDUCTION PROGRAM for I. B.Tech

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose 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 time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following (Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Familiarization to Department / Branch & Innovations, Basic Science and Foundation of Mathematics) 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.

6. CONTACT PERIODS

Depending on the complexity and volume of the course, the number of contact hours per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours / week as follows.

- Contact classes (Theory): 1 credit per lecture hour per week.
- Laboratory Hours (Practical): 1 credit for 2 Practical hours, per week.
- Project Work: 1 credit for 2 hours of project work per week

6.1 DEFINITION OF CREDIT

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

7. SUPPLEMENTARY EXAMINATIONS

The student eligible to appear the supplementary external examinations if he was absent for it or failed in it or not registered. However, IV-II semester students there will be an advanced Supplementary Examinations.

8. DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject–wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, project work shall be evaluated for100 marks whereas audit courses shall be evaluated for a maximum of 30 internal marks.

i. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii. For practical subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

Internal Examinations

For theory subjects, during the semester, there shall be two mid-term examinations. Each mid-term examination consists of objective paper for 10 marks and subjective paper for 15 marks with duration of 1hour 50 minutes (20 minutes for objective and 90 minutes for subjective paper). However 5 marks are awarded for 5 assignments (unit-wise). Assignments one & two are collected from the students before I mid-term examinations and assignments three, four and five are collected from the students before II mid-term examinations for every theory subjects.

Objective paper shall be for 10 marks. Subjective paper shall contain 5 questions of which student have to answer 3 questions for 15 marks.

Note 1: The subjective paper shall contain 5 questions of equal Weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 15 marks; any fraction shall be rounded off to the next higher mark.

Note 2: The midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall. Then the descriptive question paper and the answer booklet shall be distributed. After 90minutes the answered booklets are collected back.

If the student is absent for the internal examination, no re-exam or make up shall be conducted and internal marks for that examination shall be considered as zero.

First midterm examination shall be conducted for I & II units of syllabus and second midterm examination shall be conducted for III, IV & V units.

Final Internal marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage to the better mid exam and 20% to the other

For Ex:

Marks obtained in first mid: 20 Marks obtained in Second mid: 20

Internal Marks: (20x0.8) + (20x0.2) = 20

Final internal marks= Internal Marks+ Assignment marks

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 80% Weightage to the marks secured by the student in the appeared examination and zero to the other.

For Ex:

Marks obtained in first mid: Absent Marks obtained in Second mid: 20 Internal Marks: (20x0.8) + (0x0.2) =16

Final internal marks= Internal Marks+ Assignment marks

End Examinations

End examinations (Theory subjects)

(i). End examination of theory subjects shall have the following pattern:

a. There shall be two parts, Part-A and Part-B.

b. Part-A shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.

c. Part-B Shall be either-or type questions of 10 marks each. Student shall answer any one of them.

d. Each of these questions from Part-B shall cover one unit of the syllabus.

(ii). End examination of theory subjects consisting of two parts of different subjects, for ex: Electrical & Mechanical Technology, shall have the following pattern:

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

b. In each part, there shall be 3 either-or type questions for 12, 12 and 11 marks.

Note: The answers for Part A & Part B shall be written in two separate answer books.

End examinations (Practical subjects)

For practical subjects there shall be a 30 sessional marks (15 marks allotted for internal practical examination to be conducted before the last working day and 15 marks for Day-to-day work in the laboratory shall be evaluated by the concerned laboratory teacher based on the regularity / record / viva-voce) and end examination shall be for 70 marks.

The end examination shall be conducted by the concerned laboratory teacher and senior expert in the same subject of the department.

In a practical subject consisting of two parts (ex: Engineering Workshop & IT Workshop), the end examination shall be conducted for 35 marks in each part. Internal examination shall be evaluated as above for 30 marks in each part and final internal marks shall be arrived by considering the average of marks obtained in two parts.

Drawing Courses

For the subject having design and/or drawing, such as Engineering Drawing / Graphics, the distribution shall be 30 marks for internal evaluation and 70 marks for end examination.

All the drawing related courses are evaluated in line with laboratory courses. The distribution shall be 30 marks for internal evaluation (15 marks for day to day evaluation (unit wise chart work) and 15 marks for unit-wise assignments) and 70 marks for semester end examinations.

There shall be two midterm examinations in a semester for duration of 2hrs each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 5 questions of equal weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 15 marks, any fraction shall be rounded off to the next higher mark. There shall be no objective paper in internal examination. The sum of day to day evaluation with assignments and the internal test marks will be the final sessional marks for the subject.

In the end examination pattern for Engineering Drawing / Graphics there shall be 5 questions, either-or type, of 14 marks each. There shall be no objective / short answer type questions in the end examination.

Audit courses

There shall three audit pass courses in Constitution of India, Environmental Science and Professional Ethics with no credits. There shall be no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course only when he / she secures 40% or more in the internal examinations. In case if student fails, re-exam shall be conducted for failed candidates every six months / semester at a mutual convenient date of college / student satisfying the conditions mentioned in item 1 of the regulations.

On-line Comprehensive Test (OCT)

There shall be two On-line comprehensive Tests, one at the end of the II year II semester and the other at the end of III year – II semester, with 100 objective questions for 100 marks on the subjects studied in the respective semesters. The Controller of Examination is given responsibility of preparing question bank / question paper conducting online examination maintains confidentiality. A student shall acquire one credit assigned to the On-line Comprehensive Test only when he / she secure 40% or more marks. In case, if a student fails in On-line Comprehensive Test, he / she shall reappear at the next supplementary examination when offered.

Massive Online Open Course's (MOOC'S)

The college in line with the developments in Learning Management Systems (LMS) intends to encourage the students to do online courses in MOOCs, offered nationally / internationally. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self- learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion of the course from the MOOCs providers. Institution intends to encourage the students to do one MOOC in III year II Semester of the B.Tech. Programme. The respective departments shall give a list of standard MOOCs providers among NPTEL, edx, Udacity, Coursera, or any other standard providers, whose credentials are endorsed by the HoD. Each department shall appoint Coordinators / Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same. A student shall choose an online course (relevant to his / her program of study) from the given list of MOOCS providers, as endorsed by the teacher concerned, with the approval of the HOD. Students may be permitted to register one online course (which is provided with certificate) in 3rd year 1st semester and they should produce the course completion certificate of that course to the controller of Examination to become eligible for fulfillment of the degree.

9. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS, also called as Open Electives (OEs) will be implemented in the college. The CBCS provides choice for students to select from the prescribed courses. In which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning. It is mandatory for Under Graduate (UG) students to study 2 CBCS courses. The students have to choose one open elective (OE -I) in III year II semester, and one (OE-II) in IV year I semester, from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

10. CORE ELECTIVES

Students have to choose core electives (CE-I and CE-II) in IV year I semester and core electives (CE-III and IV) in IV year II semester, from the list of core electives courses given. However, the students may opt for core elective subjects offered in the related area.

11. VALUE ADDED COURSES (VAC)

Every student to undergo one Value Added Course (VAC) per semester from second year first semester (II-I) to fourth year first semester (IV-I). The details of the syllabus, time table and faculty may be sent to the Controller of Examinations after approval from the Head of the Institution concerned at-least one month before the course is offered. Students can take a minimum of 30 lectures / Practices / Training session per course.

12. INDUSTRIAL VISIT

Industrial Visit for every student is required to go for at least one Industrial Visit starting from the second year of the Programme. The Heads of Department shall ensure that necessary arrangements are made in this regard.

13. INDUSTRIAL TRAINING / INDUSTRIAL INTERNSHIP

Industrial Training / Industrial Internship for every student is required to go for at least one Industrial Training / Industrial Internship starting from the third year of the Programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

14. PRESERVATION OF RECORDS

The laboratory records, internal test papers and end examination answer booklets shall be preserved for minimum of 2 years in the institution.

15. ATTENDANCE REQUIREMENTS

A student shall be eligible to appear for University examinations if he / she acquires minimum of 75% of attendance in aggregate of all the subjects in a semester.

Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.

A stipulated fee shall be payable towards Condonation of shortage of attendance to the College.

16. MINIMUM ACADEMIC REQUIREMENTS (Regular Students)

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

A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subjects or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together. In case of audit courses he/she should secure 40% of the total marks.

A student shall be promoted from II to III year only if he / she fulfil the academic requirement of securing 40% of the credits in the subjects that have been studied up to II year II semester from the following examinations, if any fraction shall be rounded off to the next higher credit.

For I/I sem one regular and two supplementary examinations

For I/II sem one regular and one supplementary examinations.

For II/I sem one regular examinations.

For II/II sem one regular examinations.

A student shall be promoted from III year to IV year only if he / she fulfil the academic requirements of securing 40% of the credits in the subjects that have been studied up to III year II semester from the following examinations, if any fraction shall be rounded off to the next higher mark.

For I/I sem one regular and four supplementary examinations.

For I/II sem one regular and three supplementary examinations.

For II/I sem one regular and two supplementary examinations.

For II/II sem one regular and one supplementary examinations.

For III/I sem one regular examinations.

For III/II sem one regular examinations.

And in case if student is already detained for want of credits for particular academic year by sections 16.2 and 16.3 above, the student may make up the credits through supplementary exams of the above exams before the commencement of third or fourth year I semester class work respectively of next year.

17. MINIMUM ACADEMIC REQUIREMENTS (For Later Entry Students)

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

A student shall be deemed to have satisfied them minimum academic requirements and earned the credits allotted to each theory practical, design drawing subjects or projects if he secures not less than 35% of marks in the end examinations and a minimum of 40 % of marks in the sum total of the internal evaluation and examination taken together. In the Seminar he/she should secure 40 %

A Student shall be promoted from III year to IV year only if he / she fulfils the academic requirements of securing 40% credits of the subjects that have been studied up to III year II semester (if any fraction shall be rounded off to the next higher credit) from

For II/I sem one regular and two supplementary examinations.

For II/II sem one regular and one supplementary examinations.

For III/I sem one regular examinations.

For III/II sem one regular examinations.

In case if student is already detained for want of credits for particular academic year by sections 16.2 and 16.3 above, the student may make up the credits through supplementary exams of the above exams before the commencement of third or fourth year I semester class work respectively of next year.

A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained.

18. COURSE PATTERN

The entire course of study is for four academic years. All years shall be on semester pattern. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

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

19. WITH–HOLDING OF RESULTS

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

20. GRADING

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

Table – Conversion into Grades and Grade Points assigned

Range in which the Marks In the Subject Fall	**Grade**	**Grade Points** Assigned
≥ 90	S	10
80-89	A	9
70-79	B	8
60-69	C	7
50-59	D	6
40-49	E	5
< 40	F (Fail)	0
Absent	Abs (Absent)	0

i. A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii. For non credit courses “Pass” shall be indicated instead of the letter ‘P’ and this will not be counted for the computation of SGPA/CGPA.

20.1. SEMESTER GRADE POINT AVERAGE (SGPA) AND CUMULATIVE GRADE POINT AVERAGE (CGPA):

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

$$SGPA = \Sigma (Ci \times Gi) / \Sigma Ci$$

Where, Ci is the number of credits of the ith subject and Gi is the grade point scored by the student in the ith course.

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

$$CGPA = \Sigma (Ci \times Si) / \Sigma Ci$$

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

iv. SGPA will be given to those who cleared all the subjects in that semester

v. GRADE POINT: It is a numerical weight allotted to each letter grade on a 10-point scale.

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

21. AWARD OF CLASS:

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

Class Awarded	**CGPA Secured**
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

22. TRANSITORY REGULATIONS

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, subject to Section 2 and they will be in the academic regulations into which the candidate is presently rejoining.

23. MINIMUM INSTRUCTION DAYS:

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

24. REVALUATION

A candidate can apply for revaluation of his / her end examination answer paper in a theory courses. The examination section shall issue a notification inviting applications for the revaluation after publishing the results. The application forms can be obtained from the examination section. A candidate can apply for revaluation of answer scripts in not more than 5subjects at a time.

No revaluation for comprehensive Examination, practical and project work.

25. CONDUCT AND DISCIPLINE

(i) Students shall conduct themselves within and outside the precincts of the Institute in a manner befitting the students of an Institute of National importance

(ii) As per the order of the Hon'ble Supreme Court of India, ragging in any form is banned: acts of ragging will be considered as gross indiscipline and will be severely dealt with.

(iii) The following additional acts of omission and /or commission by the students within or outside the precincts of the college shall constitute gross violation of code of conduct and are liable to invoke disciplinary measures

(a) Ragging

(b) Lack of courtesy and decorum: indecent behaviour anywhere within or outside the campus.

(c) Wilful damages or stealthy removal of any property /belongings of the Institute / Hostel or of fellow students

(d) Possession, consumption of distribution of alcoholic drinks or any kind of hallucinogenic drugs

(e) Mutilation or unauthorized possession of library books

(f) Hacking in computer systems

(g) Furnishing false statements to the disciplinary committee, or willfully withholding information relevant to an enquiry

(h) Organizing or participation in any activity that has potential for driving fellow students along lines of religion caste batch of admission hostel or any other unhealthy criterion.

(i) Resorting to noisy and unseemly behavior, disturbing studies of fellow students

(j) Physical or mental harassment of fresher through physical contact or oral abuse

(k) Adoption of unfair means in the examination

(l) Organizing or participating in any group activity except purely academic and scientific Programmers in company with others in or outside campus without prior permission of the Principal

(m) Disturbing in drunken state or otherwise an incident in academic or students function or any other public event.

(n) Not obeying traffic rules in campus not following safety practices or causing potential danger to oneself or other persons in any way.

(o) Any other act or gross indiscipline

(iv). Commensurate with the gravity of the offence the punishment may be reprimand fine and expulsion from the hostel debarment from an examination rustication for a specified period or even outright expulsion from the College

(v). The reprimanding Authority for an offence committed by students in the Hostel and in the Department or the classroom shall be respectively, the managers of the Hostels and the Head of the concerned Department

(vi). In all the cases of offence committed by students in jurisdictions outside the purview of clause (19.v) the Principal shall be the Authority to reprimand them.

(vii). All Major acts of indiscipline involving punishment other than mere reprimand shall be considered and decided by the Principal Students Disciplinary Committee appointed by the Principal.

(viii) All other cases of Indiscipline of Students like adoption of unfair means in the examinations shall be reported to the Vice-Principal for taking appropriate action and deciding on the punishment to be levied.

(ix) In all the cases of punishment levied on the students for any offence committed the aggrieved party shall have the right to appeal to the Principal who shall constitute appropriate Committees to review the case.

26. TRANSFER DETAILS

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

27. GENERAL

The academic regulations should be read as a whole for purpose of any interpretation.

Malpractices rules- nature and punishments are appended.

Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

The college may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the college.

NATURE OF MALPRACTICES/ IMPROPER CONDUCT PUNISHMENT	PUNISHMENT
1. (a) possesses or keeps access in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory/ practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) Expulsion from the examination hall and cancellation of the performance in that subject only.	Expulsion from the examination hall and cancellation of the performance in that subject Only.
1. (b) Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons inside or outside the exam hall in respect of any matter. Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him/her.	Expulsion from the examinations hall and cancellation of the performance in that subject only of all the candidates involved in case of an outsider He / She will be handed over to the police and a case is registered against him/her.
2. Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examinations hall and cancellation of the performance in that subject and all other subjects the candidates has already appeared including practical examinations and projects work and shall not be permitted to appear for the reaming examinations of the subjects of that semester/Year The Hall Ticket of the candidate will be cancelled and retained by the CE.

3. Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
4. Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet, during or after the examination.	If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him/her. Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5. Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6. Refuses to obey the orders of the Chief Superintendent/Assistant-Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has

examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall or causes any injury to his person or to any of his relatives whether by offensive words spoken or written or by signs or by visible representation or assaults the officer-in-charge, or any person on duty inside or outside the examination hall or any of his relatives, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	(have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates are also debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7. Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all the external examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8. Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

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

Regulation Amendment

Massive Online Open Course's (MOOC'S)

If, the student is unable to complete the certified MOOC within the stipulated period of time and if the candidate selected the MOOC has discontinued from the standard MOOC provider, the college has to conduct the equivalent examination (on the same MOOC syllabus) internally with the approval from the head of the department on the request of students along with separate examination fee.

Issue of Photocopy of Answer Script

i. A student can request for the photo copy of answer script of any theory examination within one week after the declaring the results by paying fee.

ii. The examination section shall issue a notification inviting applications for the issue of photocopy of answer script after publishing the results.

iii. The application forms can be obtained from the examination section.

Challenge Valuation

i. A student can apply for challenge valuation by prescribed fee.

ii. Challenging valuation shall be carried out by an external subject expert.

iii. The challenging valuation should be done strictly as per the scheme of valuation supplied by the examination section in the presence of Principal.

iv. The examination section shall issue a notification inviting applications for the challenging valuation after publishing the results. The application forms can be obtained from the examination section.

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES.
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CURRICULUM AND SYLLABUS UNDER R18 REGULATION

I. B. Tech. I Sem.

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18SAH111	Communicative English	HS	2	-	-	2	30	70	100
2	18SAH114	Engineering Mathematics - I	BS	2	1	-	3	30	70	100
3	18SAH112	Engineering Physics	BS	2	1	-	3	30	70	100
4	18CSE111	Problem Solving using Python Programming	ES	2	1	-	3	30	70	100
5	18MEC111	Engineering Graphics	ES	1	-	4	3	30	70	100
6	18SAH115	Engineering Physics Lab	BS	-	-	2	1	30	70	100
7	18CSE112	Problem Solving using Python Programming Lab	ES	-	-	2	1	30	70	100
8	18MEC112	Engineering Workshop and IT Workshop	ES	-	-	2	1	30	70	100
Contact Hours per week				9	3	10	-	-	-	-
Total Hours per week				22			-	-	-	-
Total credits (5 Theory + 3 Labs)							17	-	-	-
Total Marks								240	560	800

I. B. Tech. II Sem.

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18SAH121	Technical English	HS	2	-	-	2	30	70	100
2	18SAH122	Engineering Mathematics - II	BS	2	1	-	3	30	70	100
3	18SAH113	Engineering Chemistry	BS	2	1	-	3	30	70	100
4	18CIV121	Engineering Mechanics	ES	2	1	-	3	30	70	100
5	18EEE113	Basic Electrical and Electronics Engineering	ES	2	1	-	3	30	70	100
6	18SAH116	Engineering Chemistry Lab	BS	-	-	2	1	30	70	100
7	18EEE114	Basic Electrical and Electronics Engineering Lab	ES	-	-	2	1	30	70	100
8	18MEC121	Computer Aided Drafting Lab	ES	-	-	2	1	30	70	100
Contact Hours per week				10	4	6	-	-	-	-
Total Hours per week				20			-	-	-	-
Total credits (5 Theory + 3 Labs)							17	-	-	-
Total Marks								240	560	800

II. B. Tech. I Sem.

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18SAH211	Engineering Mathematics -III	BS	2	1	-	3	30	70	100
2	18MEC211	Engineering Thermodynamics	PC	2	1	-	3	30	70	100
3	18MEC212	Mechanics of Solids	ES	2	1	-	3	30	70	100
4	18MEC213	Material Science and Metallurgy	PC	3	-	-	3	30	70	100
5	18MEC214	Fluid Mechanics and Hydraulic Machinery	ES	2	1	-	3	30	70	100
6	18MEC215	Machine Drawing	PC	1	-	4	3	30	70	100
7	18MEC216	Material Science and Testing Lab	PC	-	-	2	1	30	70	100
8	18MEC217	Fluid Mechanics and Hydraulic Machinery Lab	ES	-	-	2	1	30	70	100
9	18AUD211	Constitution of India	AC	2	-	-	-	-	-	-
10	18SAH212	Reasoning and Aptitude-I	HS	2	-	-	-	-	-	-
Contact Hours per week				16	4	8	-	-	-	-
Total Hours per week				28			-	-	-	-
Total credits (6 Theory + 2 Labs)							20	-	-	-
Total Marks								240	560	800

II. B. Tech. II Sem.

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18SAH222	Probability and Statistics	BS	2	1	-	3	30	70	100
2	18MEC221	Thermal Engineering-I	PC	2	1	-	3	30	70	100
3	18MEC222	Theory of Machines - I	PC	2	1	-	3	30	70	100
4	18MEC223	Manufacturing Technology	PC	3	-	-	3	30	70	100
5	18MEC224	Automobile Engineering	PC	2	1	-	3	30	70	100
6	18MBA221	Principles of Management	HS	3	-	-	3	30	70	100
7	18MEC226	Thermal Engineering and Automobile Engineering Lab	PC	-	-	2	1	30	70	100
8	18MEC227	Manufacturing Technology Lab	PC	-	-	2	1	30	70	100
9	18MEC228	Online Comprehensive Test-I	PC	1	-	-	1	-	100	100
10	18AUD212	Environmental Science	AC	2	-	-	-	-	-	-
11	18SAH223	Reasoning and Aptitude-II	HS	2	-	-	-	-	-	-
Contact Hours per week				19	4	4	-	-	-	-
Total Hours per week				27			-	-	-	-
Total credits (6 Theory + 2 Labs+ 1 OCT)							21	-	-	-
Total Marks								240	660	900

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III B.Tech- I Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18MEC311	Thermal Engineering-II	PC	2	1	-	3	30	70	100
2	18MEC312	Theory of Machines - II	PC	2	1	-	3	30	70	100
3	18MEC313	Machine Tools Technology	PC	3	-	-	3	30	70	100
4	18MEC314	Design of Machine Elements	PC	2	1	-	3	30	70	100
5	18MEC315	Engineering Metrology and Measurements	PC	3	-	-	3	30	70	100
6	18MEC316	Operation Research	ES	2	1	-	3	30	70	100
7	18MEC317	Machine Tools Technology Lab	PC	-	-	2	1	30	70	100
8	18MEC318	Engineering Metrology and Measurements Lab	PC	-	-	2	1	30	70	100
9	18SAH311	Communication and Soft Skills Lab	HS	-	-	2	1	30	70	100
10	MOOC	Massive Online Open Course	OE	-	-	-	-	-	-	P
Contact Hours per week				14	4	6	-	-	-	-
Total Hours per week				24			-	-	-	-
Total credits (6 Theory + 3 Labs)							21	-	-	-
Total Marks								270	630	900

III B.Tech- II Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18MEC321	Heat and Mass Transfer	PC	2	1	-	3	30	70	100
2	18MEC322	Finite Element Analysis	PC	2	1	-	3	30	70	100
3	18MEC323	CAD/CAM/CIM	PC	3	-	-	3	30	70	100
4	18MEC324	Design of Transmission System	PC	2	1	-	3	30	70	100
5	18MEC325	Automation and Robotics	ES	3	-	-	3	30	70	100
6	**OE-I**	**Open Elective-I**	OE	3	-	-	3	30	70	100
7	18MEC326	Heat Transfer Lab	PC	-	-	2	1	30	70	100
8	18MEC327	Computer Aided Machine Drawing Lab	PC	-	-	2	1	30	70	100
9	18MEC328	Project Skills Lab	PW	-	-	2	1	30	70	100
10	18MEC329	On-line Comprehensive Test-II	PC	1	-	-	1	-	100	100
Contact periods per week				16	3	6	-	-	-	-
Total periods per week				25			-	-	-	-
Total credits (6 Theory + 3 Labs+1 OCT)							22	-	-	-
Total Marks								270	730	1000

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IV B.Tech- I Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18MEC411	Refrigeration and Air-Conditioning	PC	2	1	-	3	30	70	100
2	18MEC412	Fundamentals of Vibration	PC	2	1	-	3	30	70	100
3	18MEC413	Mechatronics	ES	3	-	-	3	30	70	100
4	18MEC414	**Core Elective-I**	CE	3	-	-	3	30	70	100
5	18MEC415	**Core Elective-II**	CE	3	-	-	3	30	70	100
6	**OE-II**	**Open Elective-II**	OE	3	-	-	3	30	70	100
7	18MEC416	Mechatronics Lab and Theory of Machines Lab	PC	-	-	2	1	30	70	100
8	18MEC417	Computer Aided Analysis Lab and CNC Technology Lab	PC	-	-	2	1	30	70	100
9	18AUD411	Professional Ethics	AC	2	-	-	-	P	-	-
Contact periods per week				18	2	4	-	-	-	-
Total periods per week				24			-	-	-	-
Total credits (6 Theory + 2 Labs)							20	-	-	-
Total Marks								240	560	800

IV B.Tech- II Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	18MEC421	Power Plant Engineering	ES	3	-	-	3	30	70	100
2	18MEC422	Industrial Engineering and Management	PC	3	-	-	3	30	70	100
3	18MEC423	**Core Elective-III**	CE	3	-	-	3	30	70	100
4	18MEC424	**Core Elective- IV**	CE	3	-	-	3	30	70	100
5	18MEC425	Project Work	PW	-	-	20	10	30	70	100
Contact periods per week				12	-	20	-	-	-	-
Total periods per week				32			-	-	-	-
Total credits (4 Theory + 1 Project Work)							22	-	-	-
Total Marks								150	350	500

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR
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CORE ELECTIVES

IV B.Tech- I Semester (Core Elective-I)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1.	18MEC414A	Renewable Energy Sources	CE	3	-	-	3	30	70	100
2.	18MEC414B	Gas Dynamics and Jet Propulsion	CE	3	-	-	3	30	70	100
3.	18MEC414C	Advanced Internal Combustion Engine	CE	3	-	-	3	30	70	100
4.	18MEC414D	Fuel Cell Technology	CE	3	-	-	3	30	70	100
5.	18MEC414E	Computational Fluid Dynamics	CE	3	-	-	3	30	70	100
6.	18MEC414F	Hydraulics and Pneumatics	CE	3	-	-	3	30	70	100

IV B.Tech- I Semester (Core Elective-II)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1.	18MEC415A	Product Design and Development	CE	3	-	-	3	30	70	100
2.	18MEC415B	Design Concepts in Engineering	CE	3	-	-	3	30	70	100
3.	18MEC415C	Industrial Tribology	CE	3	-	-	3	30	70	100
4.	18MEC415D	Design of Pressure Vessels and Piping	CE	3	-	-	3	30	70	100
5.	18MEC415E	Design of Heat Exchangers	CE	3	-	-	3	30	70	100
6.	18MEC415F	Composite Materials and Mechanics	CE	3	-	-	3	30	70	100

IV B.Tech- II Semester (Core Elective-III)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1.	18MEC423A	Advanced Machining Processes	CE	3	-	-	3	30	70	100
2.	18MEC423B	Additive Manufacturing Technology	CE	3	-	-	3	30	70	100
3.	18MEC423C	Sustainable and Green Manufacturing	CE	3	-	-	3	30	70	100
4.	18MEC423D	Casting and Welding Processes	CE	3	-	-	3	30	70	100
5.	18MEC423E	Non-Destructive Testing and Evaluation	CE	3	-	-	3	30	70	100
6.	18MEC423F	Micro Electro Mechanical Systems	CE	3	-	-	3	30	70	100

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IV B.Tech- II Semester (Core Elective-IV)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1.	18MEC424A	Total Quality Management	CE	3	-	-	3	30	70	100
2.	18MEC424B	Production and Operations Management	CE	3	-	-	3	30	70	100
3.	18MEC424C	Process Planning and Cost Estimation	CE	3	-	-	3	30	70	100
4.	18MEC424D	Product Lifecycle Management	CE	3	-	-	3	30	70	100
5.	18MEC424E	Industrial Safety Management	CE	3	-	-	3	30	70	100
6.	18MEC424F	Engineering Economics and Cost Analysis	CE	3	-	-	3	30	70	100

OPEN ELECTIVE-I

III B.Tech. II Sem. (Open Elective-I)

Subject Code	Subject	Offered Department (Except Parent Department)	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
18OSAH321	Mathematical Modeling - Analysis and Applications	S&H	OE	3	-	-	3	30	70	100
18OSAH322	Business Communication and Career Skills		OE	3	-	-	3	30	70	100
18OSAH323	LASER and Fiber Optics		OE	3	-	-	3	30	70	100
18OCSE321	Object Oriented Programming	CSE	OE	3	-	-	3	30	70	100
18OCSE322	Operating Systems		OE	3	-	-	3	30	70	100
18OCSE323	Web Programming		OE	3	-	-	3	30	70	100
18OCIV321	Construction and Project Management	CIV	OE	3	-	-	3	30	70	100
18OCIV322	Remote Sensing and GIS		OE	3	-	-	3	30	70	100
18OCIV323	Green Buildings and Energy Conservation		OE	3	-	-	3	30	70	100
18OEEE321	SCADA System and Applications	EEE	OE	3	-	-	3	30	70	100
18OEEE322	Servicing of Electrical Appliances		OE	3	-	-	3	30	70	100
18OEEE323	Power System Reforms		OE	3	-	-	3	30	70	100
18OECE321	Machine Vision System	ECE	OE	3	-	-	3	30	70	100
18OECE322	Foundation of Nano-Electronics		OE	3	-	-	3	30	70	100
18OECE323	Medical Electronics		OE	3	-	-	3	30	70	100

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OPEN ELECTIVE-I

IV B.Tech. I Sem. (Open Elective-II)

Subject Code	Subject	Offered Department (Except Parent Department)	Subject Category	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
18OSAH411	Graph Theory with Applications	S&H	OE	3	-	-	3	30	70	100
18OSAH412	Banking and Insurance		OE	3	-	-	3	30	70	100
18OSAH413	Managing Innovation and Entrepreneurship		OE	3	-	-	3	30	70	100
18OCSE411	Fundamentals of DBMS	CSE	OE	3	-	-	3	30	70	100
18OCSE412	Basics of Internet of Things		OE	3	-	-	3	30	70	100
18OCSE413	Information Security		OE	3	-	-	3	30	70	100
18OCIV411	Transport and Environment	CIV	OE	3	-	-	3	30	70	100
18OCIV412	Disaster Management		OE	3	-	-	3	30	70	100
18OCIV413	Air Pollution and Control		OE	3	-	-	3	30	70	100
18OEEE411	Wind Energy Conversion Systems	EEE	OE	3	-	-	3	30	70	100
18OEEE412	Fundamentals of Energy Auditing		OE	3	-	-	3	30	70	100
18OEEE413	Introduction to Power Quality		OE	3	-	-	3	30	70	100
18OECE411	Fundamentals of Artificial Intelligence	ECE	OE	3	-	-	3	30	70	100
18OECE412	Fundamentals of Embedded Systems		OE	3	-	-	3	30	70	100
18OECE413	Data Communication and Networks		OE	3	-	-	3	30	70	100

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DEPARTMENT OF MECHANICAL ENGINEERING
SUMMARY OF CREDIT ALLOCATION

S.NO	Subject Area	Credits As Per Semester								Total Credits	Percentage – wise Credit Distribution
		I-I	I-II	II-I	II-II	III-I	III-II	IV-I	IV-II		
1.	HS	2	2	0	3	1	-	-	-	**08**	**05.00%**
2.	BS	7	7	3	3	-	-	-	-	**20**	**12.50%**
3.	ES	8	8	7	-	3	3	3	3	**35**	**21.87%**
4.	PC	-	-	10	15	17	15	8	3	**68**	**42.50%**
5.	CE	-	-	-	-	-	-	6	6	**12**	**07.50%**
6.	OE	-	-	-	-	0	3	3		**06**	**03.75%**
7.	PW	-	-	-	-	-	1	-	10	**11**	**06.87%**
8	AC	-	-	0	0	-	-	0	-	**0**	**0**
Total		**17**	**17**	**20**	**21**	**21**	**22**	**20**	**22**	**160**	**100%**

Note: HS- Humanities and Social Science; BS - Basic Sciences; ES – Engineering Science; PC – Professional Core; CE - Core Elective; OE - Open Elective; PW - Project Work; AC – Audit Course.

I B.Tech I Semester

		L	T	P/D	C
18SAH111	**COMMUNICATIVE ENGLISH (Common to all Branches)**	2	-	-	2

Course Educational Objectives:

CEO1: To Provide Knowledge on Behavioral aspects, developing vocabulary by deriving various ways of forming words.

CEO 2: To cultivate Individual and Team Work skills, Knowledge on the usage of foreign language words in to English Language,

CEO3: To Cultivate Adaptability Skills in work place, Knowledge on Grammatical aspects of Verbs and Adverbs, words by applying stress, how to express one's opinions and dialogue writing.

CEO4: Acquiring of Entrepreneurship Skills, Usage of grammar aspects of Prepositions, Pronunciation of suffix words, and acquisition of writing skills.

CEO5: Contextual knowledge to recognize the need of ability to engage in independent and life-long learning in the broadest context of technological change.

UNIT-I

"ISWARAN" (A Story from R.K. Narayan's Malgudi Days) - Word Formation: Clipping- Acronym- Blending- Back-formation- Derivation - Borrowing – Coinage- Compounding - Nouns-Kinds and Uses - Pronouns-Kinds and uses - Listening to Vowel Sounds - Introducing self and others - Reading Comprehension.

UNIT-II

"WHITE WASHING THE FENSE" (Team work skills by Mark Twain) - A-Z Root words from foreign languages and their use in English – Adjectives - Degrees of Comparison - Listening to Consonant Sounds – Greetings - Reading Strategies - Sentence Structures and formation.

UNIT-III

"SENOR PAYROLL" (Adaptability skills by William E. Barrett) - Verbs-Forms - List of Regular and Irregular verbs-Be verbs-Gerunds - Adverbs-types and formation of adverbs - Listening to Word Stress - Expressing opinions – Paraphrasing -Dialogue Writing.

UNIT-IV

"ACQUISITION OF ENTREPRENEURSHIP SKILLS" (a brief biography of AZIM PREMJI) – Prepositions - Uses - Listening to Inflections - Describing objects/persons/places – Summarizing - Writing a Moral Story.

UNIT-V

"REFLECTIONS OF FUTURE THE YEAR 2050" by Theodore J. Gordon - Conjunctions – Articles - Listening to a passage - Telephone Conversation - Short Story Review - Expansion of Proverbs.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to Cos
CO1	Understand the concepts on behavioral aspects, Development of vocabulary by deriving various ways of forming words, identification of Nouns and Pronouns and their usage, Pronunciation of Phonetic Vowel Sounds, Communicate effectively with others and how to read and understand a passage.	PO1, PO10
CO2	Develop Individual and Team Work skills, Knowledge on the usage of foreign language words, identification of and their usage	PO1, PO9, PO10
CO3	Cultivate Adaptability Skills in work place Knowledge on Grammatical aspects of Verbs and Adverbs. Writing dialogues effectively.	PO1, PO9, PO10
CO4	Understand in Acquiring of Entrepreneurship Skills Usage of grammar aspects on Prepositions Pronunciation of inflectional suffix words by describing objects, persons and places Acquiring writing skills through interpreting moral stories.	PO1, PO9, PO10
CO5	Knowledge to Recognize the need of ability to engage in independent and life-long learning Usage of grammar aspects on Conjunctions and Articles Communicate effectively in English over phone Reviewing a short stories and Expansion of proverbs.	PO1, PO10, PO12

Prescribed Book: The text book prepared by the Department of English of SITAMS.

Other References:

1. Exercises in spoken English: Parts I-III, CIEFL, Hyderabad, Oxford University Press.
2. Communication Skills: Sanjay Kumar and Pushpa Latha, Oxford University Press. 2011.
3. Practical English Usage: Michael Swan, Oxford University Press, 1995.
4. Remedial English Grammar: F.T. Wood. Macmillan, 2007.

I B.Tech I Sem

		L	T	P/D	C
18SAH114	**ENGINEERING MATHEMATICS – I (Common to all Branches)**	2	1	-	3

Course Educational Objectives:

CEO1: To learn the reduction of a given matrix to echelon and normal forms, rank of a matrix, solve system of linear equations by different methods and determining the eigen values and eigen vectors and develop linear transformation with emphasis on the role of eigen-values and eigen-vectors.

CEO2: To understand the Taylor's and Maclaurin's series of function in single variable and to familiarize the knowledge of partial derivatives, extreme values in multivariables.

CEO3: To identify important characteristics of first order ordinary differential equations(FOODE) and develop appropriate method of obtaining solutions of FOODE and explore the use of FOODE as models in various applications

CEO4: To learn the concepts of Laplace Transforms and inverse Laplace Transforms and to explore the solving initial value problems by using Laplace transform method.

UNIT – 1: **MATRICES**

Rank - Echelon form and Normal form - Solution of linear system of homogeneous and non-homogeneous equations - Direct methods - Gauss elimination, Gauss Jordan method - Eigen values, Eigen vectors - Properties - Cayley-Hamilton theorem(without proof) - Inverse and powers of a matrix. – Diagonalization of a matrix using similarity transformation only.

UNIT – 2: DIFFERENTIAL CALCULUS AND ITS APPLICATIONS

Taylor's and Maclaurin's series for single variable (simple examples) - Functions of several variables - Jacobian – Taylor's and Maclaurin's series for two variables - Maxima and minima of functions of two variables - Lagrangian method of undetermined multipliers with three variables only.

UNIT – 3: ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER, FIRST DEGREE AND ITS APPLICATIONS & SPECIAL FUNCTIONS

Exact equations, Equations reducible to exact, Linear and Bernoulli's equation Applications: Orthogonal Trajectories, Newton's law of cooling only.

Beta and Gamma functions – Evaluation of Integrals (Simple examples)

UNIT - 4: LAPLACE TRANSFORM - I

Laplace transform of standard functions - First shifting theorem - Second shifting theorem - Transform of Derivatives & Integrals - Inverse transform.

UNIT - 5: LAPLACE TRANSFORM – II

Laplace Transform of Unit step function, Dirac's delta function and Periodic function - Convolution theorem - Application of Laplace transforms to ordinary differential equations of first and second order.

Course Outcomes

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge in estimating ranks in solving linear equations through matrix methods, eigen values and eigen vectors and to develop analytical skills in solving problems involving diagnoliation using eigen values and eigen vectors	PO1,PO2,P012
CO2	Demonstrate knowledge in Taylor's and Maclaurin's series of a function of single variable, finding maximum and minimum values attained by functions of several variables and Develop analytical skills in solving problems involving functional dependence and independence using partial derivatives	PO1,PO2
CO3	Demonstrate knowledge in first order ordinary differential equations, Develop analytical skills in solving problems involving first order ordinary differential equations and Develop skills in designing Mathematical models for Newton's Law of cooling and orthogonal trajectories	PO1,PO2,P03
CO4	Demonstrate knowledge in Laplace transform and inverse Laplace transform and use the appropriate shift theorems in finding Laplace and inverse Laplace transforms	PO1,PO2
CO5	Develop analytical skills in solving problems involving initial value problems for constant coefficient linear ordinary differential equations using Laplace transform	PO1,PO2,PO3 PO4,PO12

Text books:

1. Engineering Mathematics–I, 2012, T.K.V. Iyengar, B.Krishna Gandhi,
   S. Ranganatham and M.V.S.S.N. Prasad, S. Chand and Company Ltd, New Delhi.
2. Higher Engineering Mathematics, 34/e, 1999, Dr. B. S. Grewal, Khanna Publishers, Delhi.

Reference books:

1. Engineering Mathematics for JNTU, 2012, B.V. Ramana, Tata McGraw Hill Publishers, New Delhi.
2. A Text Book of Engineering Mathematics,2011, N.P.Bali,Laxmi publications(P)Ltd, New Delhi.
3. Higher Engineering Mathematics, Dr. M. K. Venkata Ramana, National Pub, Madras
4. Engineering Mathematics, Volume - 1, 2012, E.Rukmangadachari, E.Keshava Reddy, Pearson Educations, Chennai.
5. Advanced Engineering Mathematics, 8/e, 2009, Erwin Kreyszig, Wiley India, New Delhi.

I B.Tech I Sem

		L	T	P/D	C
18SAH112	**ENGINEERING PHYSICS (Common to all Branches)**	2	1	-	3

Course Educational Objectives:

CEO1: To understand the principles and applications optics, Lasers and Optical Fibers in various Streams of Engineering

CEO2: To analyze the structure of crystals by using X-Ray Diffraction Technique and to study properties, productions and applications of ultrasonic

CEO3: To develop ideas & mathematical solutions to Quantum mechanics & Semiconductors

CEO4: To recognize the concepts of Superconductors and classification of magnetic materials

CEO5: To Introduce Nano-materials & their applications in various fields of science and technology

UNIT - 1: PHYSICAL OPTICS, LASERS AND FIBER OPTICS

Physical Optics: Interference in thin films by reflection (Qualitative Analysis) - Newton's rings (Qualitative) – Diffraction – Fraunhofer Diffraction at single slit- Diffraction Grating. **Lasers:** Laser characteristics – Spontaneous and Stimulated emissions - Population inversion – Pumping Mechanisms-Solid state laser (Ruby laser) - Gas (He-Ne) laser - Applications of lasers. **Fiber Optics**: Principle of Optical Fiber -Structure of optical fiber - Types of optical fibers –Step Index and Graded Index Fibers- Numerical aperture –Acceptance angle-Fiber optics in communications (Block Diagram)–Simple Applications.

UNIT - 2: CRYSTAL STRUCTURES AND ULTRASONICS

Crystal Structures: Introduction - Space lattice –Basis-Unit cell - Lattice parameters - Crystal Systems - Structures of Simple Cubic - Body Centered Cubic - Face Centered Cubic crystals - X-ray diffraction- Bragg's law –Laue Method of X-Ray Diffraction. **Ultrasonics:** Introduction – Properties of ultrasonic waves - Piezoelectric Effect- Production of ultrasonic waves by Piezoelectric method -Applications of Ultrasonics.

UNIT - 3: QUANTUM MECHANICS AND SEMI CONDUCTORS

Quantum Mechanics: de Broglie's Hypothesis- Kinetic Energy and de Broglie wavelength – de Broglie wavelength of electrons -Properties of Matter waves-Time independent Schrodinger's wave equation –Physical Significance of Wave function-Particle in one dimensional potential box (Only upto Eigen Values of Electrons). **Semiconductors:** Intrinsic and extrinsic semiconductors (Qualitative) - Drift and diffusion - Hall Effect –Applications of Hall Effect- Direct and indirect band gap semiconductors

UNIT - 4: MAGNETIC MATERIALS AND SUPERCONDUCTIVITY

Magnetic Materials: Classification of dia - para - ferro magnetic materials on the basis of magnetic moment (Qualitative) - Hysteresis curve - soft and hard magnetic materials and Applications. **Superconductivity:** General properties - Meissner Effect – Type-I and Type-II superconductors - BCS Theory - Josephson's effect - Applications of superconductors.

UNIT - 5: PHYSICS OF NANOMATERIALS

Nanomaterials: Introduction to Nanomaterials –Types of Nano materials (One dimensional, Two dimensional and Three dimensional Nano materials) - Significance of nanoscale- surface to, volume ratio –Quantum Confinement effect-Synthesis of Nanomaterials - Ball milling Method - Chemical vapour deposition methods –Optical, thermal, mechanical and electrical properties of nano materials - Applications of Nanomaterials.

Course Outcomes

On successful completion of the course the students will be able to		**POs related to COs**
CO1	Acquire the knowledge and applications on Optics, LASERS and Fiber Optics.	PO1, PO2
CO2	Identify appropriate method for the production of Ultrasonics and their usage and understanding different crystal structures	PO1, PO2
CO3	Develop the skills to solve complex problem in quantum mechanics and Semiconductors	PO1, PO2,PO4
CO4	Analyze the concepts of Superconductors and magnetic materials and their appropriate applications in the field of Engineering and Technology	PO1,PO2
CO5	Apply the theoretical concepts pertaining to Nanomaterials in various fields engineering and Technology	PO1,PO12

Text Books:

1. Engineering Physics, 2011, M.R. Srinivasan, New Age International, Chennai.
2. Engineering Physics, First Edition 2014, K. Thyagarajan, McGraw Hill Publishers, New Delhi.

Reference Books:

1. Concepts of Modern Physics, 8/e, 2007, Aurther Beiser, Tata McGraw Hill Publishers, New Delhi.
2. Modern Engineering Physics, 2012, A.S. Vasudeva, S. Chand & Co., New Delhi.
3. Materials Science, 1/e, 2004,M. Vijaya and G. Rangarajan, Tata McGraw Hill Publishers, New Delhi .
4. Physics, Part I and II(Part I 5/e,2002, Part II 5/e,2001), Halliday and Resnick, John Wiley & Sons (Asia)
5. R5 :Engineering Physics, 7/e, 2006, Gaur & Gupta, Dhanpati Rai Publications, New Delhi .

I B.Tech I Sem

		L	T	P/D	C
18CSE111	**PROBLEM SOLVING USING PYTHON PROGRAMMING (Common to all Branches)**	2	1	-	3

Course Educational Objectives:

CEO1: To understand the basics of problem solving and python programming.
CEO2: To develop the basic skills of Python program in interactive and script mode.
CEO3: To design control structure like selection control and iterative control statement.
CEO4: To construct Python programs using Lists, Dictionaries and sets
CEO5: To build Python Programs using functions, software object, turtle graphics, file handling to read and write data from/to files.

UNIT- 1: INTRODUCTION TO PROBLEM SOLVING

Fundamentals: what is computer science - Essence of computational problem solving - Limits of computational problem solving - Computer Algorithms - Computer Hardware - Computer software - Computational problem solving. **Python programming language:** IDLE python development environment - python standard library - Bit of python - learning how to use IDLE - First program in Python. **Problem solving example:** Calculating the Drake Equation.

UNIT- 2: DATA AND EXPRESSIONS

Literals: Numeric literals - String literals - Control characters - String formatting - Implicit and explicit line joining. **Variables and Identifiers:** Variable assignment and keyboard input – Identifiers - keywords and other predefined identifiers. **Operators, Expressions and Data types**: Operators - Arithmetic Operators – Expressions - Operator precedence - Operator Associativity - Data type - Multi-type expression. **Computational Problem solving:** Restaurant Tab calculation and Age in seconds.

UNIT- 3: CONTROL STRUCTURES

Control Structures and Boolean expressions: Control structures - Relational operators - Membership operators - Boolean operators - Operator precedence and Boolean Expressions - Short-Circuit Evaluation - Logically Equivalent Boolean Expression. **Selection Control:** If statement - Indentation in python - Multi-Way Selection. **Iterative Control:** While statement - Infinite Error Checking - Infinite loops - Definite Vs Infinite loops - Boolean Flags and Indefinite loops. **Problem Solving:** Numbers of days in month and Calendar month programs.

UNIT-4: LISTS, DICTIONARIES AND SETS

Lists: List structures - Common list operations - List traversal - Lists in Python - Python list type –Tuples – sequences - Nested lists - Iterating over lists in python - For loop - Built-in range function - Iterating over list elements vs. List index values - While loops and lists - More on Python lists. **Dictionaries and Sets:** Dictionary types in Python - Set data type. **Problem solving:** Chinese Zodiac Program - Password Encryption/Decryption Program - Calendar Month program and A Food Co-op’s Worker Scheduling Simulation.

UNIT-5: FUNCTIONS, SOFTWARE OBJECTS AND TEXT FILES

Functions: Function routines - Defining Functions - Calling Value-Returning Functions - Calling Non-Value-Returning Functions - Parameter Passing -Keyword Arguments in Python - Default Arguments in Python - Variable Scope. **Software Objects:** Object references - Turtle graphics - creating a Turtle Graphics Window - the "Default" Turtle - Fundamental Turtle Attributes and Behavior - Additional Turtle Attributes - Creating Multiple Turtles. **Text Files:** Fundamentals – opening - reading and writing text files - string processing – traversal - operations and methods. **Problem solving:** Temperature conversion - GPA calculation and Credit card calculation.

Course Outcomes

On successful completion of this course the students should be able to		POs related to COs
CO1	Demonstrate problem approaches techniques and acquire knowledge in IDLE development environment in interactive and script mode	PO1, PO2,PO5
CO2	Indentify computational problem solving approaches to solve problems using python variables, expression and operators	PO1, PO2, PO5
CO3	Identify and develop python programs using control structures like selection control and iterative control statements.	PO1, PO2, PO3, PO5
CO4	Analyze lists, set, tuples and dictionaries to develop python program.	PO1, PO2, PO3, PO5
CO5	Understand and Build Python Programs using functions, software objects, turtle graphics and file handling to read and write data from/to files.	PO1, PO2, PO3, PO4,PO5

Text Books:

1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2016.
2. Mark Lutz, "Programming Python," O'Reilly Publications, Fourth Edition, 2011.

Reference Books:

1. Kenneth Lambert and B.L. Juneja, Fundamentals of Python, Cengage Learning, Third Edition, 2012.
2. Python Programming: A Modern Approach, VamsiKurama, Pearson.
3. Learning Python, Mark Lutz, Orielly.
4. Introduction to Python, Kenneth A. Lambert, Cengage.

I B.Tech I Semester

		L	T	P/D	C
18MEC111	**ENGINEERING GRAPHICS (Common to all branches)**	1	-	4	3

Course Educational Objectives:

CEO1: To expose them to existing national and international standards related to technical drawings.

CEO2: To develop drawing skills for communication of concepts, ideas and design of engineering products.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of drawings in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size and layout of drawing sheets - Lettering, numbering and dimensioning - Basic geometrical constructions.

UNIT – 1: ENGINEERING CURVES

Engineering Curves: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method and rectangular hyperbola – Construction of cycloid, epi cycloid and hypo cycloid – Construction of involutes of square and circle – Tangent and normal for the above curves.

UNIT – 2: PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projection of Points: Principles of orthographic projection – Conventions – First angle projection and third angle projections – Projection of points. **Projection of Lines:** Projection of straight lines (only first angle projections) inclined to one and both the principal planes – Determination of true lengths and true inclinations by rotating line method. **Projection of Planes:** Regular planes inclined to one and both the principal planes by change of position method.

UNIT – 3: PROJECTION OF SOLIDS AND SECTION OF SOLIDS

Projection of Solids: Projection of simple solids like prisms, pyramids, cylinder and cone, when the axis is inclined to one principal plane. **Section of Solids:** Sectioning of right regular solids like prisms, pyramids, cylinder and cone, the solids are in simple vertical position and inclined to one plane, when the cutting plane is inclined to one of the principal planes – Obtaining true shape of section.

UNIT – 4: DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids like prisms, pyramids, cylinder and cone. **Isometric Projection:** Principles of isometric projection – Isometric scale – Isometric projections of simple solids and truncated solids like prisms, pyramids, cylinder and cone.

UNIT – 5: ORTHOGRAPHIC PROJECTIONS AND PERSPECTIVE PROJECTIONS

Orthographic Projections: Principles and methods of orthographic projections – Plane of projections – Representation of three dimensional objects – Layout of views – Conversion of 3D objects to 2D objects. **Perspective Projection:** Perspective projection of simple solids like prisms and pyramids by visual ray method.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Construct the Engineering Curves and generate tangent and normal for those curves.	P01,P02,P03,P10
CO2	Draw the Projection of Points, Lines and Plane Surfaces.	P01,P02,P03, P10
CO3	Draw the Projection of Solids, Sections of Solids like Prisms, Pyramids, Cylinder and Cone.	P01,P02,P03, P10
CO4	Construct the Isometric Scale, Projections and develop the development of surfaces.	P01,P02,P03, P10
CO5	Draw the Orthographic and Perspective projections of Solids.	P01,P02,P03, P10

Text Books:

1. Engineering Drawing, N.D. Bhatt and V. M. Panchal, 50th edition, Charotar Publishing House, 2010.
2. A Text book of Engineering Graphics, K.V.Natrajan, 2009, Dhanalakshmi Publishers, Chennai.

References Books:

1. Engineering Drawing, K.L.Narayana and P.Kannaiah, 2/e, 2012, Scitech Publishers.
2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, Luzzader, Warren.J and Duff,John M., 2005, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi.
3. Engineering Graphics, K.Venugopal and V.Prabhu Raja, 2008, New Age International (P) Limited.
4. Engineering Drawing, M.B.Shah and B.C.Rana, 2/e, 2009, Pearson Education.
5. Engineering Drawing, Basant Agarwal and C.M.Agarwal, 2008, Tata McGraw Hill Publishing Company Limited, New Delhi.

I B.Tech I Sem

		L	T	P/D	C
18SAH115	**ENGINEERING PHYSICS LABORATORY**				
	(Common to all branches)	-	-	2	1

Course Educational Objectives:

CEO1: To Demonstrate Knowledge on measurement of various physical quantities using optical Methods and fundamentals of magnetic fields.

CEO2: To Identify different physical properties of materials like band gap, magnetic field Intensity etc, for engineering and technological applications

CEO3: To provide valid conclusions on phenomena Interference and Diffraction.

Name of the Experiment

1 Diffraction grating - Measurement of wavelength of given Laser.
2 Determination of magnetic field along the axis of a current carrying circular coil - Stewart Gees method
3 Determination of numerical aperture and acceptance angle of an optical fiber
4 Determination of particle size using a laser source
5 Parallel fringes – Determination of thickness of thin object using wedge method
6 Newton's rings – Determination of radius of curvature of given plano convex lens
7 B-H curve – Determination of hysteresis loss for a given magnetic material
8 Determination of Energy band gap of semiconductor

Course Outcomes:

On completion of the laboratory course the student will be able to		**POs related to COs**
CO1	**Demonstrate** Knowledge on measurement of various physical quantities using optical methods and fundamentals of magnetic fields	PO1
CO2	**Identify** different physical properties of materials like band gap, magnetic field intensity etc, for engineering and technological applications	PO2
CO3	**Provide** valid conclusions on phenomena Interference and Diffraction	PO4
CO4	**Follow ethical** values during conducting of Experiments	PO8
CO5	**Work individually** or in a team effectively	PO9
CO6	**Communicate** verbally and in written form pertaining to results of the Experiments	PO10
CO7	**Learns** to perform experiments involving physical Phenomena in future years	PO12

I B. Tech I Semester

		L	T	P/D	C
18CSE112	**PROBLEM SOLVING USING PYTHON PROGRAMMING LAB (Common to all branches)**	-	-	2	1

Course Educational Objectives:

CEO1: To design the algorithms and flowchart for python programs.
CEO2: To understand the concepts of expressions and control structures in python
CEO3: To develop the python programs using functions.
CEO4: To analyze the concepts of python lists, tuples anddictionaries.
CEO5: To gain knowledge on file handling using pythonprogramming

Recommended Systems/Software Requirements:

- For Windows: IDLE/ Spyder python development environment.
- For Linux: Default python version installed/ higher version.

LIST OF EXERCISES:

Task-1:

Develop and analyze various phases of Software Development Life cycle (SDLC) through Gantt chart.

Task-2:

a) Design a flowchart for biggest of three numbers.
b) Design a flowchart to find whether the given input is leap year or not.
c) Develop a flowchart to display the multiple of 3 up to 100.

Task-3:

a) Write a python script to calculate the Drake equation.
b) Develop a simple python scripts to illustrate numeric literals and string literals.

Task-4:

a) Write a python script to calculate Restaurant Tab calculation.
b) Write a python program to calculate the approximate number of atoms that the average person contains and the percentage of the universe that they comprise.
c) Write a Python program to read temperature from the user in Fahrenheit and displays the equivalent temperature in Celsius.

Task-5:

a) Write a python program to determine the approximate age of an individual in seconds.
b) Write a Python program that prompts the user for two integer values and displays the result of the first number divided by the second with exactly two decimal places displayed.
c) Write a Python program that prompts the user for two floating-point values and displays the result of the first number divided by the second with exactly six decimal places displayed.

Task-6:

a) Write a Python program in which the user enters either 'A' - 'B'or 'C'. If 'A' is entered the program should display the word 'Apple' - if 'B' is entered it displays 'Banana' - and if 'C' is entered it displays 'Coconut'.

b) Repeat 6a) using if statement with elifheaders instead.

c) Write a Python program in which a student enters the number of college credits earned. Ifthe number of credits is greater than 90 - 'Senior Status' is displayed- if greater than 60 -'Junior Status' is displayed - if greater than 30 - 'Sophomore Status' is displayed else 'Freshman Status' is displayed.

Task-7:

a) Write a program to sum a series of (positive) integers entered by the userexcluding all numbers that are greater than 100.

b) Write a program in which the user can enter any number of positive and negative integer values that displays the number of positive values entered as well as the number of negative values.

Task-8:

a) Write a program containing a pair of nested while loop that displays the integer values 1–100. ten numbers per row - with the columns aligned as shown below

1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30
.
.
91 92 93 94 95 96 97 98 99 100

b) Display the integer values 1–100 as given in question 8a) using only *one* while loop.

Task-9:

a) Write a python script to calculate the number of days in a month.

b) Write a python program to display a calendar month for any given month between January 1800 and December 2099.

Task-10:

a) Write a Python program that prompts the user for a list of integers - stores in another list only those values between1–100 and displays the resulting list.

b) Write a Python program that prompts the user to enter a list of first names and stores them in a list. The program should display how many times the letter 'a' appears within the list.

Task-11:

Write a Python script to generate all the possible spellings of the last four digits of any given phone number – use Dictionaries.

Task-12:

a) Write a Python function named **zeroCheck** that is passed with three integers and returns true if any of the integers is 0 otherwise it returns false.

b) Write a Python function named **ordered3** that is passed three integers, and returns true if the three integers are in order from smallest to largest otherwise it returns false.

Task-13:

a) Write a python script that allows a user to convert a range of values from Fahrenheit to Celsius or Celsius to Fahrenheit using functions.

b) Write a Python function named **Hello World** that displays

"Hello World, my name is *name* "for any given name passed to the routine.

Task-14:

Write a python script to create a simple text file. Write the contents into the created file and read the contents from the file and display the same on to the console screen.

Task-15:

Mini project: Horse Race Simulation

Create a visualization of a horse race using python script in which horses are moved ahead a random distance at fixed intervals until there is a winner.

Course Outcomes:

On successful completion of this course the students should be able to		**POs related to COs**
CO1	Develop algorithms and flowcharts for given problems	PO1
CO2	Implement conditionals and loops to design the python programming	PO2
CO3	Develop Python programs step-wise by defining functions and calling them.	PO3
CO4	Implement lists, set, tuples and dictionaries to develop python program.	PO4
CO5	Build Python Programs using file handling mechanisms to read and write data from/to files.	PO5
CO6	Follow the ethical principles in implementing the programs	PO8
CO7	Do experiments effectively as an individual and as a team member in a group.	PO9
CO8	Communicate verbally and in written form, the understanding about the experiments.	PO10
CO9	Continue updating their skill related to lists, tuples and dictionaries implementing programs in future.	PO12

Reference Books:

1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2016.
2. Mark Lutz, "Programming Python," O'Reilly Publications, Fourth Edition, 2011.

I B.Tech I Semester

		L	T	P/D	C
18 MEC112	**ENGINEERING WORKSHOP AND IT WORKSHOP (Common to all branches)**	-	-	2	1

Course Educational Objectives:

CEO1: To provide exposure to the students with hands on experience on various basic engineering practices in civil, mechanical and electrical engineering.

CEO2: To include training on PC Hardware, Internet & World Wide Web and Productivity Tools including Word, Excel and Power Point.

A. ENGINEERING WORKSHOP

TRADES FOR EXERCISES:

1. **Carpentry:** Two exercises from: Middle T lap joint – Dove tail lap joint – Mortise and tenon joint from out of 300 x 50 x 35 mm soft wood stock.
2. **Sheet Metal:** Two exercise from: Square tray – Open scoop – Frustum of pyramid from out of 22 or 20 gauge G.I. sheet.
3. **Fitting:** Two exercises from: Square joint – V joint – Dove tail joint from out of 50 x 50 x 5 mm M.S. flat piece.
4. **House Wiring:** Two exercise from: Two lamps controlled by one switch in series and parallel – One lamp controlled by 2 two way switches (stair case) – Wiring for fluorescent lamp.
5. **Plumbing:** Two exercise from: Basic pipe connections – Mixed pipe material connection
   – Pipe connections with different joining components.
6. **Machining:** Exercise on drilling and tapping.

TRADES FOR DEMONSTRATION:

- **a.** Lathe machine.
- **b.** Grinding machine.
- **c.** Arc and gas welding.

Course Outcomes (Engineering Workshop):

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on differ tools used in carpentry, fitting, sheet metal, basic machining process, house wiring and plumbing sections	PO1
CO2	Analyze the basic pipeline connection using different joining connections	PO2
CO3	Design small components using different materials includes wood, GI sheet and MS plates	PO3
CO4	Apply basic electrical engineering tools on the house wiring practice	PO5
CO5	Follow the ethical principles in while doing the exercises.	PO8
CO6	Do the exercises effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally among team members and in written form, the understanding about the trade exercises.	PO10
CO8	Continue updating their skill related to trades.	PO12

Text Books:

1. Lab manual provided by the department.

IT WORKSHOP

PC HARDWARE

1. Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.
2. Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video shall be given as part of the course content.
3. Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
4. Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva
5. **Hardware Troubleshooting:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva
6. **Software Troubleshooting:** Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

LaTeX and Word

7. **Word Orientation:** The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
8. Using LaTeX and Word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Excel

9. **Excel Orientation:**The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
10. Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

LaTeX and MS/equivalent (FOSS) tool Power Point

11. Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines

and Arrows in both LaTeX and PowerPoint. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

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

Internet& World Wide Web

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

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

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

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

Course Outcomes (IT Workshop):

On the successful completion of this course, the student should be able to,		POs related to COs
CO1	Acquire knowledge on computer system such as system unit, input devices, and output devices connected to the computer.	PO1
CO2	Demonstrate the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use.	PO2
CO3	Demonstrate the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc.	PO3
CO4	Familiarize with parts of MS Office, To create and save a document, To set page settings, create headers and footers, To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.	PO5
CO5	Follow the ethical principles in implementing the programs	PO8
CO6	Do experiments effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally and in written form, the understanding about the experiments and	PO10
CO8	Continue updating their skill related to MS Office, Internet and Computer in future.	PO12

Reference books:

1. Comdex Information Technology course tool kit , 2003, Vikas Gupta, WILEY Dream tech, New Delhi
2. The Complete Computer upgrade and repair book, 3/e, 2008, Cheryl A Schmidt, WILEY Dream Tech,New Delhi
3. Introduction to Information Technology, 2008, ITL Education Solutions limited, Pearson Education, New Delhi
4. PC Hardware and A+ Handbook, 2004, Kate J. Chase, Microsoft press
5. LaTeX Companion,2/e, 2002, Leslie Lamport, Addison Wesley, New Delhi
6. IT Essentials PC Hardware and Software Companion Guide, 3/e, 2008, David Anfinson and Ken Quamme, CISCO Press, Pearson Education, New Delhi
7. IT Essentials PC Hardware and Software Labs and Study Guide, 3/e, 2008, Patrick Regan, CISCO Press, Pearson Education, New Delhi
8. Troubleshooting, Maintaining and Repairing PCs, 5/e, 2008, S.J.Bigelow, TMH, New Delhi

I B.Tech II sem

		L	T	P/D	C
18SAH121	**TECHNICAL ENGLISH**				
	(Common to all Branches)	2	-	-	2

Course Educational Objectives:

CEO1: To Provide Knowledge on developing Technical Vocabulary communicating in a verbal manner.
CEO2: To cultivate types of listening skills, Knowledge on the usage of foreign language words in to English Language,
CEO3: To acquire Knowledge on use of technology for societal aspects.
CEO4: To get knowledge on earlier technology used and latter technology in India.
CEO5: To understand the ability to write poems and communicate by using technological words.

UNIT-I COMMUNICATION SKILLS FOR PROFESSIONALS

Verbal-Areas of communication - Suggestions to improve verbal communication - Non-verbal communication - Category and features - Cultural differences in non - verbal communication - Suggestions to improve non-verbal communication – Tenses - Listening to Dialogues - Role Play
- Reading Short Stories

UNIT-II ACTIVE LISTENING

Introduction -Types of listening -Traits of a good listener - Active versus passive listening - Implications of effective listening – Verbs - Transitive and Intransitive - Identification of TV and ITV in a sentence - Voice of Verbs - Active and Passive - Listening to Intonation - Welcome/Valedictory speech - Reading Poetry - Note Making.

UNIT-III TECHNOLOGY WITH A HUMAN FACE (A lecture by E.F.Schumacher) Direct speech and Indirect speech - Modal Verbs - Listening to Short Stories - Conveying Vote of Thanks - Reading News papers - Precise Writing.

UNIT-IV Dr. A.P.J ABDUL KALAM (A missile Man)

Question tags - Subject-Verb agreement - Listening to English Songs - Process Description Reading Articles from Journals - Letter writing –official.

UNIT-V THE EXPRESS – By Stephen Spendor (A Technological poem)

Sentence structures (Simple, Compound and Complex sentence) - Listening to speeches
- Product Description - Reading Scientific Texts - Paragraph Writing - Essay writing.

Course Outcomes:

On successful completion of course, the student will be able to		POS related to COS
CO1	Acquiring Knowledge on developing Technical Vocabulary by communicating in verbal by using proper tense form in the way of acting and writing.	PO1, PO10
CO2	Acquiring Knowledge on the usage of foreign language words in to English Language through various types of listening skills by observing proper intonation and voice of verbs.	PO1, PO9
CO3	Acquiring Knowledge on the use of technology for societal aspects through listening inspiring biographies of scientists besides learning some grammatical aspects on the usage of direct and indirect speeches by applying modal verbs.	PO1, PO12
CO4	Acquiring knowledge on the achievements made by the scientists on the earth by reading scientific articles from various journals present in the library and through motion pictures in internet.	PO1, PO12
CO5	Understand how to describe a technological gadget through poetical expression by applying technological words besides writing short essays using simple to complex sentence.	PO1, PO10, PO12

Prescribed Book: The text book prepared by the Department of English of SITAMS.

Other References:

1. Exercises in spoken English: Parts I-III, CIEFL, Hyderabad, Oxford University Press.
2. Communication Skills: Sanjay Kumar and Pushpa Latha, Oxford University Press. 2011.
3. Practical English Usage: Michael Swan, Oxford University Press, 1995.
4. Remedial English Grammar: F.T. Wood. Macmillan, 2007.

I B.Tech II Sem

		L	T	P/D	C
18SAH122	**ENGINEERING MATHEMATICS – II**				
	(Common to all Branches)	2	1	-	3

Course Educational Objectives:

CEO1: To develop skill to analyze appropriate method to find the root of the Algebraic and Transcendental Equations and to develop skill to apply the concept of interpolation for the Prediction of required values

CEO2: To identify important characteristics of higher order ordinary differential equations (HOODE) and develop appropriate method of obtaining solutions of HOODE

CE03: To develop skill to design Sine and Cosine waves with the help of Fourier Series and Transforms.

CEO4: To learn the concepts of z-transformation and inverse z- Transforms and to explore the solving difference equations by using z- transform method.

UNIT – 1: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS AND INTERPOLATION

Solution of Algebraic and Transcendental Equations: Introduction - The Bisection method - The method of False position - The Iteration method - Newton-Raphson method (Single Variable). **Interpolation:** Introduction - Finite differences - Forward differences - Backward differences - Newton's forward and backward difference formulae for interpolation - Lagrange's formula.

UNIT – 2: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type eax ,Sin ax, Cos ax, polynomials in x, eax v(x), xm v(x) - Method of variation of parameters – Differential Equations reducible to constant coefficients: Cauchy-Euler equation and Legendre linear equation

UNIT – 3: FOURIER SERIES

Determination of Fourier coefficients - Fourier series - Even and odd functions - Fourier series in an arbitrary interval - Even and odd periodic continuation - Half-range Fourier sine and cosine expansions.

UNIT – 4: FOURIER TRANSFORMS

Fourier integral theorem(only statement) - Fourier sine and cosine integrals - Fourier transform - Fourier sine and cosine transforms - Properties - Inverse transforms - Finite Fourier transforms.

UNIT –5: Z- TRANSFORMS

Z-transforms - Properties - Damping rule - Shifting rule - Initial and final value theorems - Inverse Z-transform - Convolution theorem - Solution of difference equations by Z-transforms

Course Outcomes:

On successful completion of course, the student will be able to		POs related to COs
CO1	Demonstrate knowledge in solving algebraic and transcendental equations by various mathematical methods and Design novel mathematical methods for constructing the interpolating polynomials to the given data	PO1,PO2, PO12
CO2	Demonstrate knowledge in higher order linear differential equations and develop analytical skills in solving problems involving higher order non homogeneous linear differential equations	PO1,PO2, PO12
CO3	Develop analytical skills in evaluating the properties of functions through Fourier series	PO1,PO2, PO12
CO4	Develop analytical skills in evaluating the properties of functions through Fourier transform	PO1,PO2, PO12
CO5	Demonstrate knowledge in z-transform and inverse z- transform and develop analytical skills in solving problems involving difference equations using z-transformation	PO1,PO2,PO3, PO4,PO12

Text books:

1. Mathematical Methods, 2012, T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad , S. Chand and Company Ltd, New Delhi.
2. Higher Engineering Mathematics, 34/e, 1999, Dr. B. S. Grewal, Khanna Publishers, Delhi

Reference books:

1. Engineering Mathematics–I, 2012, T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand and Company Ltd, New Delhi.
2. Engineering Mathematics for JNTU, 2012, B.V. Ramana, Tata McGraw Hill Publishers, New Delhi.
3. Higher Engineering Mathematics, Dr. M. K. Venkata Ramana, National Pub & Co, Madras.
4. A Text Book of Engineering Mathematics,2011, N.P.Bali, Laxmi publications(P)Ltd, New Delhi.
5. Advanced Engineering Mathematics, 8/e, 2009, Erwin Kreyszig, Wiley India, New Delhi.

I B.Tech II Sem

		L	T	P/D	C
18SAH113	**ENGINEERING CHEMISTRY**				
	(Common to all Branches)	2	1	-	3

Course Educational Objectives:

CEO1: To learn different purification method and analysis the impurities present in water.
CEO2: To develop skill to describe the mechanism and control of corrosion.
CEO3: To train the students to effectively use the knowledge of polymer science.
CEO4: To learn the concept of refractories and to develop skill to apply the concept of Electrochemistry and fuels

UNIT- 1: WATER AND WATER FOR INDUSTRIAL PURPOSE

Water: Sources of water - Types of Impurities in Water - Hardness of water - Temporary and permanent hardness - Estimation of hardness by EDTA Method and numerical problems - Analysis of water - Dissolved oxygen - Disadvantages of hard water - Methods of treatment of water for domestic purpose - Sterilization - Chlorination -Ozonisation. **Water for industrial purpose:** Water for steam making - Boiler troubles - Priming and foaming - Boiler corrosion - Scales and sludge - Caustic embrittlement - Water treatment - Internal treatment - Colloidal - Phosphate - Calgon - Carbonate - Sodium aluminate conditioning of water - External treatment - Ion - exchange process - Demineralization of brackish water – Reverse osmosis.

UNIT - 2: SCIENCE OF CORROSION

Definition - Types of corrosion - Dry corrosion(Direct chemical attack) - Wet corrosion - Theories of corrosion and mechanism - Electro chemical theory of corrosion - Galvanic corrosion - Concentration cell corrosion - Oxygen absorption type - Factors influencing the corrosion - Control of corrosion - Cathodic protection - Sacrificial anode and impressed currentcathodic protection method.

UNIT - 3: POLYMERS

Polymerization reactions - Basic concepts - Types of polymerization - Addition and condensation polymerization with mechanism - Plastics -Thermosetting and thermoplastics – Composition, Properties and Engineering applications of teflon, bakelite, nylon and rubber - Processing of natural rubber and compounding. **Elastomers:** Buna S - Buna N - Polyurethane Rubber and Silicone Rubber.

UNIT - 4: PHASE RULE, STRUCTURAL MATERIALS AND REFRACTORIES

Phase rule: Definition - Terms involved in phase rule - Phase rule equation - Phase diagrams - One component system (water system) - Two component system (lead- silver system). **Structural materials:** Cement - Composition of Portland cement - Analysis - Setting and hardening of cement (reactions) and role of gypsum in Portland cement. **Refractories:** Definition - Classification with examples - Criteria of a good refractory material - Causes for the failure of refractory materials.

UNIT - 5: FUELS AND ELECTRO CHEMISTRY

Fuels: Definition and classification of fuels. Liquid fuels- Classification of petroleum, refining of petroleum by Bergius process. Gaseous fuels – natural gas, producer gas, water gas, coal gas and biogas**. Electro Chemistry**: Conductance - Equivalent conductance - Molar conductance – Conduct metric titrations - Conductivity Measurements. **Fuel cells**: Introduction, Hydrogen oxygen fuel cell and methanol fuel cell

Course Outcomes:

On successful completion of course, the student will be able to		POs related to COs
CO1	Demonstrate the fundamentals of water technology and develop analytical skills in determination hardness of water and different purification methods.	PO1, PO2
CO2	Demonstrate the knowledge in corrosion phenomenon and develop skills in different methods for control of corrosion	PO1, PO2
CO3	Demonstrate the knowledge on polymeric materials and to prepare polymeric material for environmental safety .	PO1, PO2,PO7
CO4	Analyze the effect of cement materials, causes for the failure of refractory materials and understanding of phase rule.	PO1, PO2
CO5	Understand and apply the concept of electrochemistry and analysis the fuels and different types of fuels cells.	PO1, PO2

Text books:

1. Chemistry for Engineers, 4/e, 2009, Prof. K. N. Jayaveera, Dr. G. V. Subba Reddy and Dr. C. Ramachandraiah, Tata McGraw Hill Publishers, New Delhi.
2. Text book of Engineering Chemistry, 15/e, 2008, Jain and Jain, DhanpatRai Publishing Company, New Delhi.
3. Text book of Engineering Chemistry, 18/e, 2008, S. S. Dara, S. Chand & Co, New Delhi.

Reference books:

1. Engineering Chemistry, 5/e, 2009, Dr. K. B. Chandrasekhar, Dr. U.N. Dash, Dr. Sujatha Mishra, Scitech Publications(India) Pvt. Ltd, Hyderabad.
2. Fuel Cells Principles and Applications, 4/e, 2008,B.Viswanath, M. AuliceScibioh, Universities press, Hyderabad.
3. Chemistry of Engineering Materials, 3/e, 2008, C.V.Agarwal, Tara Publication, Varanasi.
4. Physical Chemistry, 12/e, 2009, Glasston& Lewis,Dhanptharai Publishers,New Delhi.
5. Engineering Chemistry (Vol.1&2), 5/e, 2004, J C Kuriacose and J. Rajaram, Tata McGraw Hill Publishers, New Delhi.

I B.Tech II Semester

		L	T	P/D	C
18CIV121	**ENGINEERING MECHANICS**				
	(Common to Civil and Mechanical Branches)	2	1	-	3

Course Educational Objectives:

CEO1: To develop capacity to predict the effect of forces and motion in a system for further carrying out the design and analysis of engineering components.

UNIT-I STATICS OF PARTICLES

Concepts: Scope of mechanics - Preview of statics - Fundamental concepts and axioms - Principle of transmissibility - Force and its characteristics - Parallelogram law of forces - Triangle law of forces - Polygon law of forces. **Coplanar, Collinear and Concurrent forces:** Classicfication – Resultant of Coplanar, Collinear, Collinear coplanar and Concurrent coplanar forces (analytical methods only). **Co-planar parallel forces:** Moment of forces – Principle of moments – Types of parallel forces – Resultant of two parallel forces – Force and couple – Parallel forces in plane – Equilent systems. **Equilibrium:** Principle and law of equillibrium – Action and reaction – Free body diagram.

UNIT-II CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centre of Gravity: Centroid and centre of gravity - Centroids of lines and areas - Rectangular, circular, triangular areas, T section, I section and composite sections by method of moments - Theorems of Pappus and Guldinus. **Moment of Inertia:** Parallel axis theorem and perpendicular axis theorem - Radius of gyration - Moment of inertia of simple and composite areas (rectangle, circle, semi-circle, quarter circle, I-Section, T section, C section) - Polar, product, principle axis and mass moment of inertia (rectangular, circular and cone sections).

UNIT-III ANALYSIS OF FRAMES, VIRTUAL WORK AND FRICTION

Analysis of Perfecr Frames: Types – Assumptions – Reactions of supports – Analysis of frames by method of joints and sections (simple frames only). **Virtual Work:** Pricinciple of virtual work – Virtual work done by moment. **Friction:** Types – Laws of friction – Co-efficient of friction – Angle and cone friction – Angle of repose – Friction on horizontal and inclined plane – Ladder friction.

UNIT-IV KINEMATICS

Linear Motion: Velocity – Acceleration – Equation of motion in straight line. **Curvlinear Motion, Rotation and Translation:** Angular velocity and acceleration – Equation of motion in circular path – Motion of rotation and translation. **Projectiles**: Velocity and angle of projections – Times of flight – Horisontal range – Equation of path of projectile – Motion of body thrown in horizontal and inclined plane.

UNIT-V KINETICS

Laws of Moion : Newton's laws of motion – Motion on rough and inclined surfaces – Motion of two bodies connected by strings – D'Alembret's principle applicable to motion. **Collision of Elastic Bodies:** Time of compression, restution and collision – Types of impacts – Co-efficient of restution – Loss of kinetic energy during impact – Direct and indirect impact of a body on a fixed plane. **Work, Power and Energy:** Work – Power – Work done and power developed by torque – Mechanical energy – Law of coservation of energy.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate and apply the knowledge of principles of mechanics, system of forces and free body diagram to determine the net effect of the forces acting on a body.	PO1, PO2.
CO2	Find the location of Centroid, center of gravity and moment of inertia for the given appropriate composite sections.	PO1, PO2, PO3
CO3	Analyse the bodies subjected to friction, simple frames and apply principle of virtual work to find reactions.	PO1, PO2, PO3
CO4	Analyse the kinematics of a body undergoing rectilinear, curvilinear motion.	PO1, PO2
CO5	Apply the Dynamic equilibrium principles and work energy equations to solve appropriate problems.	PO1, PO2

Text Books:

1. Engineering Mechanics, A K Tayal, Umesh publications, New Delhi, 2010.
2. Vector Mechanics for Engineers, Beer,F.P and Johnson Jr. E.R, McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

Reference Books:

1. Engineering Mechanics, S.Timoshenko, D.H.Young and J.V Rao, Tata McGraw Hill, New Delhi.
2. Engineering Mechanics, N.H. Dubey, 1/e, Tata McGraw-Hill Education Pvt. Ltd, Noida, 2011.
3. Engineering Mechanics, 1/e, 2011, P.J. Shah, S.Chand and Company Pvt.Ltd., New Delhi.
4. Engineering Mechanics (Dynamics and Statics), Sadhu Singh, Khanna Publishers, New Delhi.
5. A Textbook of Engineering Mechanics, R.K. Bansal, 6/e, Laxmi Publications, 2015.

I B.Tech II Sem

		L	T	P/D	C
18EEE113	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**				
	(Common to Civil & Mechanical Branches)	2	1	-	3

Course Educational objectives:

CEO 1: To introduce electric circuits and its analysis
CEO 2: To impart knowledge on solving circuits using network theorems
CEO 3: To learn construction and operation of D.C. machines and transformers.
CEO 4: To learn basic principles of all measuring instruments.
CEO 5: To demonstrate knowledge on overview of the principles, operation and application of basic electronic devices and Logic gates.

UNIT-I INTRODUCTION TO ELECTRICAL ENGINEERING

Ohm's Law, Basic Circuit Components, Kirchhoff's laws, Simple Problems. Types of Sources, Series, Parallel Circuits, Star-Delta Transformation, Network Theorems-Superposition and reciprocity, Thevenin's and Norton's Theorems and Maximum Power Transfer Theorem.

UNIT-II SINGLE PHASE AC CIRCUITS

, Average values and form factor for different periodic waveforms - phase and phase difference of sinusoidal alternating quantities - steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation - concept of reactance, impedance, susceptance and admittance - Power triangle, power factor

UNIT-III DC AND AC MACHINES

Principle of Operation of DC Generators, Types of DC Generators, EMF Equation in DC Generator, OCC of a DC Shunt Generator. Principle of Operation of DC Motors, Types of DC Motors, Torque Equation, Losses and Efficiency, Calculation in DC Motors, Speed control of DC Shunt motor - Principles of Operation of Transformer, Constructional Details, Losses and Efficiency, - Principles of Operation of Three Phase Induction motor

UNIT-IV MEASURING INSTRUMENTS

Introduction, Classification of Instruments, Operating Principles, Essential Features of Measuring Instruments, Moving Coil and Moving Iron Instruments, Dynamometer Wattmeter and Energy meter

UNIT -V: ANALOG AND DIGITAL ELECTRONICS:

The P-N Junction Diode - Volt-Ampere Characteristics-Applications of Diode, Diode as a Rectifier-Operation of Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Zener Diode- Volt-Ampere Characteristics, .Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN Transistor, Input-Output Characteristics of CE Configurations, BJT act as Amplifier. Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates- NAND, NOR Gates. Boolean algebra and De Morgan's Theorems.

Text Books:

1. Basic Electrical Engineering-by M.S Naidu and S Kamakshaiah.
2. Electronic Devices and Circuits by N.Salivahanan, and N.Suresh Kumar, 3/e,TMH , 2012.

References Books:

1. Basic Electrical Engineering by T.KNagasarkar and M.S Sukhija
2. Principle of Electrical Engineering by V.K Mehtha,S Chand Publications.
3. Theory and Problems of BEE by DP Kothari and IJ Nagrath.
4. Introductory Circuit Analysis by R.L. Boylestad, PEARSON,12th edition, 2013
5. Digital Design by Morris Mano, 3/e,2006,Prentice Hall of India, New Delhi

Course Outcomes:

On successful completion of the course the student will be able to,		**POs related to COs**
CO1	Demonstrate knowledge on basic circuit components and basic concepts of electrical engineering, Analyze Circuits by different network reduction techniques	PO1, PO2
CO2	To determine and analyze different parameters of periodic waveforms and Analyze the steady state analysis of R, L,C circuits.	PO1, PO2
CO3	Demonstrate knowledge on Construction and performance of DC and AC motor and transformer Analyze Losses and Efficiency of motors and transformer	PO1, PO2
CO4	To understand and evaluate the calibration of different electrical measuring instruments	PO1, PO2, PO3
CO5	To Acquire sound knowledge on internal structure of PN junction, all the electronic devices. and logic gates	PO1, PO2

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I B.Tech II Sem

18SAH116	**ENGINEERING CHEMISTRY LABORATORY**	L	T	P/D	C
	(Common to all branches)	-	-	2	1

Course Educational Objectives:

CEO1: Demonstrate Knowledge on measurement of various analysis of water treatment methods

CEO2: Identify the different salt analysis of copper for engineering and technological applications.

CEO3: Provide valid conclusions on phenomena of dissolved oxygen.

Name of the Experiment

1. Preparation of Standard EDTA solution and Estimation of Hardness of Water
2. Preparation of Standard EDTA and Estimation of Copper
3. Estimation of dissolved oxygen in given water sample
4. Estimation of alkalinity of water
5. Estimation of Acidity of water sample
6. Preparation of Standard Potassium Dichromate and Estimation of Ferrous Iron
7. Preparation of Standard Potassium Dichromate and Estimation of Copper by Iodometry
8. Determination of strength of the given Hydrochloric acid against standard sodium hydroxide Solution by Conductometric titration
9. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration)
10. Determination of viscosity of the given oils through Redwood viscometer

Course Outcomes:

On successful completion of the course the will be able to,		**POs related to COs**
CO1	Demonstrate Knowledge on estimation of water treatment methods and other samples.	PO1
CO2	Identify the different salt analysis for engineering and technological applications.	PO2
CO3	Provide valid conclusions on phenomena of different samples.	PO4
CO4	Follow ethical codes during conducting of experiments	PO8
CO5	Do experiments effectively as an individual and as a team member in a group.	PO9
CO6	Communicate verbally and in written form pertaining to results of the Experiments.	PO10
CO7	Learns to perform different experiments involving water for future enhancements.	PO12

I B.Tech II Sem

18EEE114 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**
(Common to Civil & Mechanical Branches)

L	T	P/D	C
-	-	2	1

Course Educational Objectives:

CEO1: To gain practical experience on fundamental electric laws.
CEO2: To gain practical experience on verification of theorems.
CEO3: To evaluate the performance characteristics of DC and AC Machines **CEO4:** To gain practical experience on basic electronic devices and Circuits **CEO5:** To gain practical experience on different logic gates

.Part A (ELECTRICAL EXPERIMENTS)
(Any five of the following)

1. Verification of KCL and KVL
2. Verification of Superposition Theorem.
3. Verification of Thevinins Theorem.
4. Verification of maximum power transfer theorem.
5. Magnetization characteristics of D.C shunt generator determination of critical field resistance.
6. Load Test on Three Phase SQUIREL Cage Induction Motor

Part B (ELECTRONICS EXPERIMENTS)
(Any five of the following)

1. Volt-Ampere Characteristics of P-N Junction Diode.
2. Volt-Ampere Characteristics of Zener Diode
3. Half-wave rectifier- a) Without filter b) With filter.
4. Full-Wave Rectifier- a) Without Filter b) With Filter
5. Verification of Basic Logic gates- AND, OR, NOT,
6. Verification of Universal Logic Gates- NAND, NOR

Course Outcomes:

On successful completion of the course the will be able to,		**POs related to COs**
CO1	Demonstrate knowledge on basic electrical laws electronic principles in engineering applications.	PO1
CO2	Analyze and Verify different network theorems practically.	PO2
CO3	Design and develop various electrical and electronic circuits and logic gates and performance characteristics of DC shunt generator	PO3
CO4	Conduct investigation and testing on DC and AC machines	PO4
CO5	Select appropriate design tools and procedure to simulate and implement electronic devices, circuits and logic gates	PO5
CO6	Follow ethical principles in designing and implementing various electrical and electronic circuits and logic gates	PO8
CO7	Do experiments effectively as an individual and as a member in a group.	PO9
CO8	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO9	Continue updating their skill related to AC and DC Machines, electronic devices , circuits and logic gates for various applications during their life time	PO12

I B.Tech II Semester

18MEC122	**COMPUTER AIDED DRAFTING LAB**	L	T	P/D	C
	(Common to Mechanical and Civil Engineering Branches)	-	-	2	1

Course Objectives:

CEO1: To understand the design of the engineering components in a machine **CEO2:** To develop a skill on creating the 2D and 3D models of components **CEO3:** To understand part drawing and Assembly of components in a machine

List Exercises:

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-linefigures.
2. Drawing of a title block with necessary text and projection symbol.
3. Draw the two dimensional diagram with follow the principles of dimensioning.
4. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
5. Drawing of front view and top view of simple solids like prisms, pyramids, cylinder, cone, etc. with dimensioning.
6. Drawing sectional views of prisms, pyramids, cylinder, cone, etc.
7. Draw the development of surfaces on simple objects like prisms, pyramids, cylinder, cone, etc.
8. Creation of 3D models of simple objects and obtaining 2D multi-view drawings from 3D model.
9. Drawing front view, top view and side view of objects from the given pictorial views. (eg. V-block, base of a mixie, simple stool, objects with hole and curves.)
10. Drawing of simple 3D mechanical components like bolt, nut, screws, shafts, gears etc.
11. Drawing of a plan of residential building (two bed rooms, kitchen, hall, etc.)
12. Drawing of a simple steel truss.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Apply the knowledge of engineering fundamentals to Understand the role of design of the mechanical engineering Components.	PO1
CO2	Analyze the components as per the drawing standard	PO2
CO3	Design and Development of mechanical part drawing and Assembly of components implemented in real time applications.	PO3
CO4	Apply appropriate techniques, resources use to Create Mechanical Components 3D modeling by modern engineering software tools.	PO5
CO5	Follow the ethical principles while creating the 2D, 3D modeling	PO8
CO6	Draw effectively as an individual drawing practice in laboratory.	PO9
CO7	Communicate verbally and in written form about the drawing procedure.	PO10
CO8	Continue updating their skill related to drawing and modeling of the components in future.	PO12

Text Books:

1. Lab manual provided by the department.

II B.Tech I Sem

		L	T	P/D	C
18SAH211	**ENGINEERING MATHEMATICS – III**				
	(Common to all Branches)	2	1	0	3

Course Educational Objectives:

CEO1: To learn the method of evaluation of numerical integration and to solve ordinary differential equations numerically using numerical methods
CEO2: To learn the concepts of double and triple integrals and compute double and triple integrals
CEO3: To learn partial differential equations and how they can serve as models for physical processes and also master the technique of separation of variables to solve partial differential equation
CEO4: To develop skill to explain the characteristics of scalar and vector valued functions and master these in calculations, provide a physical interpretation of the gradient, divergence, curl and related concepts and carry out differentiation and integration of vector valued functions

UNIT – 1: NUMERICAL INTEGRATION AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical integration: Trapezoidal rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule.

Numerical solution of Ordinary Differential equations: Solution by Taylor's series - Picard's method of successive approximations - Euler's method - Runge-Kutta methods - Predictor- Corrector method - Milne's method.

UNIT – 2: MULTIPLE INTEGRALS

Multiple Integrals: Double and triple integrals - Change of variables - Change of order of integration.

UNIT - 3: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Method of separation of variables.

UNIT - 4: VECTOR DIFFERENTIATION

Introduction to Vector Differentiation, Scalar and Vector point functions- Gradient of a Scalar function - Divergence & Curl of a Vector function and their properties.

UNIT - 5: VECTOR INTEGRATION

Line Integral - Potential function - Area , Surface and volume integrals - Green's , Stoke's and Gauss divergence theorem(excluding their proof) - Verification of Green's, Stoke's and Gauss divergence theorems.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge in finding the numerical values to integrals through different mathematical methods and solving ordinary differential equations numerically through various methods and Design novel mathematical methods for solving the ordinary differential equations.	PO1,PO2, PO12
CO2	Demonstrate knowledge in evaluating double and triple integrals	PO1,PO2, PO12
CO3	Develop analytical skills for the problems involving partial differential equations and the methods to solve them	PO1,PO2, PO12
CO4	Demonstrate knowledge in differentiation of vector functions and to provide an understanding of characteristics of scalar and vector valued functions and master these in calculations, provide a physical interpretation of the gradient, divergence, curl and related concepts.	PO1,PO2, PO12
CO5	Demonstrate knowledge in integration of vector functions and to Develop skills in providing solutions for line, surface and volume integrals by vector methods and work done, flux through vector integrations and correlate them with the applications of various integral theorems	PO1,PO2, PO12

Text Books:

1. Mathematical Methods, 2012, T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and
M.V.S.S.N. Prasad , S. Chand and Company Publishers, New Delhi.
2. Higher Engineering Mathematics, 34/e, 1999, Dr. B. S. Grewal, Khanna Publishers, Delhi

Reference books:

1. Engineering Mathematics–I, 2012, T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand and Company Ltd, New Delhi.
2. Engineering Mathematics for JNTU, 2012, B.V. Ramana, Tata McGraw Hill Publishers, New Delhi
3. Advanced Engineering Mathematics, 8/e, 2009, Erwin Kreyszig, WileyIndia, New Delhi.
4. Introductory Methods of Numerical Analysis, S S Sastry, 4/e 2005, PHI Publishers.
5. A Text Book of Engineering Mathematics, 2011, N.P.Bali, Laxmi publications(P)Ltd, New Delhi.

II B.Tech I Semester

		L	T	P/D	C
18MEC211	**ENGINEERING THERMODYNAMICS**	2	1	-	3

Course Educational Objectives:

CEO1: To introduce the basic principles of thermodynamics and to acquire knowledge on zeroth and first law of thermodynamics.
CEO2: To acquire knowledge on second law of thermodynamics and its application to various systems.
CEO3: To introduce the properties of pure substances and properties of gases and gas mixtures.
CEO4: To understand thermodynamic equations, functions, relations and various specific heats.
CEO5: To understand psychometric and to analyze air standard cycles applied for engines.

UNIT – 1: BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

Basic Concepts: Concept of continuum - Microscopic and macroscopic approach - Point and path functions - Systems and their types - Property - State, path and process - Quasi static process - Work - Modes of work - Zeroth law of thermodynamics - Measurement of temperature - Thermodynamic temperature scales. **First Law of Thermodynamics:** Internal energy - Specific heat capacities - Enthalpy - Application of steady flow processes.

UNIT – 2: SECOND LAW OF THERMODYNAMICS AND ENTROPY

Second Law of Thermodynamics: Kelvin's Plank and Clausius statement and their equivalence Reversibility and irreversibility - Carnot cycle - Reversed Carnot heat engine - Carnot theorem. **Entropy:** Concept of entropy - Clausius theorem - TS plot - Clausius inequality - Entropy change in irreversible process - Entropy principle and its applications - Entropy generation in a closed and open system.

UNIT – 3: PROPERTIES OF PURE SUBSTANCES, GASES AND GAS MIXTURES

Properties of Pure Substances: Definition - Formation of steam and its thermodynamic properties - Phase change of a pure substance - pv, pT, TS, hS diagrams for a pure substance - pvT surfaces - Dryness fraction - Steam tables - Measurement of steam quality. **Properties of Gases and Gas Mixtures:** Ideal gas - Avogadro's Law - Equation of state - Van der Waal's equation - Viral expansions - Compressibility chart - Dalton's law of partial pressure.

UNIT – 4: THERMODYNAMIC RELATIONS

Thermodynamic Relations: Exact differential - Helmholtz and Gibbs function - Maxwell's relations - Tds equations – Joule Thomson effect - ClausiusClaperyon equation - Difference in heat capacities - Change in thermodynamic properties with variable specific heat - Isentropic expansion with variable specific heat.

UNIT – 5: PSYCHROMETRY AND AIR STANDARD CYCLES

Psychrometry: Concepts - Definitions - Psychrometric relations - Psychrometry charts. **Air Standard Cycles:** Assumptions and working of Carnot, Stirling, Ericsson, Atkinson, Lenoir, Brayton, Otto, Diesel and dual combustion cycle - Comparisons of Otto, Diesel and dual cycles - Problems on thermal efficiency and work output in Otto and Diesel cycles.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge and understanding the concept of conservation of mass, energy, work interaction, heat transfer and law of thermodynamics.	PO1, PO2, PO3, PO4
CO2	Identify closed and open systems and/or apply the concept of second law to analyze simple systems	PO1,PO2, PO3, PO4
CO3	Evaluate properties of pure substances and gas mixtures and use steam tables and Mollier chart in solving complex problems.	PO1, PO2, PO3, PO4
CO4	Understand the various thermodynamic equations, functions and relations.	PO1, PO2, PO3, PO4
CO5	Understand the various psychrometric relations, properties and analyze air standard cycles applied in enginesand identify methods to improve thermodynamic performance.	PO1, PO2,PO3, PO4, PO6, PO7

Text Books:

1. Engineering Thermodynamics, P.K.Nag, 5/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2013.
2. Thermodynamics-An Engineering Approach, YunusCengel and Boles, 4/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2004.

Reference Books:

1. Engineering Thermodynamics, P. Chattopadhyay, 1st Revised, Oxford, 2011.
2. Engineering Thermodynamics, J.B. Jones and R.E.Dugan, 1/e, Prentice-Hall ofIndia, Pvt. Ltd., New Delhi, 2009.
3. Fundamentals of Thermodynamics, Sonntag, Borgnakke and Van Wylen, 7/e, John Wiley & Sons (ASIA) Pvt. Ltd, 2009.
4. Thermodynamics, J.P.Holman, 3/e, McGraw-Hill, 1995.
5. Basic Engineering Thermodynamics, A. Venkatesh, 1/e, University Press (India) Private Ltd., Hyderabad, 2007.

Note: Use of steam table, Mollier diagram and psychrometric chart are permitted.

II B.Tech I Semester

18MEC212	MECHANICS OF SOLIDS	L	T	P/D	C
		2	1	-	3

Course Educational Objectives:

CEO1: To understand the concepts of stress, strain, principal stresses and principal planes.
CEO2: To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
CEO3: To determine various stresses in the beam, and different sections
CEO4: To compute slopes and deflections in determinate beams by various methods.
CEO5: To study the stresses and deformations induced in thin and thick shells

UNIT – 1: STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid bodies and deformable solids - Elasticity and plasticity - Types of stresses and strains - Hooke's law - Stress-strain diagram for mild steel - Working stress - Factor of safety - Lateral strain - Poisson's ratio - Elastic constants - Volumetric strains - Thermal stresses - Deformation of simple, compound and composite structure - Extension of tapering rods (rectangular and circular) - Analysis of stress - Strain energy - Resilience - Gradual, sudden, impact and shock loadings - Mohr's circle of stress.

UNIT – 2: TRANSVERSE LOADING ON BEAMS

Definition of beam - Types of beams - Types of loads - Concept of shear force and bending moment - S.F and B.M diagrams for simply supported, cantilever and overhanging beams subjected to point loads, U.D.L, U.V.L and combination of these loads - Point of contra flexure - Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – 3: STRESSES IN BEAMS

Bending Stresses: Theory of simple bending - Assumptions - Neutral axis - Moment of resistance -Practical applications of bending equations in circular (solid and hollow), I, T, angle, channel and beam sections. **Shear Stresses:** Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T and angle sections.

UNIT – 4: DEFLECTION OF BEAMS

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

UNIT – 5: TORSION OF SHAFTS, COLUMNS, THIN AND THICK CYLINDERS

Torsion of Circular Shafts: Theory of pure torsion - Assumptions - Torsional moment of resistance - Polar modulus - Torsion formulation stresses and deformation in solid and hollow shafts - Strength of a shaft of varying sections - Composite shafts. **Columns:** Modes of failure of columns - Euler's theory - Rankine's theory. **Thin Cylinders:** Thin seamless cylindrical shells - Riveted boiler shells - Thin spherical shells. **Thick Cylinders:** Lame's equation – Cylinders subjected to inside and outside pressures - Compound cylinders.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Apply the knowledge of mathematics, basic theory of science, fundamental principles to attain the solution of complex engineering problems on deformation of materials.	PO1,PO2,PO3,PO4
CO2	Identify, formulate to perform the stress analysis of a beam under axial loading, torsion, transverse loading to provide valid conclusions.	PO1,PO2,PO3,PO4
CO3	Evaluate & interpreted the various stresses and deformation in circular and hollows shafts, sections to analyze complex engineering problems.	PO1,PO2,PO3,PO4
CO4	Analyze and understand the fundamental concepts of deflection of beam by various methods.	PO1,PO2,PO3,PO4
CO5	Apply reasoning informed by the contextual knowledge to perform stress and strain deformations in Thin , Thick Cylinders, spherical shells	PO1,PO2,PO3,PO4

Text Books:

1. Mechanics of Materials, Dr.B.C.Punmia, Dr.Arun Kumar Jain, Er.Ashok Kumar Jain, 12/e, 2012, Laxmi Publications (P) Ltd., New Delhi.
2. Strength of Materials, S. Ramamrutham and R.Narayanan, 17/e, 2011, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Reference Books:

1. Strength of Materials, Dr.R.K.Bansal, 5/e, 2012, Laxmi publications (P) Ltd., New Delhi.
2. Strength of Materials, Bhavikatti, 3/e, 2012, Lakshmi Publications, New Delhi.
3. Mechanics of Materials, R.C.Hibbeler, 6/e, 2007, Pearson Education, New Delhi.
4. An Introduction to Mechanics of Solids, Thomas Lardner, Norman Dahl, 3/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Strength of Materials, R.K.Rajput, 5/e, 2006, S. Chand & Company Pvt. Ltd., New Delhi.

II B.Tech I Semester

18MEC213	**MATERIAL SCIENCE AND METALLURGY**	L	T	P/D	C
		3	-	-	3

Course Educational Objectives:

CEO1: To impart knowledge on the micro-structure, properties, treatment, testing and applications of metals and non-metallic materials.

CEO2: To identify and select suitable materials for various applications.

CRYSTALLOGRAPHY (Not for Examination)

Crystal structure - Cubic systems SC, BCC, FCC and HCP structure - Space lattices - Unit cell - Bravais lattices - Miller indices - Packing factor in cubic systems - Co-ordination number.

UNIT – 1: CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

Crystal Defects: Point, line, Surface and volume defects. **Constitution of Alloys:** Solidification Solid solutions - Hume-Rothery rule - Gibb's phase rule - Cooling curves. **Phase Diagrams:** One component system - Binary phase diagrams - Lever rule - Isomorphous, eutectic, eutectoid, peritectic, peritectoid - Study of important binary phase diagrams: C_u-N_i , Al-C_u , Fe-Fe_3C.

UNIT – 2: HEAT TREATMENT

Effect of alloying elements on iron - Isothermal transformation diagrams - Cooling curves superimposed on TTT diagrams and CCT diagrams - Critical cooling rate - Annealing and its types - Normalizing - Hardening and its methods - Hardenability and Jominy end quench test - Tempering - Martempering - Austempering - Maraging - Case hardening, carburizing, nitriding, cyaniding, carbonitriding - Flame and induction hardening - Vacuum and plasma hardening.

UNIT – 3: FERROUS AND NON FERROUS METALS

Ferrous Materials: Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti, W) - Specification of steels - Classification, composition, properties and applications of carbon steels, alloy steels, stainless steels and tool steels - Classification, structure, composition, properties and applications of gray, ductile, white, malleable cast irons and compacted graphite iron. **Non- Ferrous Materials:** Copper and copper alloys - brass, bronze and cupronickel - Aluminum and its alloys - Gun metal - Bearing materials - Tin and its alloys - Nickel alloys - Titanium alloys.

UNIT – 4: NON METALLIC MATERIALS

Polymers: Types of polymers - Properties and applications of various thermosetting and thermoplastic polymers. **Engineering Ceramics:** Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON. **Composites Materials:** Introduction, definition, classification, properties and applications of fibrous, laminated and particulate composites - Hybrid composites – Introduction of nano composites.

UNIT – 5: MECHANICAL DEFORMATION AND TESTING

Mechanical Properties: Deformation of metals - Slip and twinning - Ductile and brittle fracture Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) - Micro and nano-hardness tests - Charpy and Izod impact tests, fatigue and creep test.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Apply the knowledge of mathematics, science, and engineering fundamentals of alloys and Phase diagram of various materials and the classification of micro structure in steel and cast iron.	P01,P02,P03,P04
CO2	Acquire the knowledge of engineering fundamentals for heat treatment process. Identify, formulate, analysis and apply appropriate techniques used in all the heat treatment process with an understanding of its limitations.	P01,P02,P03,P04
CO3	Understand the engineering knowledge of ferrous and non-ferrous metal and its alloys. Identify, formulate the appropriate techniques and engineering application of ferrous and non-ferrous metal and alloys.	P01,P02,P03,P04
CO4	Understand the engineering knowledge of polymers, ceramics and composites. Identify, formulate the appropriate techniques and engineering application of polymers, ceramics and composites.	P01,P02,P03,P04
CO5	Understand the engineering knowledge of mechanical properties and its deformation mechanisms.	P01,P02,P03,P04

Text Books:

1. Material Science and Engineering, R.K.Rajput, 4/e, 2013, S.K. Kataria and Sons Publications.
2. Material Science & Metallurgy, O.P.Khanna, 2014, Dhanpat Rai Publications.

Reference Books:

1. Introduction to Physical Metallurgy, Sidney H Avner, 2/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Materials Science and Engineering-An Introduction, William D. Callister, 6/e, 2010, Wiley India Pvt. Ltd.
3. Introduction to Engineering Materials, B.K.Agrawal, 1/e, 2003, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Material Science and Engineering, V. Raghavan, 5/e, 2009, Prentice-Hall of India, Pvt. Ltd.
5. Elements of Material Science and Engineering, Lawrence H.Vanvlack, 6/e, 2002, Pearson Education, New Delhi.
6. Material Science and Metallurgy for Engineers, Dr.V.D. Kodgire and S.V.Kodgire, 25/e, 2009, Everest Publishing House, Pune.

II B.Tech I Semester

		L	T	P/D	C
18MEC214	**FLUID MECHANICS AND HYDRAULIC MACHINERY (Common to MECH and EEE Branches)**	2	1	-	3

Course Educational Objectives:

CEO1: To understand the properties of fluids, pressure measuring and concept of fluid flows.
CEO2: The applications of the conservation laws to flow through pipes are studied.
CEO3: To understand the importance of dimensional analysis.
CEO4: To understand the importance of various types of pumps and turbines.

UNIT- 1: PROPERTIES OF FLUIDS, PRESSURE MEASUREMENTS, BUOYANCY AND KINEMATICS OF FLOW

Properties of Fluids: Introduction - Definition - Mass density - Specific weight - Specific gravity - Specific volume - Compressibility - Surface tension and capillarity. **Pressure and its Measurements:** Variation of static pressure - Atmospheric, absolute, gauge and vacuum pressure - Pressure measurements - Piezometer - U tube manometer - Differential manometers. **Buoyancy and Floatation:** Basic concepts of Buoyancy, buoyancy force, centre of buoyancy, metacentre and metacentric height (only basic approach). **Kinematics of Flow:** Basic principles of fluid flow - Types of fluid flow - Rate of flow - Continuity equation.

UNIT – 2: DYNAMICS OF FLUID FLOW, BOUNDARY LAYER THEORY FORCES ON SUBMERGED BODIES AND FLOW THROUGH PIPES

Dynamics of Fluid Flow: Equations of motion - Euler's equation of motion - Bernoulli's equation - Bernoulli's equation for real fluid - Application of Bernoulli's equation in venturimeter, orifice meter and pitot tube. **Boundary Layer Theory:** Boundary layer characteristics - Types of boundary layer - Boundary layer, displacement, momentum and energy thickness (Basics only). **Forces on Submerged bodies:** Expression for Drag and Lift – Drag on a sphere. **Flow Through Pipes:** Reynold's experiment - Loss of energy in pipes - Loss of energy due to friction: Darcy's Weisbach equation and Chezy's formula - Minor energy losses - Pipes in series and parallel - Equivalent pipe.

UNIT – 3: DIMENSIONAL ANALYSIS AND TURBO MACHINERY

Dimensional Analysis and Hydraulic Modeling: Dimensions - Dimensional homogeneity - Rayleigh method - Buckingham π-method - Methods of selecting repeating variables - Model analysis - Similitude and types of similarities - Forces acting in moving fluid - Dimensionless numbers - Similarity laws - Model testing of partially submerged bodies - Distorted and undistorted models. **Basics of Turbo Machinery:** Force exerted by the jet on a stationary and moving of flat, inclined and curved vanes - Jet on a hinged plate - Jet striking centrally and at tip of moving curved plate.

UNIT – 4: HYDRAULIC TURBINES

Hydraulic Turbines: Turbine - Layout of hydroelectric power plant - Heads and efficiencies of a turbine - Classification of hydraulic turbines - Pelton wheel - Francis turbine - Kaplan turbine - Working principles - Velocity triangle diagrams - Work done - Heads and efficiencies - Hydraulic design - Draft tube - Unit quantities and specific speed - Characteristics curves - Governing of turbines - Water hammer - Surge tank.

UNIT – 5: HYDRAULIC PUMPS

Centrifugal pumps: Classification – Principles of working - Work done - Heads and efficiencies of a centrifugal pump - Minimum starting speed - Multi stage centrifugal pump - Specific speed - Model testing - Priming - Characteristics curves - Cavitation - Suction height - NPSH. **Reciprocating pumps:** Classification and working –Slip.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Apply mathematical knowledge to predict the properties and characteristics of a fluid, analysis of pressure measurements and concept of fluid flows.	PO1, PO2, PO3, PO4
CO2	Demonstrate knowledge and understanding the basic equations of fluid flows, compute drag and lift coefficients and solve problems in flow of fluids	PO1, PO2, PO3, PO4
CO3	Analyze the model and the prototype using dimensional analysis.	PO1, PO2, PO3, PO4
CO4	Design the working proportions of hydraulic turbines and analysis to improve the performances.	PO1, PO2, PO3, PO4
CO5	Analyze to improve the performance of pumps and ability to engage in independent.	PO1, PO2, PO3, PO4

Text Books:

1. Hydraulics and Fluid Mechanics, P.N. Modi and S.M. Seth, 18/e, 2011, Standard Book House, Delhi.
2. Fluid Mechanics, A.K. Jain, 11/e, 2012, Khanna Publishers, New Delhi.

Reference Books:

1. Fluid Mechanics and Hydraulic Machinery, R.K. Rajput, 4/e, 2010, S. Chand & Company, Pvt. Ltd., New Delhi.
2. Fundamentals of Fluid Mechanics, Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, 5/e, 2008, McGraw Hill, New York.

3. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, 9/e, 2011, Laxmi Publications (P) Ltd.
4. Fluid Mechanics, Yunus A. Cengel, 2010, Tata McGraw Hill Education Private Ltd.
5. Introduction to Fluid Machines, S.K. Som and G. Biswas, 2/e, 2010, Tata McGraw-Hill Education, Pvt. Ltd., Noida.

II B.Tech I Semester

18MEC215	**MACHINE DRAWING**	L	T	P/D	C
		1	-	4	3

Course Educational Objectives:

CEO1: To familiarize with the standard conventions for different materials and machine parts in working drawings.
CEO2: To make part drawings including sectional views for various machine elements.
CEO3: To prepare assembly drawings given the details of part drawings.

UNIT – 1: MACHINE DRAWING CONVENTIONS

Need for drawing conventions - Introduction to IS conventions - Methods of dimensioning - General rules for sizes and placement of dimensions for holes, centers, curved and tapered features - Conventional representation of materials - Common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs - Conventional representation of limits, fits and tolerances - Types of sections - Selection of section planes and drawing of sections and auxiliary sectional views - Title boxes - Size - Location and details - Common abbreviations and their liberal usage - Types of drawings - Working drawings for machine parts.

UNIT – 2: DRAWING OF MACHINE ELEMENTS

Selection of views - Additional views for the following machine elements and parts with every drawing proportion - Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws
- Keys, cotter joint and knuckle joint - Rivetted joints for plates.

UNIT – 3: DRAWING OF SIMPLE MECHANICAL PARTS

Selection of views - Additional views for the following machine elements and parts with every drawing proportion - Shaft coupling, spigot and socket joint - Journal and foot step bearings.

UNIT – 4: ASSEMBLY DRAWINGS OF ENGINE PARTS

Assembly drawing of stuffing box, cross head of steam engine, eccentrics, piston and connecting rod.

UNIT – 5: ASSEMBLY DRAWINGS OF MACHINE PARTS

Assembly drawing of screw jack, plummer block, pipe vice and tailstock.

Course Outcomes:

On successful completion of the course, students will be able to:		POs related to COs
CO1	Understand the importance of engineering and working drawings with dimensions and bill of material during design and development.	PO1, PO2, PO3, PO4
CO2	Demonstrate knowledge and understanding the selection of section planes, drawing of sections and auxiliary sectional views	PO1, PO2, PO3, PO4
CO3	Design and Develop the simple mechanical, coupling parts	PO1, PO2, PO3, PO4
CO4	Develop the skill of assembling the reciprocating engine parts	PO1, PO2, PO3, PO4
CO5	Demonstrate knowledge on the assembly the machine parts	PO1, PO2, PO3, PO4

Text Books:

1. Machine Drawing, P.S.Gill, n/e, 2012, S.K Kataria and Sons, New Delhi.
2. Machine Drawing, K.L.Narayana, P.Kannaiah and K.Venkata Reddy, 4/e, 2012, New Age International (P) Ltd. Publishers, New Delhi.

Reference Books:

1. A Text Book of Machine Drawing in First Angle, R.K.Dhawan, 1/e, 2009, S. Chand & Company Pvt.Ltd. New Delhi.
2. Machine Drawing, Goel, n/e, 2012, S.K.Kataria and Sons, New Delhi.
3. Machine Drawing, N.D.Butt and V.M.Panchal, 48/e, 2013, Charotar Publishing House Pvt. Ltd.
4. Machine Drawing (With Auto CAD), Ajit Singh, 2/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Fundamentals of machine Drawing, P.L.Sah and Sadhu Singh, 2/e, 2012, Prentice-Hall of India, Pvt. Ltd., New Delhi.

Note:

- The end exam will be for 4 hrs in the following format.
- All answers should be on the drawing sheet only
- **Question 1** set on unit **I** of the syllabus 2 out of 3 to be answered with a weightage of 4 marks each – 08 marks.
- **Question 2** set on unit **II** or **III** of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each – 20 marks.
- **Question 3** set on unit **IV** or **V** of the syllabus with a weightage of 42 marks.

18MEC216 MATERIAL SCIENCE AND TESTING LAB

L	T	P/D	C
-	-	2	1

Course Educational Objectives:

CEO1: To supplement the theoretical knowledge gained in Material science and Mechanics of solids with practical testing to determine mechanical properties under external loads.

CEO2: To enable the student to have a clear understanding of microstructure and properties.

List of Experiments

1. **a)** Study of metallurgical microscope.
   b) Preparation of specimen.
2. **a)** Study of Fe-Fe_3C diagram.
   b) Study of the micro structures of cast irons.
3. Study of the microstructure of mild steels, low carbon steels, high carbon steels.
4. Study of the micro structures of Cu.
5. Study of the micro structures of brass.
6. Study of the micro structures of Al.
7. Hardeneability of steels by Jominy end quench test.
8. Tension test on mild/high yield strength deformed bars.
9. **a)** Compression test on wood (parallel and perpendicular to grains).
   b) Torsion test.
10. Spring test.
11. **a)** Charpy and Izod impact tests.
    b) Brinell's and Rockwells hardness tests.
12. Load-deflection test on simply supported beam.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on the microstructure of materials	PO1
CO2	Analyze the mechanical properties of materials by suitable testing.	PO2
CO3	Design the materials strength using various impact and deflection test.	PO3
CO4	Conduct investigation on the harness of different materials	PO4
CO5	Evaluate the structure of the material by using modern microscope	PO5
CO6	Follow the ethical principles while doing the experiments	PO8
CO7	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO8	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO9	Continue updating their skill related to material science in future.	PO12

18MEC217 FLUID MECHANICS & HYDRAULIC MACHINERY LAB L T P/D C
(Common to MECH and EEE Branches) - - 2 1

Course Educational Objectives:

CEO1: To understand the properties of fluid, types of fluid and types of flow.
CEO2: To understand about flow measuring devices based on Bernoulli's principle and notches.
CEO3: To help the students acquire knowledge about various loss in fluids flow through pipes.
CEO4: To acquire knowledge on basics of turbo machinery.
CEO5: To perform characteristic study of turbines and pumps.

List of Experiments

1. Calibration of venturimeter and orificemeter.
2. Determination of coefficient of discharge for small orifice by a constant head method.
3. Determination of coefficient of discharge for an external mouth piece by variablehead method.
4. Calibration of contracted rectangular notch and triangular notch.
5. Determination of coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's theorem.
7. Impact of jet on vanes.
8. Turbine flow meter.
9. Study of hydraulic jump.
10. Performance test on hydraulic turbine.
    a) Pelton wheel.
    b) Francis turbine
    c) Kaplan turbine
11. Performance test on centrifugal pump.
    a) Single stage centrifugal pump.
    b) Multi stage centrifugal pump.
12. Performance test on reciprocating pump.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on properties of fluids and fluid flow characteristics of various hydraulic machines.	PO1
CO2	Measure and analyze the flow parameters using orifice, mouth piece and notches also Analyze the performance of centrifugal, reciprocating pumps and also ability to engage in independent	PO2
CO3	Determine and design the pipe flow by considering various loss of energy	PO3
CO4	Understand working, performance of hydraulic turbine by conduct investigation.	PO4
CO5	Follow the ethical principles while doing the experiments	PO8
CO6	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO8	Continue updating their skills related to fluid mechanics and hydraulic machines in future.	PO12

Text Books: Lab manual provided by the department.

II B.Tech I Semester

18AUD211 **CONSTITUTION OF INDIA**

L	T	P/D	C
2	-	-	-

Course Educational Objectives:

CEO1: To know about Indian constitution and functionalities of state and central government of India
CEO2: To realize the functions of local administration in rural and urban areas
CEO3: To understand the functions of Chief election and state election commissions.

UNIT – 1: INTRODUCTION

Constitution-meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT – 2: UNION GOVERNMENT AND ITS ADMINISTRATION

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

UNIT – 3: STATE GOVERNMENT AND ITS ADMINISTRATION

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT – 4: LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT – 5: ELECTION COMMISSION

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Course Outcomes

On successful completion of the course the student will be able to		**POs related to COs**
CO1	Understand the functions of the Indian constitution	PO6, PO8,PO12
CO2	Recognize the structure, functions of Indian central government	PO6, PO8,PO12
CO3	Realize the structure and functions of State government in India	PO6, PO8,PO12
CO4	Explain the functions of local administration in rural and urban	PO6, PO8,PO12
CO5	Understand the role of state and chief election commission	PO6, PO8,PO12

Text books:

1. Introduction to the Constitution of India, Durga Das Basu, Prentice Hall of India, New De1hi.
2. Indian Po1itica1 System, R.C.Agarwa1, S.Chand and Company, New De1hi. 1997

References:

1. Introduction to the Constitution of India, Sharma, Brij Kishore, Prentice Hall of India, New De1hi.
2. Indian Po1itica1 System, U.R.Gahai, New Academic Pub1ishing House, Jalandar.

II B.Tech I Semester

		L	T	P/D	C
18SAH212	**REASONING AND APTITUDE - I**	2	-	-	-

Course Educational Objectives:

CEO1: To apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.

REASONING AND APTITUDE

Numbers and fractions – LCM and HCF – Simplification and roots – Averages – Percentages – Ratios and proportions – Profit and loss – Partnership and shares – Simple and compound interest – Series (Verbal) – Coding and decoding – Blood relations – Venn diagrams
– Problems on ages – Directions – Assertion and reasoning – Logarithms – Syllogism.

Course Outcomes:

On successful completion of the course, students will be able to:		**POs related to COs**
CO1	Apply the mathematical concepts in real life problem solving methodologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12
CO2	Apply the reasoning knowledge in real life problem solving methodologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12

Text Books:

1. Quantitative Aptitude, Dr.R.S.Aggarwal, 2012, S.Chand and Company Ltd, New Delhi.
2. A Modern Approach to Verbal and Non-Verbal Reasoning, Dr.R.S.Aggarwal, 2012, S.Chand and Company Ltd, New Delhi.

Reference Books:

1. Quantitative Aptitude for Competitive Examinations, Abhijit Guha, 14/e, 2010, Tata McGraw Hill Publishers, New Delhi.
2. Course in Mental Ability and Quantitative Aptitude, Edgar Thorpe, 3/e, 2012, Tata McGraw Hill Publishers, New Delhi.
3. Fast Track Objective Arithmetic, Rajesh Verma, 2012, Arihant Publications, Meerut.

II B.Tech II Semester

		L	T	P/D	C
18SAH222	**PROBABILITY AND STATISTICS (Common to CSE, MEC, CE)**	2	1	-	3

Course Educational Objectives

CEO1: To develop skill to analyze the discrete and continuous data using appropriate Statistical Distributions like Binomial, Poisson, Normal..etc
CEO2: To develop skill to design different graphical representations like pie chart, Bar graph, scatter Diagram, line graph, Regression line etc.,
CEO3: To inculcate skill to investigate different applications of statistical distributions and the Corresponding conclusions required for the analysis of sample data.
CEO4: To develop skill to apply the concept of test of significance using t-test, f-test, chi-square test, ANOVA suitable of the required conclusion.

UNIT - 1: PROBABILITY AND RANDOM VARIABLES

Probability: Sample space and events - Probability - The axioms of probability - Some elementary theorems - Conditional probability - Baye's theorem.
Random variables: Discrete and continuous distributions – Statistical Parameters (Mean, Variance and Standard Deviation) of distribution functions.

UNIT - 2: PROBABILITY DISTRIBUTIONS

Binomial - Poisson and Normal distributions - Related properties.

UNIT - 3: SAMPLING DISTRIBUTION AND ESTIMATION

Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) - Proportions - Sums and differences.
Estimation: Point estimation - Interval estimation - Bayesian estimation.

UNIT - 4: TEST OF HYPOTHESIS AND TEST OF SIGNIFICANCE

Test of Hypothesis: Means - Hypothesis concerning one and two means - Type I and Type II errors - One tail, two-tail tests.
Test of Significance: Student's t-test - F-test - Chi-square test of goodness of fit.

UNIT - 5: CURVE FITTING & ANOVA

Curve fitting: The method of least squares – Linear, Parabola, Exponential and Power form.
ANOVA: ANOVA for one-way and two-way classification data.

Course Outcomes:

After the completion of this course, a successful student is able to		POs related to COs
CO1	Demonstrate knowledge on use the probability and Random Variables in the field of engineering	PO1,PO2,PO3
CO2	Demonstrate knowledge in probability distributions and develop analytical skills for the problems involving means, probability	PO1,PO2,PO3
CO3	Construct confidence intervals on parameters for a single sample	PO1,PO2,PO3,PO12
CO4	Demonstrate knowledge in testing of hypotheses and Tests of significance for small and large samples and Develop skills for	PO1,PO2,PO3,PO4,PO12
CO5	Demonstrate knowledge on constructing a curve, or mathematical function, that has the best fit to a series of data points, possibly subject	PO1,PO2,PO3,PO4,PO12

Text Books:

1. Fundamentals of Mathematical Statistics, 10/e, 2001, S.C. Gupta, V.K. Kapoor, S. Chand and Company Publishers, New Delhi.
2. Probability and Statistics, 2012, T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and
M.V.S.S.N. Prasad , S. Chand and Company Publishers, New Delhi.

Reference Books:

1. Probability and Statistics, 2011, V. Ravindranath, T.S.R. Murthy, I.K. International Pvt. Ltd, New Delhi.
2. Probability and Statistics for Engineers, 6/e, 2006, Johnson A. Richard, Miler & Fruends, Pearson Education, New Delhi.
3. Higher Engineering Mathematics, 34/e, 1999, Dr. B. S. Grewal, Khanna Publishers, Delhi
4. Probability and Statistics for Engineers, 2011, Dr. J. Ravichandran, Wiley-India Publishers, New Delhi.
5. Probability and Statistics for Engineers and Scientists, 7/e, 2002, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Pearson Education Asia, New Delhi.

II B.Tech II Semester

18MEC221	**THERMAL ENGINEERING - I**	L	T	P/D	C
		2	1	-	3

Course Educational Objectives:

CEO1: To acquire knowledge on analysis of stages in gas power cycles.
CEO2: To introduce the principles, working and various systems of IC engines.
CEO3: To analyze the combustion of SI engines and CI engines.
CEO4: To analyze the performance parameters of IC engines and air compressor

UNIT – 1: GAS POWER CYCLES

Otto, Diesel cycle analysis - MEP, efficiency calculations - Comparison of air standard and fuel- air cycles - Causes for deviation of fuel-air cycle from air standard cycle - Comparison of air standard and actual cycles - Time loss factor, head loss factors, blowdown loss and rubbing friction factors.

UNIT – 2: INTERNAL COMBUSTION ENGINES

Introduction of IC Engines: Classification of IC engines - Components and their function - Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, S.I and C.I engines. **Fuel Systems:** S.I. Engine: Carburetor - Mechanical and electrical fuel pump - C.I. Engine: Fuel injection pump - Fuel injector - Types of fuel injector nozzles. **Cooling Systems:** Cooling requirements - Air cooling and water cooling (thermosyphon and forced circulation system). **Lubrication Systems:** Petroil, splash, pressurized and mist lubrication. **Ignition Systems:** Function of an ignition system - Battery coil, magneto coil and electronic ignition system using contact breaker and contact triggers.

UNIT – 3: COMBUSTION IN IC ENGINES

S.I. Engine: Normal and abnormal combustion - Importance of flame speed and effect of engine variables - Type of abnormal combustion, pre ignition and knocking - Fuel requirements and fuel rating, antiknock additives - Combustion chambers. **C.I. Engine:** Stages of combustion - Delay period and its importance - Effect of engine variables - Diesel knock - Combustion chambers - Fuel requirements and fuel rating.

UNIT – 4: TESTING AND PERFORMANCE OF IC ENGINS

Performance parameters - Measurement of cylinder pressure - Fuel consumption - Air intake - Exhaust gas composition - Brake power - Determination of frictional losses and indicated power - Performance test - Heat balance sheet.

UNIT – 5: AIR COMPRESSOR

Classification of air compressor - Reciprocating compressor - Workdone by single stage reciprocating air compressor with and without clearance volume - Efficiencies of reciprocating compressor - Multistage air compressor and inter cooling - Types of rotary air compressors (basics only) - Comparison between reciprocating and rotary air compressors.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Acquire knowledge on gas power cycles and analysis on it.	PO1, PO2, PO3, PO4
CO2	Know the basic knowledge of an engine, identify the types, components of IC engines and explain the functions of each.	PO1, PO2, PO3, PO4
CO3	Demonstrate the basic knowledge and analyze the types and stages of combustion in SI and CI engines.	PO1, PO2, PO3, PO4
CO4	Investigation on IC engines for performance improvement and emission reduction to environment.	PO1, PO2, PO3, PO4, PO7
CO5	Demonstrate the basic knowledge of an air compressor in developing the analytical models.	PO1, PO2, PO3, PO4

Text Books:

1. Thermal Engineering, R.K Rajput, 8/e, 2010, Laxmi Publications (P) Ltd, New Delhi.
2. Internal Combustion Engines, V. Ganesan, 4/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference Books:

1. IC Engines, Mathur and Sharma, 1/e, 2010, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. A course in thermal Engineering, C.P.Kothandaraman, S.Domkundwar, A. V. Domku ndwar 5/e, 2002, Dhanpat Rai & Sons.
3. Thermal Engineering, Rudramoorthy, 15/e, 2012, Tata McGraw-Hill Education Pvt.Ltd., Noida.
4. I .C. Engines, Heywood, 1/e, 1998, Tata McGraw-Hill Education Pvt.Ltd., Noida.
5. Thermal Engineering, R.S.Khurmi and J.K.Gupta, 5/e, 2008, S Chand & Company Pvt. Ltd., New Delhi.

II B.Tech II Semester

18MEC222	**THEORY OF MACHINES-I**	L	T	P/D	C
		2	1	-	3

Course Educational Objectives:

CEO1: To understand the basic components and layout of linkages in the assembly of a system with respect to the displacement, velocity and acceleration.
CEO2: To understand the motion resulting from a specific set of linkages and design linkage as well as cam mechanisms for specified output motions.
CEO3: To understand the basic concepts of toothed gearing.

UNIT – 1: BASICS OF MECHANISMS

Basic kinematic concepts and definitions - Types of motions - Mechanism: Kinematic links - Kinematic pairs - Kinematic chain - Types of joints in chains - Degree's of freedom - Application of plane mechanism - Inversion of mechanism - Inversions of quadric, single and double slider. **Straight Line Motion Mechanisms:** Exact and approximate copiers and generated types - Peaucellier, Hart's and Scott-Russell's mechanism - Grasshopper mechanism - Watt's-modified Scott-Russell mechanism - T.Chebicheff's and Robert mechanism - Pantograph.

UNIT – 2: KINEMATICS OF LINKAGE MECHANISMS

Instantaneous Centre Method: Instantaneous centre of rotation, centroides and axodes - Relative motion between two bodies - Three centres in-line theorem - Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links. **Relative Velocity Method:** Velocity and acceleration - Motion of link in machine - Determination of Velocity and acceleration diagrams - Graphical method - Application of relative velocity method - Slider crank mechanism - Four bar mechanism. **Acceleration Method:** Acceleration diagrams for simple mechanisms, Coriolis acceleration and determination of Coriolis component of acceleration - Kleins construction - Analysis of slider crank mechanism for displacement, velocity and acceleration.

UNIT – 3: STEERING MECHANISMS AND DRIVES

Steering Mechanisms: Conditions for correct steering - Davis steering gear - Ackerman's steering gear - Velocity ratio - Hooke's joint - Single and double Hooke's joint - Application. **Drive Systems:** Belt, Rope and chain drives - Selection of belt drive - Types of belt drives - Materials used for belts and ropes - Velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt - Chains - Length, angular speed ratio - Classification of chains - .

UNIT – 4: KINEMATICS OF CAM

Classification of cams and followers - Terminology and definitions - Displacement diagrams - Uniform velocity, parabolic, simple harmonic and cycloidal motions - Derivatives of follower motions - Layout of plate cam profiles - Specified contour cams - Circular arc and tangent cams - Pressure angle and undercutting - sizing of cams.

UNIT – 5: GEARS AND GEAR TRAINS

Gearing: Law of toothed gearing - Involutes and cycloidal tooth profiles - Spur gear terminology and definitions - Gear tooth action - Contact ratio - Interference and undercutting - Helical, bevel, worm, rack and pinion gears. **Gear trains:** Gear trains - Speed ratio - Train value
– Simple gear train – Compound and reverted gear train – Epicyclic gear trains.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Define link, pairs, mechanisms, inversion, structure and machines. Explain various terminologies associated with theory of machine. Draw inversions of different mechanisms.	PO1, PO2 ,PO3
CO2	Draw velocity and acceleration diagram for a given mechanism. Calculate velocity and acceleration from a given mechanism.	PO1, PO2, PO4
CO3	Explain steering geometry. Describe various steering mechanisms with its need and importance. Identify various linkages of steering mechanisms, steering gears.	PO1, PO2, PO3,
CO4	Explain different types of cams and cam followers and its motions. Construct different types of CAM profile for a given data.	PO1, PO2, PO3, PO4
CO5	Develop a practical approach to optimizing gear trains with spur gears based on a selection matrix of optimal materials, gear ratios and shaft axes positions.	PO1, PO2, PO3

Text Books:

1. Theory of Machines and Mechanisms, S.S.Rattan, 3/e, 2009, Tata McGraw-Hill Education Pvt.Ltd.
2. Theory of Machines, R.S Khurmi and J.K Gupta, 14/e, 2013, S.Chand & Company Pvt. Ltd.

Reference Books:

1. Theory of Machines, R.K Bansal, 5/e, 2010, Lakshmi Publications, New Delhi.
2. Theory of Machines, Sadhu Singh, 3/e, 2011, Pearson Education, New Delhi.
3. The Theory of Machines, Shiegley, 3/e, 2011, Oxford University Press, New Delhi.
4. Theory of machines, PL. Ballaney, 25/e, 2011, Khanna Publishers, New Delhi.
5. Theory of Machines, Thomas Bevan, 3/e, 2009, Pearson Education, New Delhi.

II B.Tech II Semester

18MEC223	**MANUFACTURING TECHNOLOGY**	L	T	P/D	C
		3	-	-	3

Course Educational Objectives:

CEO1: To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming,

CEO2: To understand the Powder metallurgy process and manufacture of plastic components.

UNIT – 1: METAL CASTING

Fundamentals of Casting: Steps involved in foundry and casting - Types of patterns - Pattern materials - Pattern allowances - Moulding sand types, properties and testing - Core moulding - Moulding machines - Concept of solidification of metals and alloys - Design considerations in casting - Principles of gating - Methods of melting by crucible, blast and cupola furnaces - Defects in casting. **Special Casting Processes:** Pressure die casting - Centrifugal casting - Investment - Shell mould - Continuous casting - Plaster mould – Vacuum casting - Ceramic mould - CO_2 process - Stir casting.

UNIT – 2: WELDING TECHNOLOGY

Classification of welding process - Types of welds and welded joints and their characteristics - Design of welded joints - Heat affected zones in welding - Types of electrodes. **Gas welding:** Flame characteristics – Oxy-acetylene, Oxy-hydrogen and air-acetylene welding. **Arc Welding:** Metal arc welding - TIG and MIG welding - Submerged arc welding - Electro slag and gas welding - Plasma arc welding. **Solid State Welding:** Friction and friction stir welding - Explosive welding. **Resistance Welding:** Spot and projection welding. **Modern Welding Process:** Thermit welding - Electron beam welding - Induction welding - Laser welding - Welding defects causes and remedies. **Other Process:** Gas cutting - Brazing and soldering – Introduction of Nondestructive testing of welds.

UNIT – 3: ROLLING, EXTRUSION AND DRAWING PROCESSES

Hot and Cold working: Strain hardening - Recovery, Recrystallization and grain growth - Cold and hot working processes and comparison. **Rolling:** Fundamentals - Theory of rolling - Types of rolling mills and products - Forces in rolling and power requirements - Rolling operations - Defects in rolled parts. **Extrusion of Metals:** Basic extrusion process and its characteristics - Hot extrusion and cold extrusion - Forward extrusion and backward extrusion - Impact extrusion - Hydrostatic extrusion. **Drawing:** Types of drawing methods - Wire drawing and tube drawing.

UNIT – 4: FORGING AND SHEET METAL PROCESSES

Forging Processes: Principles of forging - Forging process - Tools and dies - Types: Smith, drop, roll and rotary forging - Forging hammers - Forging defects. **Sheet Metal Processes:** Sheet metal characteristics - Formability of sheet metals test methods for formability - Shearing, bending and drawing operations - Stretch forming - Hydro forming - Rubber forming - Explosive forming - Magnetic pulse forming - Peen forming - Super plastic and micro forming - Metal spinning.

UNIT – 5: POWDER METALLURGY AND MANUFACTURE OF PLASTIC COMPONENTS

Powder Metallurgy: Powder metallurgy process - Preparation of powders - Characteristics of metal powders - Mixing - Compacting - Sintering - Applications - Forming and shaping of ceramics and glass. **Manufacture of Plastic Components:** Types and characteristics of plastics Bonding of Thermoplastics - Moulding of thermoplastics - Extrusion - Injection moulding - Blow moulding - Rotational moulding -Thermoforming - Compression moulding - Transfer Moulding.

Course Outcomes:

On successful completion of the course the student will be able to		POs related to COs
CO1	Illustrate principles of foundry and recognize the different types of casting processes for manufacturing components and design the gating and riser system.	PO1, PO3
CO2	Demonstrate various types of joining processes and choose the appropriate one according to the application.	PO1, PO2
CO3	Explain the concept of forging ,rolling and drawing operations.	PO1,PO3
CO4	Illustrate the various sheet metal forming processes for a specific application.	PO1, P03
CO5	Acquire the knowledge of metal powder production methods and classify different molding process and select suitable manufacturing process for the typical component with the aim of reducing cost and manpower.	PO1, P03, PO12

Text Books:

1. Manufacturing Technology, P.N. Rao, 3/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Manufacturing Technology, Kalpak Jain, 4/e, 2002, Pearson Education, New Delhi.

Reference Books:

1. Production Technology, R.K. Jain, 17/e, 2011, Khanna publishers, New Delhi.
2. Process and Materials of Manufacturing, Lindberg, 4/e, 2008, Pearson Education, New Delhi.
3. Manufacturing Technology, R.K. Rajput, 1/e, 2007, Laxmi Publications (P) Ltd.,New Delhi.
4. A Text book of Manufacturing Technology-II, P.C.Sharma, 1/e, 2008, S.Chand &Company Pvt. Ltd., New Delhi.
5. Elements of workshop Technology -Vol I and II, S.K.Hajra Chouldhary and A.K.Hajra Choudhury, 1997, Media promoters and Publishers Private Limited, Mumbai.

II B.Tech II Semester

18MEC224	**AUTOMOBILE ENGINEERING**	L	T	P/D	C
		2	1	-	3

Course Educational Objectives:

CEO1: To understand the construction and working principle of various parts of an automobile

CEO2: To have the practice for assembling and dismantling of engine parts and transmission system

CEO3: To develop the knowledge on steering system and wheel alignment.

CEO4: To describe functioning of suspension , braking system and to identify the new technologies of braking system.

CEO5: Detecting the emissions from automobile and analyze the engine management system.

UNIT – 1: VEHICLE STRUCTURE, ENGINES AND FILTERS

Vehicle Structure: Introduction - Components of an automobile - Basic structure - Power unit - Chassis, frames and body - Resistance to vehicle motion - Power transmission - Rear wheel drive, Front wheel drive and four wheel drive. **Automobile Engines:** Types - Construction - Components - Functions and materials - Turbo charging and super charging. **Filters:** Oil filters - Air filters - Fuel filters.

UNIT – 2: TRANSMISSION SYSTEM

Clutches: Requirements and types clutch - Principles of friction clutches - Dry friction and wet clutches - Clutch operations - Principles of fluid fly wheel - Trouble shooting. **Gear Box:** Function and necessity of transmission - Principles and features of sliding mesh, constant mesh, synchromesh, epi-cyclic gear box and torque converter - Over drive - Automated manual transmissions - Trouble shooting. **Drive Line:** Propeller shaft, universal joint, final drive (differential), rear axles and rear axle drives.

UNIT – 3: STEERING SYSTEM

Wheels and Tyres: Types of wheels - Tyre properties and types. **Front axle and steering:** Front axle - Wheel alignment - Factors of wheel alignment - Factors pertaining to wheels - Steering geometry - Center point steering - Steering mechanisms - Vehicle handling - Steering linkages - Steering gears - Power steering – Four wheel steering – Trouble shooting.

UNIT – 4: SUSPENSION AND BRAKING SYSTEM

Suspension System: Objects - Rigid axle suspension system - Torsion bar - Shock absorber - Independent suspension system – Air suspension system. **Braking System**: Drum and disc brake system, Mechanical brake system, hydraulic brake system, pneumatic and vacuum brake systems - Antilock braking system, electronic brake force distribution and traction control.

UNIT –5: EMISSION AND ELECTRICAL SYSTEM

Emission: Emission from automobiles - Pollution standards national and international - Pollution control - Techniques - Multipoint fuel injection for SI engines - Common rail diesel

injection, emissions from alternative energy sources - Hydrogen, biomass, alcohols, LPG, CNG. **Electrical System:** Charging circuit, generator, current-voltage regulator - Starting system, Bendix drive, mechanism of solenoid switch, lighting systems, horn, wiper, fuel gauge, oil pressure gauge and engine temperature indicator - Working of engine management system - Intelligent lighting system – Night vision system.

Course Outcomes:

On successful completion of the course the student will be able to,		POs related to COs
CO1	Acquired knowledge on vehicle components and basic construction	PO1, PO4
CO2	Synthesized the principles of transmission system in automobile, and identify the trouble shooting problems in transmission	PO1, PO2, PO3
CO3	Identified the steering system, wheel alignment and trouble shooting.	PO1, PO2 PO4,
CO4	Understand the functioning of suspension and braking system, identified the new technologies of braking system	PO1, PO3, PO4,PO5
CO5	Understand the emissions from automobile and analyzed the engine management system	PO1, PO3,PO7,PO12

Text Books:

1. Automobile Engineering-Vol.I and II, Kirpal Singh, 12/e, 2011 Standard Book House, New Delhi.
2. Automotive Mechanics, William Crouse, 10/e, 2006, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference Books:

1. Automobile Engineering, R.K.Rajput, 1/e, 2007, Laxmi Publications (P) Ltd., New Delhi.
2. Automobile Engineering, K.K. Ramalingam, 2/e, 2003, Scitech Publishers, Chennai.
3. Automotive Engines, Newton, Steeds and Garret, Butterworth Publishers.
4. Internal Combustion Engines, V.Ganesan, 4/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Automobile Engineering: Vol-I, P.S.Gill, 2011, S.K.Kataria and Sons Publications, New Delhi.

II B.Tech II Semester

18MBA221	**PRINCIPLES OF MANAGEMENT**	L	T	P/D	C
		3	-	-	3

Course Educational Objectives:

CEO1: To enable the students to study the evolution of management and organizations
CEO2: To study the functions and principles of management and to learn the application of the principles in an organization.

UNIT – 1: INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of management – Science or art – Manager Vs Entrepreneur – Types of managers – Managerial roles and skills – Evolution of management – Scientific, human relations , system and contingency approaches – Types of business organization – Sole proprietorship, partnership, company – Public and private sector enterprises – Organization culture and environment – Current trends and issues in management.

UNIT – 2: PLANNING

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic management – Planning Tools and techniques – Decision making steps and process.

UNIT – 3: ORGANISING

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and decentralization – Job design – Human resource management – HR planning, recruitment, selection, training and development, performance management , career planning and management.

UNIT – 4: DIRECTING

Foundations of individual and group behaviour – Motivation – Motivation theories – Motivational techniques – Job satisfaction – job enrichment – Leadership – Types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT – 5: CONTROLLING

System and process of controlling – Budgetary and non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

Course Outcomes:

On successful completion of the course the student will be able to,		POs related to COs
CO1	Understand the concepts of organization, management and the role of managers. Then the global management and ethical responsibilities of the engineer to the organization and society.	PO6,PO9,PO10, PO12
CO2	Obtain the knowledge of planning processes, types of plans, strategies, policies and decision making processes. And how to function effectively as a individual and team work with management principles in ethical manner.	PO6, PO8,PO9,PO10, PO11
CO3	Gain the knowledge of organizing, organization structure and the importance of team work in groups, departmentation, staffing, selection and recruitment, understanding of the engineering and management principles.	PO6,PO9,PO10, PO12
CO4	Acquire the knowledge of directing, motivation, leadership, communication in the management of the organization. And they will understand the responsibilities of the individual and team work to manage the organization culture with ethical principles.	PO6,PO8, PO9,PO10,PO12
CO5	Know about the controlling, types of control and how to manage projects in multidisciplinary environment through proper communication. Then the life-long learning of the management skills in the broadest context of technological change.	PO6,PO9,PO10, PO11,PO12

Text Books:

1. Total Quality Management, Dale.H.Besterfiled, 3/e, 2010, Pearson Education, New Delhi.
2. Principles of Management, M. Govindarajan and S. Natarajan, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Management, Stephen P. Robbins and Mary Coulter, 8/e, Prentice Hall of India.
2. Principles of Management, Charles W.L Hill, Steven L McShane, 2007Mcgraw Hill Education, Special Indian Edition.
3. Management-A Competency Based Approach, Hellriegel, Slocum and Jackson, 10/e, 2007, Thomson South Western.
4. Management – A global and Entrepreneurial Perspective, Harold Koontz, Heinz Weihrich and mark V Cannice, 12/e, 2007, Tata Mcgraw Hill.
5. Essentials of Management, Andrew J. Dubrin, 7/e, 2007, Thomson South western.

II B.Tech II Semester

		L	T	P/D	C
18MEC226	**THERMAL ENGINEERING & AUTOMOBILE ENGINEERING LAB**	-	-	2	1

Course Educational Objectives:

CEO1: To develop the basic knowledge of timing diagram and to analyze the performance of IC engines.
CEO2: To introduce the methods to study the heat distribution and improve the performance of IC engines,
CEO3: To analyze the performance of air compressor, study of boilers and air conditioning system.
CEO4: To study, dismantling and assembling of SI/CI for two stroke/four stroke engines and fuel systems.
CEO5: To study, dismantling and assembling of power transmission, steering and breaking systems in automobiles.

List of Experiments:

1. **a)** Valve timing diagram of an IC engines.
   b) Port timing diagram of an IC engines.
2. Performance test on 4 -stroke diesel engines.
3. Heat balance sheet of an IC engine.
4. Retardation test on 4- stroke diesel engine.
5. Study of boilers.
6. Performance test on 2-stroke multi cylinder petrol engine.
7. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinderpetrol engine.
8. Performance test on reciprocating air compressor unit.
9. Performance test on variable compression ratio engines and economical speed test.
10. Motoring test on 4- stroke petrol engine.
11. Study air conditioning system.
12. Study, dismantling and assembling of multi cylinder petrol/diesel engine.
13. **a)** Study of petrol engine fuel system.
    b) Study of diesel engine fuel system.
14. **a)** Study and measurement of heavy commercial vehicle frame.
    b) Study, dismantling and assembling of front and rear axles.
15. **a)** Study, dismantling and assembling of clutch.
    b) Study, dismantling and assembling of gear box.
    c) Study, dismantling and assembling of differential.
16. **a)** Study of steering system.
    b) Study of breaking system.

Course Outcomes:

On successful completion of the course, students will be able to:		POs related to COs
CO1	Demonstrate the knowledge on Automobile system, engines and air compressor.	PO1
CO2	Identify and analyse various performance parameters of engines and compressors.	PO2
CO3	Develop systems to identify the performance parameters of engines and compressors and Dismantle and assemble various parts of transmission systems in automobile system.	PO3
CO4	Conduct investigation on performance of various engines, air compressors and provide valid conclusion about its efficiency, heat balance, engine friction, speed and retardation.	PO4
CO5	Follow ethical principle in conduction of experiments.	PO8
CO6	Perform individually and also in a team to complete the process	PO9
CO7	Communicate in verbally or in written form, their understanding about the experiments.	PO10
CO8	Continue updating their knowledge on various testing methods evolve in future for the identification of performance parameters of engines and compressors.	PO12

Text Books:

1. Lab manual provided by the department.

II B.Tech II Semester

18MEC227 **MANUFACTURING TECHNOLOGY LAB**

L	T	P/D	C
-	-	2	1

Course Educational Objectives:

CEO1: To help students acquire knowledge about the behavior and manufacturing properties of all engineering materials and basic concepts of welding, foundry and casting processes.

CEO2: To help students acquire knowledge about sheet metal and manufacture plastic components.

List of Experiments:

1. Pattern design and Moulding.
   a) Single pattern b) Split pattern
2. Sand properties testing.
3. Melting and casting.
4. Arc welding.
   a) Lap joint, b) Butt joint, c) Single 'V' butt joint, d) Double 'V' butt joint
   e) T-corner joint
5. Spot welding.
6. TIG welding.
7. Gas welding.
8. Gas cutting.
9. Study of simple, compound and progressive press tool.
10. Blanking and piercing operation.
11. Bending operations.
12. Injection moulding.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Gain the knowledge on the principles of foundry, the metal joining, forming processes	PO1
CO2	Analyze and choose the appropriate metal joining and forming processes.	PO2
CO3	Design and manufacturing components by adopting the concept of forging ,rolling and drawing operations.	PO3
CO4	Develop the plastic components using modern machine tools.	P05
CO5	Follow the ethical principles while doing the experiments	PO8
CO6	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO8	Continue updating their skill related to manufacturing process in future.	PO12

Text Books:

1. Lab manual provided by the department.

II B.Tech II Semester

18MEC228	**ONLINE COMPREHENSIVE TEST-I**	L	T	P/D	C
		1	-	-	1

Course Educational Objectives:

CEO1: To assess the comprehensive knowledge gained in basic courses relevant to the branch of study.

CEO2: To comprehend the questions asked and answer them with confidence.

On-line Comprehensive Test:

On-line comprehensive test will be conducted at the end of the II year II semester with 100 objective questions (multiple choice questions) for 100 marks on the courses studied in the respective semesters (II year I semester and II year II semester).

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Understand and comprehend any given problem related to mechanical engineering field.	PO1,PO2,PO3,PO4, PO5,PO6, PO7, PO8, PO9,PO10,PO11,PO12
CO2	The students will be confident in discussing the fundamental aspects of any engineering problem/situation and give answers in dealing with them.	PO1,PO2,PO3,PO4, PO5,PO6, PO7, PO8, PO9,PO10,PO11,PO12

II B.Tech II Semester

		L	T	P/D	C
18AUD212	**ENVIRONMENTAL SCIENCE**				
	(Common to All Branches)	2	-	-	-

Course Educational Objectives:

CEO1: To study the nature and facts about environment.
CEO2: To finding and implementing scientific, technological, economic and political solutions to environmental problems.
CEO3: To study the interrelationship between living organism and environment.
CEO4: To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
CEO5: To study the dynamic processes and understand the features of the earth's interior and surface.
CEO6: To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT – 1: INTRODUCTION TO ENVIRONMENTAL SCIENCE AND NATURAL RESOURCES

Introduction: Definition - Scope and importance of environment - Need for public awareness - Natural Resources: Forest resources: Use and over-exploitation - Deforestation - Conservation of forests. **Mineral resources:** Use and exploitation - Environmental effects of extracting mineral resources - Case studies. **Energy resources:** Conventional energy resources - Natural gas and Nuclear fuels - Non-conventional energy resources - Solar energy - Wind energy - Tidal energy - Geothermal energy and Biogas energy - Use of alternate energy sources - Case studies.

UNIT – 2: ECOSYSTEM AND BIODIVERSITY

Ecosystem: Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem - Food chains - Food webs - Ecological pyramids - Types - Characteristic features - Structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (Ponds - Streams - Lakes - Rivers - Oceans - Estuaries). **Biodiversity:** Introduction to biodiversity - Genetic - Species and Ecosystem diversity - Value of biodiversity: Consumptive value - Productive value - Social value - Ethical value - Aesthetic and Option values -Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – 3: POLLUTION AND WASTE MANAGEMENT

Definition - Causes - Effects - Control measures of pollution. **Air Pollution:** Types of pollutants - Their sources and impacts - Air pollution control. **Noise Pollution:** Impacts of noise - Permissible limits of noise pollution - Measurement of noise - Control of noise pollution. Soil Pollution: Causes of soil degradation - Excessive use of fertilizers - Problems with pesticide use - Excess salt and water. **Solid waste management:** Characteristics - Generation - Collection and transportation of solid wastes - Engineered systems for solid waste management (reuse, recycle, energy recovery, treatment and disposal).

UNIT – 4: SOCIAL ISSUES AND THE ENVIRONMENT

Water conservation measures - Rain water harvesting and water shed management - Resettlement and rehabilitation of people - Its problems and concerns - Case studies - Role of NGO's - Climate change - Global warming (Green house effect) - Ozone layer depletion - Acid rain - Nuclear accidents. Sustainable development: Definition - Objectives - Environmental dimensions of sustainable development.

UNIT– 5: ENVIRONMENTAL LEGISLATION AND HUMAN POPULATION

Environmental acts: The water (Prevention and control of pollution) Act - The air (Prevention and control of pollution) act - The wild life (protection) act - The forest conservation act - The environmental protection act. **Case studies:** Chipko movement - Narmada bachao andolan - Silent valley project - Chernobyl nuclear disaster - and Bhopal gas tragedy. **Population growth:** Variation among nations - Population explosion - Value education - HIV/AIDS - Role of information technology in environment and human health - Case studies.

Field Work:

Visit to a local area to document environmental assets: River/ Forest/ Grasslands/ Mountains
Visit to local polluted site: Urban/ Rural/ Industrial/ Agriculture
Study of simple ecosystems: Pond/ River/ Hill slope etc.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Gain the knowledge of natural resources of the nation and to preserve and utilize it in an appropriate manner through various projects.	PO6, PO7, PO8
CO2	Understand the concepts of environment, ecosystem, biodiversity of the nation, social and ethical responsibilities of the engineer to the society.	PO6, PO7, PO8
CO3	Realize and create the public awareness regarding various environmental pollutions in the society and to control it through individual and team work for the environmental sustainability in ethical manner.	PO6, PO7, PO8
CO4	Acquire the knowledge of social issues and its impact on the environment, sustainable development, various acts and its amendments to protect the environment through various projects and disaster management.	PO6, PO7, PO8
CO5	Know about the increase in human population and its variation among nations, human rights, role of communication in environment and human health.	PO6, PO7, PO8

Text Books:

1. Text book of Environmental Studies, 4/e, 2012, C.P. Kaushik and Anubha Kaushik, New Age International (P) Ltd., Publishers, New Delhi.
2. Text book of Environmental Studies, 1/e, 2008, Erach Bharucha, University Press (India) Private Ltd. Hyderabad.

Reference Books:

1. Environmental Studies-From Crisis to Cure, 2/e, 2012, R. Rajagopalan, Oxford University Press , New Delhi.
2. A Text Book of Environmental science and Technology ,1/e, 2008, Dr.M.Anji Reddy, B.S. Publications, Hyderabad.
3. Principles of Environmental Science and Engineering, 1/e, 2005, Keerthinarayana and Daniel Yesudiam, Hi –Tech Publications , Chennai.
4. Glimpses of Environment , 1/e, 2005, Dr. KVSG Murali Krishna, Environmental Protection Society, Kakinada, India.
5. Environmental Studies, 1/e, 2009, Anindita Basak , Pearson Education, New Delhi.

II B.Tech II Semester

18SAH223	**REASONING AND APTITUDE - II**	L	T	P/D	C
		2	-	-	-

Course Educational Objectives:

CEO1: To apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.

REASONING AND APTITUDE

Time and work – Pipes and cistern – Time, distance and speed – Problems on trains – Boats and streams – Allegations / mixture – Permutations and combinations – Probability – Logarithms – Analogy – Classifications – Completion of incomplete patterns – Area, surface area and volume – Heights and distances – Calendars' based problems – Clocks – Data interpretation (tabulation- line graphs, bar graphs, pie charts) – Data sufficiency.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Apply the mathematical concepts in real life problem solving methodologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12
CO2	Apply the reasoning knowledge in real life problem solving methodologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10,PO11, PO12

Text Books:

1. Quantitative Aptitude, Dr.R.S.Aggarwal, 2012, S.Chand and Company Ltd, New Delhi.
2. A Modern Approach to Verbal and Non-Verbal Reasoning, Dr.R.S.Aggarwal, 2012, S.Chand and Company Ltd, New Delhi.

Reference Books:

1. Quantitative Aptitude for Competitive Examinations, Abhijit Guha, 14/e, 2010, Tata McGraw Hill Publishers, New Delhi.
2. Course in Mental Ability and Quantitative Aptitude, Edgar Thorpe, 3/e, 2012, Tata McGraw Hill Publishers, New Delhi.
3. Fast Track Objective Arithmetic, Rajesh Verma, 2012, Arihant Publications, Meerut

III B.Tech I Semester

L	T	P	C
2	1	0	3

18MEC311 THERMAL ENGINEERING – II

Course Educational Objectives:

1. To apply the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance
2. To classify and analyze the boiler and draught to increase its efficiency
3. To realize the concepts of steam flow through nozzle and the condenser
4. To understand the thermodynamic concepts for steam turbines.
5. To gain basic knowledge about gas turbine and jet propulsion.

UNIT – 1: STEAM POWER CYCLE (9)

Rankine cycle – Schematic layout, comparison between Rankine cycle and Carnot cycle. Thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance: Reheat cycle – Regenerative cycle – Binary vapour cycle.

UNIT – 2: BOILERS AND DRAUGHT (9)

Boilers: Classification of steam boilers – Modern high pressure boilers –Mountings and accessories – Methods of feed water treatment – Equivalent evaporation – Boiler efficiency – heat losses in a boiler – Heat balance sheet. **Draught:** Classification – Natural draught: Chimney height and diameter – Condition for maximum discharge through a chimney – Artificial draught: Forced draught, induced draught and balanced draught.

UNIT – 3: STEAM NOZZLES AND STEAM CONDENSERS (9)

Steam Nozzles: Introduction - Steam flow through nozzles – Nozzle efficiency – Supersaturated flow in a nozzle. **Steam Condensers:** Requirements of steam condensing plant – Classification – Sources of air in condensers – Effects of air leakage in a condenser – Vacuum measurement – Vacuum efficiency and condenser efficiency – Edwards's air pump – Cooling towers.

UNIT – 4: STEAM TURBINES (9)

Classifications – Compounding – Velocity diagrams for impulse and reaction turbine – Condition for maximum efficiency in De-Laval impulse turbine and Parsons reaction turbine – Degree of reaction – State point locus and reheat factor – Bleeding – Governing and control.

UNIT – 5: GAS TURBINES AND JET PROPULSION (9)

Gas Turbines: Classifications, simple layout, essential components and performance – Ideal and actual cycle – Regeneration – Inter cooling and reheating – Constant pressure gas turbine – Constant volume gas turbines – Methods improvement of thermal efficiency – Effects of operating variables. **Jet Propulsion:** Classification – T-S Diagram – Thrust, thrust power and propulsion efficiency – Working principles of turbo jet, turbo prop, ram jet, pulse jet engine and rocket engine – Introduction to Rocket propulsion.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Apply the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance.	**PO1,PO2,PO3**
CO2	Analyze different types of boilers and drafts to compute their performance parameters.	**PO1,PO2,PO3, PO4**
CO3	Analyze the performance of steam nozzle and condenser, to calculate critical pressure ratio.	**PO1,PO2, PO3,PO4**
CO4	Evaluate the performance of steam turbines through velocity triangles.	**PO1, PO2, PO3,PO4**
CO5	Understand and analyze the different types of gas turbines and jet propulsions.	**PO1,PO2,PO3**

Text books:

1. Basic and Applied Thermodynamics, P.K. Nag, 2/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Thermal Engineering, Mahesh. M. Rathore, 1/e, 2010, Tata McGraw Hill, New Delhi.

Reference books:

1. Thermal Engineering, Soman. K, 2/e, 2011, Prentice Hall of India, 2011.
2. Thermal Engineering, Ballaney. P.L .25/e, 2017, Khanna publishers.
3. Thermal Engineering, R.K Rajput, 10/e, 2018, Laxmi Publications (P) Ltd, New Delhi.
4. Thermal Engineering, R.S.Khurmi and J.K.Gupta, 15/e, 2018, S Chand & Company Pvt. Ltd., New Delhi.
5. A Course in Thermal Engineering, Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V., 6/e, 2011. Dhanpat Rai & Sons.
6. Thermal Engineering, Sadhu Singh and Sukumar Pati, 1/2018, Pearson Education India.

Codes/Tables: Steam table book is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	2	2	2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	1	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-	-	-	-	-	-	-
CO.5	3	1	1	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**1.8**	**1**	-	-	-	-	-	-	-	-

III B.Tech I Semester

L	T	P	C
2	1	0	3

18MEC312 THEORY OF MACHINES - II

Course Educational Objectives:

1. To understand the gyroscopic effect on vehicles and study of friction in various machine elements.
2. To examine the dynamic concepts of the clutches, Brakes and dynamometer.
3. To understand the concepts of inertia forces and turning moment diagrams of IC engines.
4. To understand the force analysis and effects of balancing in rotors and engines.
5. To gain the basic knowledge on the dynamics of various governors.

UNIT – 1: GYROSCOPIC EFFECTS AND FRICTION (9)

Gyroscopes: Angular motion – Gyroscopic couple – Effect of gyroscopic couple an aero planes – Effect of gyroscopic couple on a naval ship during steering, pitching and rolling – Precession motion on the stability of moving four wheel and two wheel drive – Rigid disc at an angle fixed to rotating shaft. **Friction:** Laws of friction – Coefficient of friction – Friction of screw, nuts, screw jack and V-thread – Friction of journal bearing – Friction of journal pivot and collar bearing – Friction axis of link – Film friction.

UNIT – 2: CLUTCHES, BRAKES AND DYNAMOMETER (9)

Clutches: Friction clutches – Single disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch. **Brakes:** Materials for brake lining – Single, double and pivoted block – Simple and differential band brake – Band and block brake – Internal expanding brake – Braking of a vehicle. **Dynamometers:** Prony brake and rope brake absorption dynamometers – Epicyclic-train, belt transmission and torsion transmission dynamometers.

UNIT – 3: INERTIA FORCES AND TURNING MOMENT DIAGRAMS (9)

Inertia Forces: Introduction – D-Alembert's principle – Velocity and acceleration of the reciprocating parts in engines – Velocity and acceleration of the piston and connecting rod – Forces on the reciprocating parts of an engine – Equivalent dynamical system – Analytical method for inertia torque and force. **Turning Moment Diagrams:** Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine – Fluctuation of Energy – Crank effort – Coefficient of fluctuation of energy – Fly wheels – Coefficient of fluctuation of speed – Energy stored in fly wheel – Fly wheel design – Flywheel in punching press.

UNIT – 4: BALANCING OF ROTATING AND RECIPROCATING MASSES (9)

Rotating Masses: Balancing of rotating masses – Single and multiple planes, single and different planes. **Reciprocating Masses**: Primary, secondary and higher balancing of reciprocating masses – Unbalanced forces and couples – Balancing of coupled locomotives – V-type, multi cylinder, in-line and radial engines for primary and secondary balancing – Variation of tractive force, hammer blow and swaying couple – Analytical and graphical methods.

UNIT – 5: GOVERNORS (9)

Governors: Types - Watt, Porter and Proell governors – Hartnell, Hartung, Wilson-Hartnell and Pickering governors with auxiliary springs – Sensitiveness, stability, isochronous and hunting of governors – Effort and power of governor – Controlling force – Coefficient of insensitiveness.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the gyroscopic effects on various moving elements and also analyze the effects of friction in various mechanical elements.	**PO1, PO2 ,PO3,**
CO2	Analyze the effects of friction in clutches, brakes and dynamometers.	**PO1, PO2, PO3**
CO3	Analyze the force-motion relationship in components subjected to external forces and analyze of standard mechanisms.	**PO1, PO2, PO3, PO4**
CO4	Analyze the undesirable effects of unbalances resulting from prescribed motions in mechanism.	**PO1, PO2, PO3, PO4**
CO5	Understand and analyze the different types of governors.	**PO1, PO2, PO3, PO4**

Text books:

1. Theory of Machines and Mechanisms, S.S.Rattan, 5/e, 2019, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Kinematics and Dynamics of Machinery, Robert L Norton, 1/e, 2009, Tata McGraw-Hill Education Pvt.Ltd.

Reference books:

1. Theory of Machines and Mechanisms, John J. Uicker Jr, Gordon R. Pennock & Joseph E. Shigley, SI Edition, 3/e, 2009, Oxford University Press.
2. Theory of Machines, Thomas Bevan, 3/e, 2009, Pearson Education, New Delhi.
3. Theory of Machines, Sadhu Singh, 3/e, 2011, Pearson Education, New Delhi.
4. Theory of Machines, R.S Khurmi and J.K Gupta, 14/e, 2013, S.Chand & Company Pvt. Ltd. New Delhi.
5. Theory of Machines, PL. Ballaney, 25/e, 2011, Khanna Publishers, New Delhi.
6. Theory of Mechanisms and Machines, Amitabha Ghosh and Asok Kumar Mallik, 3/e, 2008, East-West Press Pvt Ltd.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	2	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-	-	-	-	-	-	-
CO.5	3	2	2	1	-	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**1.8**	**1**	-	-	-	-	-	-	-	-

III B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC313 MACHINE TOOLS TECHNOLOGY

Course Educational Objectives:

1. To apply the fundamental knowledge, principles and importance of metal cutting parameters.
2. To apply the fundamental knowledge on turning and automatic machine tools.
3. To apply the principles of reciprocating, milling and gear cutting machines.
4. To understand the working principles and applications of drilling, boring machines, jigs and fixtures
5. To apply the principles of abrasive processes and broaching processes.

UNIT – 1: THEORY OF METAL CUTTING (9)

Theory of Metal Cutting: Elements of cutting process – Geometry of single point tool and angles – Mechanics of chip formation – Types of chips – Chip breakers – Orthogonal and oblique cutting – Cutting forces – Merchant's force diagram –Thermal aspects – Cutting speeds feed, depth of cut and surface finish – Tool life, tool wear and tool materials – Cutting fluids – Machinability – Economics.

UNIT – 2: LATHES (9)

Engine Lathe: Constructional features – Specification – Principle of working – Operations – Taper turning and thread cutting methods – Work holders and tool holders – Special attachments – Machining time and power estimation. **Capstan and Turret Lathes:** Constructional features – Collet chucks – Work and tool holding devices – Tool layout. **Automatic Lathes:** Principal features of semi-automatic and automatic lathes – Classification – Single spindle and multi-spindle automatic lathes – Swiss type lathe – Automatic screw type lathe.

UNIT – 3: MILLING, SHAPER, SLOTTER, AND PLANNER MACHINES (9)

Milling Machine: Principles of working – Specifications – Classifications – Principal features of horizontal, vertical and universal milling machines – Milling operations – Geometry of milling cutters – Methods of indexing – Accessories to milling machines – Machining time calculations. **Shaping, Slotting, Planning and Machines**: Principles of working – Principal parts – Specification, classification, operations performed – Kinematic scheme of the shaping slotting and planning machines – Machining time calculations.

UNIT – 4: DRILLING, BORING, JIGS AND FIXTURES (9)

Drilling and Boring Machines: Principles of working, specifications, types, operations performed – Tool holding devices – Twist drill – Boring machines – Fine boring machines – Jig boring machine – Deep hole drilling machine – Kinematics scheme of the drilling and boring machines. **Jigs and Fixtures:** Principles of design – Classification – Principles of location and clamping – Types of clamping and work holding devices – Typical examples of jigs and fixtures.

UNIT – 5: ABRASIVE PROCESSES AND BROACHING (9)

Grinding Machine: Theory of grinding – Classification – Cylindrical and surface grinding machine – Tool and cutter grinding – Special types of grinding. **Grinding wheel:** Types of abrasives, bonds, specification and selection of a grinding wheel – Lapping – Honing – Comparison of grinding, lapping and honing. **Broaching Machines:** Broach construction – Push, pull surface and continuous broaching machines.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the theory of metal cutting, tool life and geometry of single point cutting tool.	**PO1,PO2,PO3**
CO2	Understand the basic principle of lathe and identify various cutting tools used for different operations.	**PO1,PO3**
CO3	Select suitable reciprocating machines for typical component.	**PO1,PO2,PO3**
CO4	Design jigs for drilling and fixtures for turning, milling.	**PO1,PO3**
CO5	Identify various grinding machines used for different operations.	**PO1,PO2**

Text Books:

1. Manufacturing Technology - Metal Cutting and Machine Tools, Volume – II, 4/e, Rao. P.N, 2018, Tata McGraw Hill, New Delhi.
2. Manufacturing Engineering and Technology (SI Edition), Serope Kalpakjian and Steven R. Schmid, 7/e, 2018, Pearson Education, New Delhi.

Reference Books:

1. Manufacturing Science, Amitabha Ghosh and Ashok Kumar Mallik, 2/e, 2010, East-West Press Pvt Ltd.
2. Production Technology - Machining Techniques and Automated Machine Tool Systems, Volume – II, R.K. Jain, 19/e, 2018, Khanna Publishers, New Delhi.
3. Fundamentals of Metal Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, 3/e, 2005, Routledge, CRC Press, Taylor and Francis Group.
4. Production Technology, Hindustan Machine Tools, Bangalore, India.
5. Workshop Technology-Vol II, B.S. Raghuwanshi, 2/e, 2006, S.Chand & Company Pvt. Ltd., New Delhi.
6. Elements of Workshop Technology- Machine Tools, Volume – II, Hajra Choudhury S.K and Nirjhar Roy, 15/e, 2010, Media Promoters and Publishers Pvt.Ltd.,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	-	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	-	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**0.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech I Semester

L	T	P	C
2	1	0	3

18MEC314 DESIGN OF MACHINE ELEMENTS

Course Educational Objectives:

1. To understand the design concepts and stress developed in machine members.
2. To design the machine elements subjected to static and variable loads.
3. To analyze the bolted and welded joints for various kinds of loads.
4. To design and analyze the temporary joints like cotter, knuckle and screwed joints.
5. To design the shafts and couplings for various applications.

UNIT – 1: DESIGN CONCEPTS AND STRESSES IN MACHINE ELEMENTS (9)

Design Concepts: Traditional design methods – Design synthesis and standards – Classifications, general considerations, procedures and basic requirements of machine design – Safety, ecological, societal, aesthetic and ergonomic considerations in design – Selection of engineering materials – BIS codes of materials – Manufacturing considerations in the machine design – Preferred numbers, selective assembly, limits, fits and tolerances. **Stresses in Machine Elements:** Basic concepts and applications of fracture mechanics – Simple stresses – Direct, bending and torsional stress equations – Impact, shock eccentric loading – Calculation of principle stresses for various load combinations – Curved beams – Crane hook and 'C' frame – Factor of safety – Theories of failure – Design for stiffness, strength and rigidity.

UNIT – 2: DESIGN FOR VARIABLE LOADS (9)

Cyclic stresses – Fatigue and endurance limit – Effect of loading, surface finish and size on endurance limit – Fatigue loading – Stress concentration factor – Stress concentration due to holes and notches – Fatigue failure – Fatigue stress concentration factor – Notch sensitivity – Gerber method ,Goodman method and Soderberg method – Combined variable normal stress and variable shear stress.

UNIT – 3: DESIGN OF PERMANENT JOINTS (9)

Riveted Joints: Types, Methods and material of riveting – Caulking and fullering – Failures – Strength and efficiency – Design of boiler through riveted joints – Design of boiler joints and pressure vessels – Uniform strength and eccentric loading. **Welded Joints:** Types – Weld symbols – Strength of transverse and parallel fillet welded joints – Special cases of fillet joint – Strength of butt joints – Stresses and stress concentration factor – Axially loaded unsymmetrical welded sections – Eccentrically load.

UNIT – 4: DESIGN OF TEMPORARY JOINTS (9)

Screwed Joints: Types – Designation of screw threads – Stresses in screwed fastening – Design of cylinder covers – Bolts of uniform strength – Design of a nut – Bolted joints under eccentric loading. **Cotter and Knuckle Joints:** Design of socket and spigot cotter joint, and sleeve and cotter, – Gib and cotter joint for Square rod, connecting rod, piston and crosshead – Cotter foundation bolt – Design of knuckle joint – Methods of failure of knuckle joint – Design of turnbuckle.

UNIT – 5: DESIGN OF SHAFTS, KEYS AND COUPLING (9)

Design of Shafts: Types and standard sizes of the shafts – Stresses in shafts – Design of shafts subjected to twisting, bending and combined moment – Shafts subjected to fluctuating, axial and combination loads – Design of shafts on the basis of rigidity. **Design of Keys and Coupling:** Types of keys – Forces and strength of sunk key – Effect of keyways – Types of shaft couplings – Design of rigid and flexible couplings.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Understand the design concepts and analyze the stress development in machine elements.	**PO1,PO2, PO3**
CO2	Design the machine members subjected to static and variable loads.	**PO1,PO2,PO3**
CO3	Analyze the bolted and welded joints for various kinds of loads.	**PO1,PO2,PO3, PO4**
CO4	Design and analyze the temporary joints like cotter, knuckle and screwed joints.	**PO1,PO2,PO3,PO4**
CO5	Design and analyze the shafts and couplings for various applications.	**PO1,PO2,PO3, PO4**

Text Books:

1. Design of Machine Elements, V.B. Bhandari, 4/e, 2016, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Shigley's Mechanical Engineering Design, Richard G. Budynas and Keith J. Nisbett, 10/e, 2015, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference Books:

1. Machine Design, Robert L. Norton, 5/e, 2018, Pearson Education Ltd., India.
2. A Text Book of Machine Design, R S Khurmi and J. K. Gupta, 34/e, 2018, S.Chand & Company Pvt. Ltd., New Delhi.
3. Machine Design, N. C. Pandya and C. S. Shah, 20/e, 2015, Charotar Publishing House Pvt. Ltd.
4. Machine Elements in Mechanical Design, Robert L Mott, 4/e, 2020, Pearson Education Ltd., India.
5. Mechanical Design of Machine Components, Ansel C. Ugural, 2/e, 2015, Taylor & Francis Group, LLC.
6. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, 1/e, 2016, Wiley India Edition.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2		-	-	-	-	-	-	-	-
CO.3	3	1	2	1	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-	-	-	-	-	-	-
CO.5	3	2	2	1	-	-	-	-	-	-	-	-
CO*	**3**	**1.8**	**2**	**1**	-	-	-	-	-	-	-	-

III B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC315 ENGINEERING METROLOGY AND MEASUREMENTS

Course Educational Objectives:

1. To understand the basic need for metrology and standards of measurements
2. To study the principle and applications of various linear, angular and measuring instruments.
3. To apply the principles and methods of form measurements and surface metrology.
4. To develop the advanced measurements for quality control in manufacturing industries.
5. To discuss various measuring techniques of mechanical properties in industrial applications.

UNIT – 1: NEED FOR METROLOGY AND STANDARDS OF MEASUREMENTS (9)

Introduction: Need for inspection and quality control – Factors affecting the measurements – Methods of measurements – Characteristics of measuring instruments – Errors in measurements – Precision, accuracy, calibration and uncertainty. **Standards:** Line, end and wave length standards – Limits, fits and tolerances – Unilateral and bilateral system – Hole and shaft basis systems – Interchangeability and selective assembly – Fundamentals of GD & T – Indian Standard Institution (ISI) system – International Standard (IS) system. **Gauges**: Plug, ring, snap, taper and position gauges – Taylors's principle – Design of Go and No Go gauges.

UNIT – 2: LINEAR, ANGULAR MEASUREMENTS AND COMPARATORS (9)

Linear Measuring Instruments: Graduated scales – Scaled instruments – Vernier caliper –Vernier height gauge – Micrometer – Types of micrometers – Slip gauges – Dial indicators. **Angular measurements:** Bevel protector, sine bar, sine centre, angle dekkor, clinometer, angle gauges, autocollimator and alignment telescope. **Comparator:** Mechanical, pneumatic, optical and electrical comparators and applications.

UNIT – 3: FORM MEASUREMENTS AND SURFACE FINISH MEASUREMENT (9)

Form Measurements: Principles and methods of straightness – Flatness measurements – Measurements of roundness – Measurement of screw thread elements – Measurement of gear elements. **Surface Finish Measurement:** Surface texture – Surface roughness – Codes – Analysis of surface traces – Methods for measuring surface roughness – Introduction to 3D surface metrology.

UNIT – 4: ADVANCES IN METROLOGY (9)

Laser in Metrology: Michelson, single frequency, NPL and DC interferometer – Laser interferometer – Optical flats – Toolmaker's microscope – Profile projector – Ball bar tests. **CMM:** Constructional features, types, probes, accessories, software and applications. **Machine Vision:** Basic concepts – Elements – Applications – On-line and in-process monitoring – Computed tomography – White light Scanners.

UNIT – 5: MEASUREMENT OF DISPLACEMENT, FORCE, TORQUE AND TEMPERATURE (9)

Displacement, Speed, Force, Torque, and Strain: LVDT – Piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers – Tachometers – Stroboscope – Measurement of force by direct methods, load cells and proving rings – Measurement of torque by torsion-bar, servo-controlled and absorption dynamometer – Measurement of strain by mechanical and electrical strain gauges. **Temperature and Pressure:** Measurement of temperature by bimetallic strip, thermocouples, pyrometry, thermistors and electrical resistance thermometer – Measurement of pressure by dead weight gauges and manometers, elastic and resonant transducers, vibrating cylinder, high and low pressure measurement – Measurement of vacuum by McLeod and Pirani gauge.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the importance of measurements in engineering and the factors affecting measurements and to estimate measurement uncertainty and its knowledge using lifelong.	**PO1, PO2, PO5, PO12**
CO2	Apply the working principle and applications of various linear and angular measuring instruments and basic concepts of comparators uncertainty and its knowledge using lifelong.	**PO1, PO5, PO12**
CO3	Apply the principles and methods of form measurements and surface metrology	**PO1, PO5**
CO4	Apply the advances in measurements for quality control in manufacturing industries.	**PO1, PO2, PO5**
CO5	Understand various measuring techniques of mechanical parameters in industrial applications.	**PO1, PO2, PO5**

Text Books:

1. Engineering Metrology, R.K. Jain, 21/e, 2020, Khanna Publishers, New Delhi.
2. Engineering Metrology and Measurements, N.V. Raghavendra and L. Krishnamurthy, 1/e, 2013, Oxford University Press.

Reference Books:

1. Fundamentals of Dimensional Metrology, Connie L. Dotson, 6/e, 2016, Cengage Learning, India.
2. Metrology & Measurement, Anand K Bewoor and Vinay A. Kulkarni, 1/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Handbook of Dimensional Measurement, Mark Curtis and Francis T. Farago, 5/e, 2013, Industrial Press.
4. Mechanical Measurements, S. P. Venkateshan, 2/e, 2015, John Wiley &Sons.
5. Mechanical Measurements, Thomas G. Beckwith, Roy D. Marangoni and John H. Lienhard V, 6/e, 2009, Pearson Educations, New Delhi.
6. The Metrology Handbook, Jay L. Bucher, 2/e, 2012, The Measurement Quality Division, ASQ.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	1	-	-	-	-	-	-	1
CO.2	2	-	-	-	1	-	-	-	-	-	-	1
CO.3	2	-	-	-	2	-	-	-	-	-	-	-
CO.4	3	2	-	-	2	-	-	-	-	-	-	-
CO.5	3	2	-	-	2	-	-	-	-	-	-	-
CO*	**2.6**	**2**	**-**	**-**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

III B.Tech I Semester

L	T	P	C
2	1	0	3

18MEC316 OPERATIONS RESEARCH

Course Educational Objectives:

1. To select the constraints on the availability of resources and developing a model for rendering an optimal solution.
2. To evaluate the challenges in the transportation and assignment problems and furnishing a rational solution to maximize the benefits.
3. To investigate the nature of the project/ failure and offering methodical assistance towards sequencing
4. To analyze the decision criteria's and strategies in game theory.
5. To expand the basic knowledge on queuing theory.

UNIT – 1: LINEAR PROGRAMMING MODELS (9)

Characteristics, phases and scope of operations research – Linear programming formulation – Graphical method of solution – Simplex method – Artificial variables – Big-M method – Two-phase method – Dual simplex method – Duality theorem – Principle of duality – Economic interpretation of the duality – Complementary slackness theorem – Revised simplex method.

UNIT – 2: TRANSPORTATION AND ASSIGNMENT PROBLEMS (9)

Transportation Problem: Formulation – Feasible solutions – North west corner rule, least cost method and Vogel`s approximation method – Optimal solution by MODI method – Unbalanced transportation problem – Degeneracy – Maximization type. **Assignment Problem:** Formulation – Minimization and maximization problems – Unbalanced assignment problem – Traveling salesman problem.

UNIT – 3: NETWORK AND SEQUENCING MODELS (9)

Network models – Minimal spanning tree algorithm – Shortest route problem – Maximal flow models – Minimum cost flow problem – Network simplex method – Project network – CPM and PERT – Critical path and float calculations – Determining minimum time required to complete the project. **Sequencing:** 'n' jobs through two machines – 'n' jobs through three machines – 'n' jobs through 'm' machines

UNIT – 4: DECISION THEORY AND GAME THEORY (9)

Decision Theory: Decision criteria and trees – Maximin and maximax – Hurwicz, laplace, savage and EOL criterion – Decision making under risk. **Game Theory:** Zero sum games – Games with and without saddle points – 2×2 games – Games with mixed strategies – Dominance principle and property – Graphical method.

UNIT – 5: QUEUING THEORY (9)

Queuing Theory: Queuing models and networks – Pure birth and death models Poisson queuing model – Poisson queuing model – Balking, Reneging, Jockeying – Kendall notation – Single, multi and machine server model – Exponential distribution – Constant rate service – Infinite and finite population – Exponential service –Monte Carlo simulation technique.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Select the constraints on the availability of resources, develop a model and render an optimal solution during the given circumstances.	**PO1,PO2,PO3**
CO2	Appraise the challenges in the transportation and assignment problems and furnish a rational solution to maximize the benefits.	**PO1,PO2,PO3**
CO3	Construct the network diagram and estimate the time required to complete the project and determine optimum processing job order and investigate the nature of the project/ failure and offering methodical assistance towards sequencing.	**PO1,PO2, PO3, PO11**
CO4	Analyze the decision criteria's and strategies in game theory.	**PO1,PO2,PO3**
CO5	Expand the basic knowledge on queuing theory.	**PO1,PO2,PO3**

Text Books:

1. Operations Research, P. Sankara Iyer, 1/e, McGraw Hill Education (India) Private Ltd.
2. Operations Research an Introduction, Hamdy A. Taha, 10/e, 2017, Pearson Education Limited.

Reference Books:

1. Introduction to Operations Research, Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag and Preetam Basu, 10/e, 2017, Tata McGraw HillEducation Pvt. Ltd.
2. Operations Research: Applications and Algorithms, Wayne L Winston, 4/e, 2020, Cengage Learning, India.
3. Operations Research, R. Panneerselvam, 2/e, PHI, Learning (P) Ltd.
4. Operations Research, M. Sreenivasa Reddy, 4/e, 2019, Cengage Learning, India.
5. Quantitative Techniques in Management, N D Vohra, 5/e, 2017, McGraw Hill Education (India) Private Ltd.
6. Operations Research: A Systems Engineering Approach, Prasanna Devidas Dahe, 2020, Cengage Learning, India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3	3	2	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	1	-
CO.4	3	3	2	-	-	-	-	-	-	-	1	-
CO.5	3	3	2	-	-	-	-	-	-	-	1	-
CO*	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

III B.Tech I Semester

L	T	P	C
0	0	2	1

18MEC317 MACHINE TOOLS TECHNOLOGY LAB

Course Educational Objectives:

1. To study and acquire knowledge on various basic machining operations and special purpose machines and their applications.

List of Experiments:

1. Demonstration of construction and operations of general purpose machines: Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on given work piece using lathe machine.
3. Thread cutting and knurling on given work piece using lathe machine.
4. Eccentric turning on lathe machine on given work piece using.
5. External and internal thread cutting on given work piece using lathe machine.
6. Drilling and reaming operation on given work piece.
7. Contour milling on given work piece using milling machine.
8. Gear cutting on given work piece using milling machine.
9. Shaping operation on given work piece using shaping machine.
10. Slotting operation on given work piece using slotting machine.
11. Grinding operation on surface grinding machine.
12. Grinding operation on cylindrical grinding machine.
13. Grinding operation on tool cutter grinding machine.
14. Study on abrasive jet machining (AJM).

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Knowledge in general purpose machines: Lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.	**PO1**
CO2	Analyze problems and offer a Qualitative assessment on problem solutions	**PO2**
CO3	Design the model and develop the parts	**PO3**
CO4	Identify different manufacturing techniques to produce complex shapes	**PO4**
CO5	Manufacture simple parts using lathe/milling drilling/shaper and alignment are verified by standard metrology instruments	**PO5**
CO6	Follow the ethical principles in conducting the experiments	**PO8**
CO7	Perform Experiments individually and also a team to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the experiments	**PO10**
CO9	Continue updating their skill related to Machine Tools for various applications during their life time	**PO12**

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	3	-	-	-	-	-	-	-	-	-	-
CO.3	-	-	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3	-	-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	**-**	**3**	**3**	**3**	-	**3**

III B.Tech I Semester **L T P C**

0 0 2 1

18MEC318 ENGINEERING METROLOGY AND MEASUREMENTS LAB

Course Educational Objectives:

1. To demonstrate the theoretical concepts taught in mechanical measurements and metrology.
2. To understand and use various measuring instruments.

List of Experiments:

1. Calibration of following measuring instruments using slip gauges a) Vernier caliper b) Micrometer.
2. Comparison and measurements of linear dimensions using following measuring instruments a) Digital vernier caliper b) Micrometer.
3. Measurements of thread diameters using screw thread micrometer.
4. Measurements of inside diameter using inside micrometer.
5. Comparison and measurements of height and depth by using following measuring instruments a) Vernier height gauge b) Vernier depth gauge.
6. Measurement of gear parameters using gear tooth vernier.
7. Taper angle measurement using sine bar and slip gauge.
8. Measurement of angle using vernier bevel protractor.
9. Measurement of dimension of given specimen using tool maker's microscope.
10. Measurement of thread parameter using profile projector.
11. Quality checking & comparison of the dimensions of standard component using comparator.
12. Measurement of alignment using autocollimator.
13. Checking the flatness of surface plate using sprit level.
14. Measurement of bore diameter using dial bore gauge.
15. Calibration of following measuring instruments a) Temperature measurement b) Pressure measurement

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Develop the knowledge on measuring instruments such as vernier caliper, micrometer, sine bar, bevel protractor, autocollimator, etc.,	**PO1**
CO2	Analyze the instrumental error and calibration of the instruments.	**PO2**
CO3	Create complex analysis knowledge on measurements and alignment test on machines such as lathe, drilling, milling machines.	**PO4**
CO4	Use of Modern tools to measure the complex shape of the specimen such as gear tooth.	**PO5**
CO5	Follow ethical principle during usage of instruments.	**PO8**
CO6	Evaluate the value of measurements and compare with group members.	**PO9**
CO7	Communicate verbally and in written form of the understanding about the experiments.	**PO10**
CO8	Continue updating their measurement knowledge for various components and continue learning of new technology in metrology.	**PO12**

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech I Semester

L	T	P	C
0	0	2	1

18SAH311 COMMUNICATION AND SOFT SKILLS LAB

Course Educational Objectives:

1. To expose the students to variety of self instructional, learner friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor.
3. To enable them to learn better pronunciation through Stress, Intonation and Rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing.,

List of Exercises:

1. Pronunciation of English words using Phonetic sounds and Symbols.
2. Describing – Objects-People-Situations
3. Stress and Intonation
4. Oral Presentations
5. Functional English
6. Reading Comprehension
7. Vocabulary Building
8. Group Discussion
9. Resume writing and Report writing
10. Interview Skills

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To remember and understand the different aspects of the English Language proficiency with emphasis on LSRW skills.	PO1
CO2	To analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.	PO2
CO3	Use of modern computing facilities and suitable software tools to improve the communication skills and elocution.	PO5
CO4	Follow the ethical principles to prepare the group tasks	PO8
CO5	Perform exercise individually and also a team to complete the task	PO9
CO6	To apply communication skills through various language learning activities.	P10
CO7	To create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.	P12

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-		3	-	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-
CO7	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	-	-	**3**	-	-	**3**	**3**	**3**	-	**3**

III B.Tech I Semester

L	T	P	C
0	0	0	0

MOOC MASSIVE ONLINE OPEN COURSE'S

The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion of the course from the MOOCs providers.

Institution intends to encourage the students to do one MOOC in III year I Semester of the B.Tech. Program. The respective departments shall give a list of standard MOOCs providers among NPTEL, edx, Udacity, Coursera, or any other standard providers, whose credentials are endorsed by the HoD.

Each department shall appoint Coordinators / Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.

A student shall choose an online course (relevant to his / her program of study) from the given list of MOOCS providers, as endorsed by the teacher concerned, with the approval of the HOD.

Students may be permitted to register one online course (which is provided with certificate) in 3rd year 1st semester and they should produce the course completion certificate of that course to the controller of Examination to become eligible for fulfillment of the degree.

III B.Tech II Semester

L	T	P	C
2	1	0	3

18MEC321 HEAT AND MASS TRANSFER

Course Educational Objectives:

1. To understand and analyze the basics of heat transfer and steady state and unsteady state conduction
2. To understand the convective heat transfer systems with types
3. To illustrate the basic knowledge on phase change heat transfer and heat exchangers
4. To demonstrate the transfer of heat on radiation
5. To expand the basic knowledge of mass transfer in a system

UNIT – 1: CONDUCTION (9)

Mechanism of heat transfer – General differential equation – Cartesian, cylindrical and spherical coordinates – One dimensional steady state heat conduction – Heat generation – Thermal conductivity – Composite system – Critical radius of insulation – System with heat resources – Extended surfaces – Unsteady heat conduction – Lumped heat analysis – Surface resistance – Semi infinite and infinite solids – Heislers chart for transient conduction.

UNIT – 2: CONVECTION (9)

Convective Heat Transfer: Heat transfer coefficient – Boundary layer concepts and equations – Turbulence and time averaging equations – Flow through pipes – Dimensional analysis. **Forced Convection:** Flow over a flat plate, cylinders and spheres – Flow through tubes – Flow of liquid metals. **Natural Convection:** Free convection on vertical flat plate – Transition and turbulence in free convection – Free Convection in vertical plates, horizontal plates, inclined surfaces, blocks, cylinders and spheres.

UNIT – 3: PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS (9)

Boiling and Condensation: Nusselt's theory of condensation – Regimes of Pool boiling and flow boiling – Condensation heat transfer – Film and dropwise condensation. **Heat Exchangers:** Types – Overall heat transfer coefficient – Fouling factors – LMTD and NTU methods – Introduction to TEMA Standards.

UNIT – 4: RADIATION (9)

Radiation: Nature of radiation – Emissive power – Absorption, reflection, transmission – Black body and gray body Radiation – Laws of radiation – Radiation from real surfaces – Shape factor – Electrical network analogy – Radiation shields.

UNIT – 5: MASS TRANSFER (9)

Diffusion Mass Transfer: Concepts – Fick's Law – Diffusion coefficient – Steady state molecular diffusion. **Convective Mass Transfer**: Mass transfer coefficient – Governing equations – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand and analyze the basics of heat transfer and steady state and unsteady state conduction	**PO1,PO2,PO3,PO4**
CO2	Understand the convective heat transfer systems with types	**PO1,PO2,PO3,PO4**
CO3	Illustrate the basic knowledge on phase change heat transfer and heat exchangers	**PO1,PO2,PO3,PO4**
CO4	Demonstrate the transfer of heat on radiation	**PO1,PO2,PO3,PO4**
CO5	Know and expand the basic knowledge of mass transfer in a system	**PO1,PO2,PO3,PO4**

Text books:

1. Fundamentals of Engineering Heat and Mass Transfer (SI Units), Sachdeva, R.C., 5/e, 2018, New Age International (P) Ltd, Publishers, New Delhi.
2. Heat Transfer, J.P. Holman and Souvik Bhattacharyya, 10/e, 2017, Tata McGraw-Hill Education Pvt.Ltd., Noida.

Reference books:

1. Heat and Mass Transfer: Fundamentals and Applications (SI Units), Yunus A. Cengel and Afshin J. Ghajar, 2015, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Fundamentals of Heat and Mass Transfer**,** C.P.Kothandaraman, 4/e, 2012, New Age International (P) Ltd, Publishers, New Delhi.
3. Heat and Mass Transfer, P.K.Nag, 3/e, 2011, Tata McGraw-Hill Education Pvt.Ltd., Noida.
4. Principles of Heat and Mass Transfer, Frank P. Incropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine, 2018, Wiley India Edition
5. Principles of Heat Transfer, Frank Kreith, Raj M. Manglik and Mark S. Bohn, 7/e, 2011, Cengage Learning, India.
6. A Textbook of Heat and Mass Transfer (SI Units), R. K. Rajput, Concise Edition, 2015, S.Chand & Company Limited, New Delhi.

Codes/Tables: Heat and mass transfer data book is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	1	1	-	-	-	-	-	-	-	-
CO.2	3	3	1	1	-	-	-	-	-	-	-	-
CO.3	2	3	1	1	-	-	-	-	-	-	-	-
CO.4	3	3	1	1	-	-		-	-	-	-	-
CO.5	2	3	1	1	-	-		-	-	-	-	-
CO*	**2.6**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester **L T P C**

2 1 0 3

18MEC322 FINITE ELEMENT ANALYSIS

Course Educational Objectives:

1. To understand the fundamental concepts of finite element analysis
2. To analyze one dimensional element and truss element problems
3. To evaluate the Constant Strain Triangle Element in two dimensional scalar problems
4. To formulate the modern of two dimensional vector variable problems
5. To demonstrate the isoparametric formulations and applications in heat transfer

UNIT – 1: FUNDAMENTAL CONCEPT (9)

Historical background – Methods of engineering analysis – General steps of finite element analysis – Mathematical modeling of field problems in engineering – Weighted residual methods – Ritz technique – Boundary, initial and eigen value problems – Application of FEA.

UNIT – 2: ONE-DIMENSIONAL PROBLEMS (9)

One Dimensional Elements: Modeling – Shape function – Stiffness matrix – Analysis of element stiffness equation, displacements, load vector, treatment of boundary condition, Element stress calculation and support reactions for one dimensional bar, spring and tapered elements – Analysis of temperature effects with one dimensional bar element. **Truss Element:** Analysis of length, stiffness matrix, assembly of element equation, load vector, boundary condition and element stresses in one dimensional truss element.

UNIT – 3: TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS (9)

Constant Strain Triangle Element (CST): Plane stress and plane strain – Finite element modeling – Shape function – Analysis of strain displacement matrix, stress-strain relationship, stiffness matrix, element stresses, element strains for CST element – Analysis of temperature effects with CST element.

UNIT – 4: TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS (9)

Axisymmetric Element: Finite element modeling – Shape function – Analysis of strain displacement matrix, stress-strain relationship, stiffness matrix, element stresses, element strains for CST element – Analysis of temperature effects with axisymmetric element.

UNIT – 5: ISOPARAMETRIC FORMULATION AND APPLICATIONS IN HEAT TRANSFER (9)

Isoparametric Element: Co-ordinates – Shape function for four noded rectangular elements and isoparametric quadrilateral element – Evaluation of Jacobian matrix, Strain-displacement matrix and element stresses – Numerical Integration. **Heat Transfer Applications:** Gaussian quadrature – Temperature and shape function for one dimensional heat conduction element – Stiffness matrix – Finite element equations for one dimensional heat conduction – Heat conduction in fin element.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamental concepts behind variation methods	**PO1,PO2,PO3,PO4**
CO2	Analyze in one dimensional elements and trusses	**PO1,PO2,PO3,PO4**
CO3	Implement the formulation techniques to solve the Constant Strain Triangle element in two dimensional scalar problems	**PO1,PO2,PO3,PO4**
CO4	Formulate FE characteristic equations for two dimensional vector variable problems	**PO1,PO2,PO3,PO4**
CO5	Able to identify the isoparametric formulations and how the finite element method expands beyond the structural domain	**PO1,PO2,PO3,PO4**

Text Books:

1. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrupatla and Ashok D.Belegundu, 4/e, 2015, Pearson Education, India.
2. Finite Element Method in Engineering, Singiresu S Rao, 6/e, 2017, Butterworth-Heinemann, Elsevier India Pvt.ltd Publishers. New Delhi.

Reference Books:

1. A First Course in the Finite Element Method, Daryl L Logan, 5/e, 2012, Cengage Learning, India.
2. An Introduction to Finite Element Method, JN Reddy, 3/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Fundamentals of Finite Element Analysis, David V Hutton, 1/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Text Book of Finite Element Analysis, Seshu,P, 2007, Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Finite Element Analysis Theory and Application with ANSYS, D.K. Maharaj, Wiley India Edition.
6. Finite Element Analysis Theory and Application with ANSYS, Saeed Moaveni, 3/e, 2011, Pearson India Education Services Pvt. Ltd.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	1	-	-	-	-	-	-	-	-
CO.2	3	3	2	1	-	-	-	-	-	-	-	-
CO.3	3	3	2	1	-	-	-	-	-	-	-	-
CO.4	3	3	2	1	-	-	-	-	-	-	-	-
CO.5	3	3	2	1	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**1**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC323 CAD/CAM/CIM

Course Educational Objectives:

1. To gain knowledge about the basic fundamental of CAD and computer graphics
2. To understand the requirements of Geometric modeling
3. To gain knowledge about the basic fundamental of NC/CNC system and programming.
4. To obtain the concepts, applications and components of Computer integrated manufacturing
5. To gain knowledge on advance manufacturing and flexible manufacturing system.

UNIT – 1: COMPUTER GRAPHICS AND DRAFTING (9)

Product cycle – Design process – Sequential and concurrent engineering – CAD architecture – CAD/CAM hardware – System software and configuration. **Computer Graphics:** Raster scan – Coordinate system – Database structure – Engineering data management – Transformation of geometry – 3D transformations – Clipping – Surface removal – Colour and shading – Geometric commands, layers, display control commands, editing and dimensioning – Standardization – Kernel system – Exchange of modeling data.

UNIT – 2: GEOMETRIC MODELING (9)

Requirements – Geometric models – Geometric construction methods – Constraint based modeling – Wire frame modeling – Curve representation – Surface representation – Solid representation – Modeling facilities desired.

UNIT – 3: NC/CNC SYSTEMS (9)

NC – NC modes – NC elements. **Structure of CNC:** Spindle, drives, actuation system, feedback device and axis standards. **CNC Tooling and Centre:** Tool geometry – Tool presetting – ATC – CNC machining centre and turning centre – Machine control unit. **CNC Programming:** Fundamentals – Manual part programming methods (preparatory methods and miscellaneous functions) – Tool length compensation – Canned cycle – Simple CNC programs for turning, milling and drilling operations – Computer aided part programming.

UNIT – 4: COMPUTER INTEGRATED MANUFACTURING (9)

Various phases in Product Design and CAD, CAM, Concepts of CAD/CAM – CIM concepts and elements – CASA/SME model. **Computer Communication and Networking:** Communication matrix – Data transmission methods – Series, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex – Types of communication – Point to point (PTP), star and multiplexing – Seven layer of OSI model – LAN and MAP model – Network topologies – Star, ring and bus, advantages of networks.

UNIT – 5: GROUP TECHNOLOGY, PROCESS PLANNING AND FMS (9)

Group Technology: Role of G.T in CAD/CAM integration – Part families classification and coding – OPTIZ, VUOSO-PRAHA, MICLASS, KK-3, DCLASS and MDSI coding systems – Production flow analysis – Cellular manufacturing. **Cellular Manufacturing:** Composite part concept – Machine cell design. **Process Planning**: Process planning in CAD/CAM integration – Variant approach and generative approaches. **FMS**: Types – FMS workstation and components – Tool management system – FMS layouts – FMS controls – Material handling and storage system.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Gained knowledge about the basic fundamental of CAD and computer graphics	**PO1,PO2,PO3,PO5**
CO2	Acquire knowledge on Requirements of geometric modeling and design different models using methodologies'.	**PO1,PO2,PO3,PO5**
CO3	Know the basics of computerized numerical programming by using modern tools.	**PO1,PO2,PO3,PO5**
CO4	Obtain the concepts, applications and components of Computer integrated manufacturing	**PO1,PO2,PO3,PO5**
CO5	Knowledge of advance manufacturing and flexible manufacturing system for manufacture custom specific components and evaluate basics of variability	**PO1,PO2,PO3,PO5**

Text Books:

1. CAD/CAM-Principles and Applications, P.N. Rao, 3/e, 2010, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. CAD/CAM, Mikell.P.Groover and Emory W Zimmers, 1/e, 2003, Pearson Education, New Delhi.

Reference Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, Mikell.P.Groover, 4/e, 2016, Pearson Education, New Delhi.
2. CAD/CAM: Theory & Practice, Ibrahim Zeid and R Sivasubramanian, 2/e, 2015, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. CAD/CAM/CIM, V.Raju, S.Subramanyam, P.Radhakrishnan, 3/e, 2007, New Age International (P) Ltd, Publishers, New Delhi.
4. Computer Integrated Manufacturing, James A. Regh and Henry W. Kreabber, 3/e, 2005, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Computer-integrated Manufacturing: Automation in Manufacturing, R. Panneerselvam, P. Senthilkumar and P. Sivasankaran , 1/e, 2020, Cengage Learning, India.
6. CAD/CAM: Principles and Applications, J. Srinivas, 2017, Oxford University Press, India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	1	-	1	-	-	-	-	-	-	-
CO.2	3	1	1	-	1	-	-	-	-	-	-	-
CO.3	3	1	1	-	1	-	-	-	-	-	-	-
CO.4	3	1	1	-	1	-	-	-	-	-	-	-
CO.5	3	1	1	-	1	-	-	-	-	-	-	-
CO*	**3**	**1**	**1**	-	**1**	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
2	1	0	3

18MEC324 DESIGN OF TRANSMISSION SYSTEM

Course Educational Objectives:

1. To understand the design the parts in the internal combustion engines
2. To demonstrate the design of mechanical components such as power screws and drives
3. To design the energy storing elements of springs and flywheel
4. To know the procedure of designing the sliding contact bearings and rolling contact bearings
5. To gain the knowledge in the design of gears

UNIT – 1: DESIGN OF INTERNAL COMBUSTION ENGINE PARTS (9)

Principal parts of an I.C. engine – Design of a cylinder and cylinder liner – Design of piston, piston head, piston rings, piston skirt and piston pin – Forces acting on the connecting rod – Design of connecting rod – Bearing pressure and stresses in crankshafts – Design of crankshaft – Design of valves and rocker arm.

UNIT – 2: DESIGN OF POWER SCREWS AND TRANSMISSION SYSTEM (9)

Power Screws: Types of screw threads – Torque required rising and lowering load – Efficiency – Overhauling and self locking – Coefficient of friction – ACME – Stresses in power screws – Design of screw jack. **Belt and Chain Drives:** Types of belt and rope drives – Materials used for belt and rope drives – Design of flat belt, V-belt and rope drives – Classification of chains – Design of chain drives.

UNIT – 3: ENERGY STORING ELEMENTS (9)

Springs: Types – Design of helical springs – Energy stored in helical springs – Design of composite springs – Design of helical torsion springs – Design of flat spiral springs – Design of leaf springs. **Flywheel:** Coefficient of fluctuation of speed – Fluctuation of energy – Maximum fluctuation of energy – Coefficient of fluctuation of energy – Energy stored in a flywheel – Stresses in a flywheel rim – Stresses in flywheel arms – Design of flywheel arms – Design of shaft, hub and key – Construction of flywheels.

UNIT – 4: DESIGN OF BEARINGS (9)

Sliding Contact Bearings: Types – Properties and materials – Lubricants – Critical pressure – Sommerfeld number – Heat generation – Design procedure for journal bearing – Design of bearing caps and bolts – Solid journal bearing – Bushed bearing – Plummer block – Oil grooves – Design of thrust bearing. **Design of Rolling Contact Bearings:** Types – Static dynamic and equivalent loading – Life of a bearing – Lubrication – Reliability and Selection.

UNIT – 5: DESIGN OF SPUR, HELICAL, BEVEL AND WORM GEARS (9)

Spur Gears: Types – Gear materials – Load concentration factor – Design spur gear – Design of shaft and arm for spur gear. **Helical Gears:** Proportions – Strength – Design of helical gear. **Bevel Gear:** Types – Pitch angle – Formative number – Strength and forces – Design procedure for bevel gear. **Worm Gears:** Types – Proportions – Efficiency and strength of worm gear teeth – Wear tooth load – Thermal rating – Forces acting on worm gears – Design of worm gearing.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Design and analyze the parts in the internal combustion engines	**PO1, PO2, PO3, PO4**
CO2	Design of mechanical components such as power screws and drives	**PO1, PO2, PO3, PO4**
CO3	Design and analyze the energy storing elements of springs and flywheel	**PO1, PO2, PO3, PO4**
CO4	Know the procedure of designing the sliding contact bearings and rolling contact bearings	**PO1, PO2, PO3, PO4**
CO5	Gained the knowledge in the design of gears	**PO1, PO2, PO3, PO4**

Text Books:

1. Design of Machine Elements, V.B. Bhandari, 4/e, 2016, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Shigley's Mechanical Engineering Design, Richard G. Budynas and Keith J. Nisbett, 10/e, 2015, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference Books:

1. Machine Design, Robert L. Norton, 5/e, 2018, Pearson Education Ltd., India.
2. A Text Book of Machine Design, R S Khurmi and J. K. Gupta, 34/e, 2018, S.Chand & Company Pvt. Ltd., New Delhi.
3. Machine Design, N. C. Pandya and C. S. Shah, 20/e, 2015, Charotar Publishing House Pvt. Ltd.
4. Machine Elements in Mechanical Design, Robert L Mott, 4/e, 2020, Pearson Education Ltd., India.
5. Mechanical Design of Machine Components, Ansel C. Ugural, 2/e, 2015, Taylor & Francis Group, LLC.
6. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, 1/e, 2016, Wiley India Edition.

Codes/Tables: Design data book is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	2	-	-	-	-	-	-	-	-
CO.2	3	3	2	2	-	-	-	-	-	-	-	-
CO.3	3	3	2	2	-	-	-	-	-	-	-	-
CO.4	3	3	2	2	-	-	-	-	-	-	-	-
CO.5	3	3	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**2**	**-**	-	-	-	-	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC325 AUTOMATION AND ROBOTICS

Course Educational Objectives:

1. To study the various fundamental and advanced concepts of automation in industry
2. To understand the line balancing and flow lines in automated industry
3. To learn about basic concepts of drives, sensors used in robots
4. To study about the kinematics and dynamics analysis of robots
5. To gain knowledge in robot programming and application.

UNIT – 1: BASICS OF AUTOMATION (9)

Basic elements of an automated system – Advanced automation function – Levels of automation – Hardware components for automation and process control – Overview of material handling – Material transport equipments – Analysis of material transport system – Introduction to automated storage and retrieval system – Conventional storage methods and equipments – Analysis of storage system – Over view of automated identification technique – Bar code technology – Radio frequency techniques – AIDC technologies.

UNIT – 2: AUTOMATED FLOW LINES AND LINE BALANCING (9)

Automated flow lines: Work part transport – Storage buffers – Control of the production line – Applications of flow line in machining system – System design consideration of flow lines. **Assembly line balancing:** Line balancing methods – Ways of improving line balance and flexible assembly lines – Automated assembly system and configuration – Parts delivery at work station and applications.

UNIT – 3: INDUSTRIAL ROBOTICS AND DRIVE SYSTEM (9)

Introduction – Robot anatomy – Robot configuration and motions – Robot specifications – Pitch, yaw, roll, joint notations, speed of motion, pay load – Work volume. **Robot Drive System:** Pneumatic, hydraulic drives, mechanical and electrical drives – Servo motors and stepper motor. **Grippers:** Mechanical, pneumatic and hydraulic grippers, magnetic grippers and vacuum grippers – Two fingered and three fingered grippers – Internal and external grippers. **Robot Sensors:** Position and velocity sensor – Tactile sensor – Proximity and range sensor – Touch sensor – Force and torque sensor – Uses of sensors in robotics.

UNIT – 4: ROBOT MOTION ANALYSIS AND CONTROL (9)

Robot Kinematics: Manipulator kinematics – Position representation – Forward and reverse transformation – Adding orientation – Homogeneous transformations – D-H notation – Forward and inverse kinematics. **Robot Dynamics:** Differential transformation – Compensating for gravity – Robot arm dynamics. **Trajectory Planning:** Trajectory planning and avoidance of obstacles – Path planning – Skew motion – Joint integrated motion – Straight line motion.

UNIT – 5: ROBOT PROGRAMMING AND APPLICATIONS (9)

Robot Programming: Lead through programming – Robot language structure – Motion commands of move, speed control, workplace, path, frames, end effecter operation, sensor operation and react statement – Program sequence and subroutine – Teach pendant programming – VAL II programming. **Robot Applications:** Material transfer and machine loading / unloading – Processing applications in spray coating, spot and arc welding – Assembly and inspection automation – Selection of robots in industry applications.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Summarize the various fundamental and advanced concepts of automation in industry	**PO1, PO2**
CO2	Understand the line balancing and flow lines of robotics in automated industry	**PO1, PO2**
CO3	Demonstrate the basic concepts of drives, sensors used in robots	**PO1, PO2**
CO4	Compare and analyze the kinematics and dynamics of robots	**PO1, PO2**
CO5	Explain about robot programming and applications	**PO1, PO2, PO3, PO4, PO5**

Text books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, Mikell.P.Groover, 4/e, 2016, Pearson Education, New Delhi.
2. Industrial Robotics: Technology, Programming and Applications, Mikell P Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G Odrey and Ashish Dutta 2/e, 2012, Tata McGraw-Hill Education Pvt. Ltd.,

Reference books:

1. Introduction to Robotics: Analysis, Control, Applications, 3/e, 2020, Saeed B.Niku, Wiley India Pvt, Ltd., New Delhi.
2. Robotics Technology and Flexible Automation, S.R.Deb and Sankha Deb, 2/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Robots and Robotics - Principles, Systems, and Industrial Applications, Mark R Miller & Rex Miller 2017, McGraw-Hill Education.
4. Introduction to Robotics: Mechanics and Control, John J. Craig, 3/e, 2005, Pearson Education, New Delhi.
5. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, 1/e, 2006, Oxford University Press, New Delhi.
6. Robotics: Control, Sensing, Vision and Intelligence, K.S. Fu, R.C.Gonzales and C.S.G.Lee, 1/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	2	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
0	0	2	1

18MEC326 HEAT TRANSFER LAB

Course Educational Objectives:

1. To determination of thermal conductivity of materials and overall heat transfer co-efficient
2. To know the heat transfer modes and heat flux
3. To determination of emissivity, condensation and gain knowledge on heat exchangers

List of Experiments:

1. Thermal conductivity of insulating powder material through concentric sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through composite slab apparatus.
4. Thermal conductivity of metal (conductor).
5. Heat transfer in pin-fin.
6. Experiment on transient heat conduction.
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection.
9. Experiment on parallel and counter flow heat exchanger.
10. Emissivity of a gray body through emissivity apparatus.
11. Experiment on Stefan Boltzman apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on critical heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of two-phase flow.
16. Study of Triple-pipe heat exchangers.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Demonstrate the knowledge on conduction, convection and radiation.	**PO1**
CO2	Identify and analyse various performance parameters of conduction, convection and radiation equipments.	**PO2**
CO3	Develop systems to identify the performance parameters of various heat transfer mechanisms.	**PO3**
CO4	Conduct investigation on performance of heat conduction, composite walls, transient heat flow, critical heat flux, forced and natural convection, emissivity and radiation.	**PO4**
CO5	Measure the values of conductivity, heat transfer co-efficient, effectiveness, Stephen-Boltzman constant by using modern tools like sensors.	**PO5**
CO6	Follow ethical principle in conduction of experiments.	**PO8**
CO7	Perform individually and also in a team to complete the process	**PO9**
CO8	Communicate in verbally or in written form, their understanding about the experiments.	**PO10**
CO9	Continue updating their knowledge on various testing methods in future, for the identification of performance parameters of heat transfer equipments.	**PO12**

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech II Semester **L T P C**

0 0 2 1

18MEC327 COMPUTER AIDED MACHINE DRAWING LAB

Course Educational Objectives:

1. To make the students understand and interpret drawings of machine components.
2. To prepare assembly drawings using standard CAD packages.
3. To familiarize the students with Indian Standards on drawing practices and standard components.
4. To gain practical experience in handling 2D drafting and 3D modeling software systems.

List of Exercises:

1. Study of drawing standards (Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.) and CAD tools (Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of geometric dimensioning & tolerancing etc.).
2. Assembly drawing of sleeve and cotter joint.
3. Assembly drawing of socket and spigot joint.
4. Assembly drawing of knuckle joint.
5. Assembly drawing of universal joint.
6. Assembly drawing of shaft coupling.
7. Assembly drawing of screw jack.
8. Assembly drawing of plummer block.
9. Assembly drawing of stuffing box.
10. Assembly drawing of connecting rod and piston.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Develop knowledge on design procedure for specific machine components and programming knowledge for CNC machine.	**PO1**
CO2	Analysis of various types of force and its influences on machine components.	**PO2**
CO3	Design the model and develop CNC programs.	**PO3**
CO4	Investigate the results of analyzing tool with theoretical calculation.	**PO4**
CO5	Create models and analyze using CATIA V6 and ABACUS software packages.	**PO5**
CO6	Follow ethical principle in conduction of exercise.	**PO8**
CO7	Perform individually and also in a team to complete the process	**PO9**
CO8	Communicate in verbally or in written form, their understanding about the exercise.	**PO10**
CO9	Continue updating their knowledge on various analysing tools for model designs and drawing.	**PO12**

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3		-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	-	**3**	**3**	**3**	-	**3**

III B.Tech II Semester **L T P C**

0 0 2 1

18MEC328 PROJECT SKILLS LAB

Course Educational Objectives:

1. Objective is to give an opportunity to the student to get hands on training in design and innovation.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

The aim of the project skill lab is to deepen comprehension of principles by applying them to a new problem which may be the device / system / component / working mode to be created / fabricated may be decided in consultation with the supervisor and if possible with an industry. A project topic must be selected by the students in consultation with their supervisor. The students may be grouped into 3 to 5 and work under a project supervisor.

A project report to be submitted by the group and along with the model / system, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report along with device / system / component / working model jointly by external and internal examiners constituted by the Head of the Department.

Course Outcomes:

On successful completion of course, the student will be able to		**POs related to COs**
CO1	Demonstrate in-depth knowledge on the project topic	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen project problem.	**PO3**
CO4	Undertake investigation of project problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work	**PO5**
CO6	Apply project results for sustainable development of the society.	**PO6**
CO7	Understand the impact of project results in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the project work.	**PO8**
CO9	Function effectively as individual and a member in the project team	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	**PO12**

Manual: Refer project work manual for preparation and method of evaluation

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	3	-	-	-	-	-	-	-	-	-	-
CO.3	-	-	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3	-	-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO.6	-	-	-	-	-	3	-	-	-	-	-	-
CO.7	-	-	-	-	-	-	3	-	-	-	-	-
CO.8	-	-	-	-	-	-	-	3	-	-	-	-
CO.9	-	-	-	-	-	-	-	-	3	-	-	-
CO.10	-	-	-	-	-	-	-	-	-	3	-	-
CO.11	-	-	-	-	-	-	-	-	-	-	3	-
CO.12	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

III B.Tech II Semester

L	T	P	C
1	0	0	1

18MEC329 ON-LINE COMPREHENSIVE TEST – II

Comprehensive online examinations will be conducted at the end of III year, II semester; it has 100 objective questions for 100 marks on the subjects studied in the respective semesters (III-I & III-II).

A student shall acquire 1 credit assigned to the comprehensive online examination only when he / she secure 40% or more marks. In case, if a student fails in comprehensive online examination, he shall reappear at the next supplementary examination when offered.

IV B.Tech I Semester **L T P C**

2 1 0 3

18MEC411 REFRIGERATION AND AIR-CONDITIONING

Course Educational Objectives:

1. To know the basics functions and necessity of Air Refrigeration system
2. To learn the working of Vapour Compression and Vapour Absorption Refrigeration systems
3. To understand the behavior of Refrigerants, functions of System Components and environmental issues.
4. To know the Psychometric properties, processes & Air Conditioning Equipments
5. To understand the air conditioning systems and cooling load estimation

UNIT – 1: AIR REFRIGERATION SYSTEMS (9)

Necessity and applications – Unit of refrigeration and C.O.P – Refrigeration methods. **Air Refrigeration:** Open and dense air systems – Reversed Carnot and Bell-Coleman cycle – Refrigeration needs of air craft's.

UNIT – 2: VAPOUR REFRIGERATION SYSTEMS (9)

Vapour Compression Refrigeration: Working principle and essential components of the plant – COP – Representation of cycle on T-S and P-h charts – Effect of sub cooling and super heating – Cycle analysis – Actual cycle – Influence of various parameters on system performance. **Vapour Absorption Refrigeration:** Working of aqua-ammonia (NH_3) – $LiBr_2$-water (two shells and four shells) systems – Calculation of maximum COP – Principle and operation of electrolux refrigerator (three fluid systems).

UNIT – 3: REFRIGERANTS AND SYSTEM COMPONENTS (9)

Refrigerants: Desirable properties – Classification – Nomenclature – Secondary refrigerants – Ozone depletion – Global warming. **System Components:** Classification and working of compressors, condensers, evaporators and expansion valves. **Other Refrigeration Systems:** Working principle and basic components of steam jet refrigeration system, thermo-electric refrigeration system and vortex tube (Hilsch tube) refrigeration systems.

UNIT – 4: PSYCHROMETRY (9)

Psychrometric properties and processes – Psychrometric chart – Problems on psychrometry – By-pass factor (BPF), efficiency of heating and cooling coils (contact factor-CF), sensible heat factor (SHF). **Air Conditioning Equipments:** Humidifiers, dehumidifiers, air filters, ducts, fans and blowers.

UNIT – 5: AIR CONDITIONING SYSTEMS AND COOLING LOAD ESTIMATION (9)

Requirements of human comfort and concept of effective temperature – Comfort chart – Comfort air conditioning – Working principle of centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV and VRV Systems – Indoor Air quality concepts. **Cooling Load Calculations:** Types of loads and heat load concepts – RSHF, GSHF and ERSHF – Estimation of total load – Dynamic and frictional losses in air duct – Equal friction method – Fan characteristics of duct system.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire knowledge to understand the principles and applications of refrigeration systems.	**PO1,PO2,PO3**
CO2	Know the working of vapour compression and vapour absorption refrigeration system and identify methods for performance improvement.	**PO1,PO2,PO3**
CO3	Understand the behavior of Refrigerants, functions of System Components, contextual knowledge to assess societal, health, safety and also understand the impact of the professional engineering solutions in societal and environmental contexts	**PO1,PO2,PO3,PO6, PO7**
CO4	Apply psychrometric charts, analyze the problems on psychrometry and acquire knowledge on air conditioning equipment's	**PO1,PO2,PO3**
CO5	Understand the air conditioning systems and cooling load estimation and also to engage in independent and life-long learning	**PO1,PO2,PO3, PO12**

Text books:

1. Refrigeration and Air Conditioning, C.P. Arora, 3/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Principles of Refrigeration, Roy J Dossat, 4/e, 2007, Pearson Education, New Delhi.
3. Refrigeration and Air Conditioning, P.L.Ballaney, 16/e, 2016, Khanna Publishers, New Delhi.

Reference books:

1. Basic Refrigeration and Air-Conditioning, Ananthanarayanan, 4/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Refrigeration and Air Conditioning, G F Hundy, A. R. Trott and T C Welch, 5/e, 2016, Elsevier Butterworth-Heinemann,
3. Refrigeration and Air Conditioning, Manohar Prasad, 3/e, 2018, New Age International (P) Ltd, Publishers, New Delhi.
4. Refrigeration and Air Conditioning Technology, William C. Whitman, William M. Johnson, John A. Tomczyk, and Eugene Silberstein, 6/e, 2009, Delmar, Cengage Learning.
5. Refrigeration Systems and Applications, Ibrahim Dincer, 3/e, 2017, John Wiley & Sons Ltd,

Codes/Tables: Steam table and Psychrometric chart of various refrigerants is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	-	-	-	-	-	-	-	-	-
CO.2	3	3	3	-	-	-	-	-	-	-	-	-
CO.3	3	3	3	-	-	2	2	-	-	-	-	-
CO.4	3	3	3	-	-	-	-	-	-	-	-	-
CO.5	3	3	3	-	-	-	-	-	-	-	-	2
CO*	**3**	**3**	**3**	-	-	**2**	**2**	-	-	-	-	**2**

IV B.Tech I Semester

L	T	P	C
2	1	0	3

18MEC412 FUNDAMENTALS OF VIBRATIONS

Course Educational Objectives:

1. To understand the sources of vibration, Constructions of dampers and harmonic motion.
2. To study free vibration of single-degree of freedom systems in all kind of vibration systems
3. To determination of natural frequencies of vibrating system in forced vibration
4. To understand the different methods of controlling the vibration in the system.
5. To measure and monitor the frequency and vibration exciters measurements.

UNIT – 1: FUNDAMENTALS OF VIBRATIONS (9)

Introduction: Basic Concepts – Classification of vibration –Vibration analysis procedure. **Spring elements**: Nonlinear springs, linearization of a nonlinear spring, spring constants of elastic elements, combination of springs, mass or inertia elements – combination of masses. **Damping Elements:** Construction of viscous dampers, linearization of a nonlinear damper, and combination of dampers. **Harmonic Motion:** Vectorial representation, complex number representation, complex algebra, operations on harmonic functions.

UNIT – 2: FREE VIBRATION (9)

Vibratory motions – Free vibrations – Single degree of freedom – Natural frequency of free longitudinal, transverse vibration and free torsional vibrations – Effect of the inertia – Natural frequency of free transverse vibrations under various load conditions –Viscous damping – Logarithmic decrement – Free torsional vibrations of a single two and three rotor system – Equivalent shaft system – Geared System.

UNIT – 3: FORCED VIBRATION (9)

Response of single degree freedom systems to periodic forcing – Single degree freedom forced undamped vibration systems – Disturbance caused by unbalance – Transient vibrations – Harmonic disturbances – Whirling speed of a shaft – Isolation and Transmissibility – Transmissibility Frequency of under damped forced vibrations.

UNIT – 4: VIBRATION CONTROL (9)

Vibration nomograph – Reduction of vibration at the source – Balancing of rotating machines – Control of vibration balancing of reciprocating engines – Control of vibration and natural frequencies – Vibration absorbers (Theoretical concept and simple problems only).

UNIT – 5: VIBRATION MEASUREMENT (9)

Transducers – Vibration pickups – Frequency-Measuring instruments – Vibration exciters – Signal analysis – Dynamic testing of machines and structures – Experimental modal analysis – Machine-Condition monitoring and diagnosis (Theoretical concept only).

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Know the sources of vibration, Constructions of dampers and harmonic motion.	**PO1,PO2,PO3,PO4**
CO2	Examine the free vibration of single-degree of freedom systems	**PO1,PO2,PO3,PO4**
CO3	Determination of natural frequencies of vibrating system in forced vibration	**PO1,PO2,PO3,PO4**
CO4	Understand the different methods of controlling the vibration in the system.	**PO1,PO2,PO3,PO4**
CO5	Measure and monitor the frequency and vibration exciters measurements	**PO1,PO2,PO3,PO4**

Text Books:

1. Mechanical Vibrations (SI Edition), Singiresu S.Rao, 6/e, 2018, Pearson Education.
2. Mechanical Vibration Practice and Noise Control, V. Ramamurti, 1/e, 2017, Narosa Publishing House Pvt. Ltd.

Reference Books:

1. Vibration and Acoustics: Measurement and Signal Analysis, Sujatha C, 1/e, 2010, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Mechanical Vibrations, Debabrata Nag, 1/e, 2011, Wiley India Edition.
3. Theory of Vibrations with Applications, 5/e, William T Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, Pearson Education.
4. Introduction to Mechanical Vibrations, Ronald J. Anderson, 1/e, 2020, John Wiley & Sons Ltd,
5. Mechanical Vibrations: Theory and Applications, S. Graham Kelly, 1/e, 2012, Cengage Learning.
6. Vibrations, Balakumar Balachandran and Edward B. Magrab, 3/e, 2018, Cambridge University Press.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	2	2	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC413 MECHATRONICS

Course Educational Objectives:

1. To understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors
2. To know the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in the systems
3. To demonstrate the Basic system models and Controller used in Mechatronic systems
4. To understand the applications of microprocessors and programmable logic controller in the system
5. To study the Programmable Logic Controller and Mechatronic Systems

UNIT – 1: MECHATRONICS, SENSORS AND TRANSDUCERS (9)

Introduction to mechatronics systems and measurement systems. **Control Systems:** Open loop, closed loop, automatic control, block diagram, pneumatic control and hydraulic control systems. **Transducers:** Actuating mechanisms – Electro-mechanical, resistance, variable inductance, capacitive, piezoelectric, photoelectric, thermo electric and Hall Effect transducers – Strain gauge (theory only). **Sensors:** Proximity, pneumatic, light, tactile and smart sensors – Load cells – Digital encoders – Selection of sensors.

UNIT – 2: ACTUATIORS (9)

Mechanical Actuator: Gear drive, belt drive, chain drive and bearings. **Electrical Actuator:** Mechanical and solid state switches – Construction and working principle of stepper motor and servo motor. **Hydraulic Actuators:** Hydraulic systems – Pumps, regulator, compressors and valves – Linear and rotary actuator. **Pneumatic Actuators:** Pneumatic systems – Valves – Linear and rotary actuator.

UNIT – 3: SYSTEM MODELS AND CONTROLLERS (9)

System Models: Basic system models – Mechanical system buildings – Electrical system buildings – Fluid system buildings – Thermal system buildings – Rotational-translational systems – Electro mechanical systems – Hydraulic mechanical systems. **Controller:** Control, two step, proportional and derivative mode – Combination of PD, PI and PID – PID and igital controllers – Concepts in adaptive control systems.

UNIT – 4: MICROPROCESSORS AND PROGRAMMABLE PERIPHERAL INTERFACE (9)

Microprocessors: Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller with block diagram. **Programmable Peripheral Interface:** Architecture of 8255 – Keyboard interfacing – LED display – Interfacing – ADC and DAC interface – Temperature control – Stepper motor control – Traffic control interface.

UNIT– 5: PROGRAMMABLE LOGIC CONTROLLER AND MECHATRONIC SYSTEMS (9)

Programmable Logic Controller: Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC. **Mechatronic Systems:** Design process of engine management system, automatic camera, automatic washing machine, pick and place robot, automatic car park barrier, wireless surveillance balloon and uninterruptible power supply.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors	**PO1,PO2**
CO2	Know the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in mechatronics systems	**PO1,PO2**
CO3	Demonstrate the Basic system models and Controller used in Mechatronic systems	**PO1, PO2, PO3**
CO4	Understand the applications of microprocessors and programmable logic controller in mechatronic system	**PO1, PO2, PO3, PO5**
CO5	study the Programmable Logic Controller and Mechatronic Systems	**PO1, PO2, PO3, PO5, PO12**

Text Books:

1. Mechatronics: Electronic control systems in mechanical and electrical engineering, William Bolton, 6/e, 2019, Pearson Education, India.
2. A Textbook of Mechatronics, R.K.Rajput, 4/e, 2007, S. Chand & Co.

Reference Books:

1. Mechatronics Systems Design, Devdas Shetty and Richard A. Kolk, 2/e, 2011, Cengage Learning.
2. Mechatronics, Principles and Applications, Godfrey Onwubolu, 1/e, 2005, Elsevier Butterworth-Heinemann.
3. Introduction to Mechatronics and Measurement Systems, David G. Alciatore and Michael B. Histand, 4/e, 2014, Tata McGraw Hill Education.
4. Mechatronics: A Foundation Course, Clarence W. de Silva, 1/e, 2010, CRC Press, Taylor & Francis Group
5. Mechatronics with Experiments, Sabri Cetinkunt, 2/e, 2015, John Wiley & Sons Ltd
6. Mechatronics: Principles, Concepts and Applications, Nitaigour Premchand Mahalik, 1/e, 2003, Tata McGraw Hill Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	2	-	-	-	-	-	-	-
CO.5	3	2	2	-	2	-	-	-	-	-	-	2
CO*	**3**	**2**	**2**	-	**2**	-	-	-	-	-	-	**2**

IV B.Tech I Semester

L	T	P	C
2	0	2	0

18AUD411 PROFESSIONAL ETHICS
(Common to ALL Branches)

Course Educational Objectives:

1. To develop the human values in work place, society and everywhere.
2. To understand the importance of engineering ethics with the mentors' theory on ethics
3. To inculcate codes of ethical values to the engineers in the society
4. To understand the ethical issues on safety, responsibilities and human rights in society.
5. To know the ethics issues on environmental, weapons, computers ethics & Moral leaderships.

UNIT - 1: HUMAN VALUES (6)
Morals, values and ethics – Integrity – Work Ethic –Honesty – courage – Empathy – Self-confidence – Character.

UNIT - 2: ENGINEERING ETHICS (6)
Senses of 'Engineering Ethics' – Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles – Theories about right action – Self-interest – Customs and religion – Uses of ethical theories – Valuing time – Co-operation – Commitment.

UNIT - 3: ENGINEERING AS SOCIAL EXPERIMENTATION (6)
Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

UNIT - 4: SAFETY, RESPONSIBILITY AND RIGHTS (6)
Safety and risk – Assessment of safety and risk – Risk benefit analysis – The Three Mile Island and Chernobyl case studies.

UNIT - 5: GLOBAL ISSUES (6)
Multinational corporations – Environmental ethics - Computer ethics – Weapons development – Engineers as managers – Engineers as expert witnesses and advisors – Moral leadership.

TOTAL: 30 HOURS

Course Outcomes:

After the completion of this course, a successful student is able to		POs related to COs
CO1	Develop the human values in work place, society and everywhere.	**PO6,PO8,PO9, PO11,PO12**
CO2	Understand the importance of engineering ethics with the mentors' theory on ethics	**PO6,PO8,PO9, PO11,PO12**
CO3	Inculcate codes of ethical values to the engineers in the society	**PO6,PO8, PO12**
CO4	Understand the ethical issues on safety, responsibilities and human rights in society.	**PO6,PO8,PO9, PO12**
CO5	Know the ethics issues on environmental, weapons, computers ethics & Moral leaderships	**PO6,PO7,PO8,PO9**

Text books:

1. A Textbook on Professional Ethics and Human Values, 1/e, 2006, Naagarazan R.S., New Age International (P) Ltd, Publishers, New Delhi.
2. Professional Ethics and Human Values, S. Dinesh Babu, Laxmi Publications (P) Ltd, New Delhi.

Reference books:

1. Engineering Ethics, 2004, M. Govindarajan, S. Natarajan, V.S.Senthil Kumar, Prentice - Hall of India, Pvt. Ltd., and New Delhi.
2. Engineering Ethics, 2004, Charles D. Fleddermann, Pearson Education/ Prentice- Hall, New Jersey (Indian reprint now available).
3. Engineering Ethics- Concepts and Cases, 2000, Charles E Harris, Michael S. Protchard and Michael J Rabins, Wadsworth Thompson Leaning, United States (Indian reprint now available).
4. Ethics in Engineering, Mike Martine and Roland Schinzinger, Tata McGraw- Hill Education, Pvt. Ltd.,Noida.
5. Ethics and the Conduct of Business, 2003, John R Boatright, Pearson Education, New Delhi.
6. Fundamentals of Ethics for Scientists and Engineers, 2001, Edmund G Seebauer and Robert L Barry, Oxford University press, Oxford.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	2	-	1	2
CO2	-	-	-	-	-	2	-	3	2	-	1	2
CO3	-	-	-	-	-	3	-	3	-	-	-	2
CO4	-	-	-	-	-	2	-	3	2	-	-	2
CO5	-	-	-	-	-	2	2	3	2	-	-	-
CO*	-	-	-	-	-	**2.2**	**2**	**3**	**2**	-	**1**	**2**

IV B.Tech I Semester

L	T	P	C
0	0	2	1

18MEC416 MECHATRONICS LAB AND THEORY OF MACHINES LAB

Course Educational Objectives:

1. To impart practical knowledge about the elements and techniques involved in mechatronics systems
2. To understand the concept of automation by hydraulic and pneumatic actuators.
3. To study the parameter of gears, Mechanism, Joints and gear trains
4. To study of gyroscopic effect and determination of range sensitivity, effort of Governors
5. To determination of natural frequency of single degree and two degree of freedom.

MECHATRONICS LAB:

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion
2. Stepper motor interface
3. Speed control of DC and AC motor (speed and direction control by using microcontroller)
4. Traffic light interface
5. Study of various types of transducers
6. Study of PLC and its applications (PLC Automation with timers and counters)
7. Study of image processing technique
8. Study of hydraulic, pneumatic and electro-pneumatic circuits.

THEORY OF MACHINES LAB:

1. a) Study of gear parameters. b) Experimental study of velocity ratios of simple, compound, epicyclic and differential gear trains
2. a) Experimental study of kinematics of four bar, slider crank, crank rocker, double crank, double rocker, oscillating cylinder mechanisms. b) Experimental study kinematics of single and double universal joints.
3. Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, motion curves and study of jump phenomenon.
7. Single degree of freedom spring mass system – determination of natural frequency and verification of laws of springs – damping coefficient determination.
8. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
9. a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies. c) Determination of transmissibility ratio using vibrating table.
10. Study of Balancing of rotating masses. (b) Balancing of reciprocating masses.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the practical knowledge about the elements and techniques involved in mechatronics systems	**PO1**
CO2	Understand the concept of automation by hydraulic and pneumatic actuators	**PO2**
CO3	Describe the parameter of gears, Mechanism, Joints and gear trains	**PO3**
CO4	Determine the range sensitivity, effort of Governors and gyroscopic effect	**PO4**
CO5	Determine natural frequency of single degree and two degree of freedom.	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to manufacturing process in future.	**PO12**

Text Books:

1. Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	3	-	-	-	-	-	-	-	-	-	-
CO.3	-	-	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3		-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO.6	-	-	-	-	-	-	-	3	-	-	-	-
CO.7	-	-	-	-	-	-	-	-	3	-	-	-
CO.8	-	-	-	-	-	-	-	-	-	3	-	-
CO.9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

IV B.Tech I Semester

L	T	P	C
0	0	2	1

18MEC417 COMPUTER AIDED ANALYSIS LAB AND CNC TECHNOLOGY LAB

Course Educational Objectives:

1. To gain practical experience in FEA software systems.
2. To estimate the natural frequencies and mode shapes, harmonic response of 2D beam
3. To learn the G Code and M codes for CNC Machining process
4. To write Part programming exercise on turning, milling, drilling.

COMPUTER AIDED ANALYSIS LAB:

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Model analysis of Beams.
8. Estimation of natural frequencies and mode shapes, harmonic response of 2D beam.
9. Vibration analysis of spring-mass systems.

CNC TECHNOLOGY LAB:

1. Study of CNC machines.
2. Study of CNC and NC part programming.
3. Experiments on CNC lathe machine: Facing, turning, step, tapper tuning operations.
4. Part programming exercise on turning operations.
5. Part programming exercise on milling operations.
6. Part programming exercise on drilling operations.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the practical experience in FEA software systems	**PO1**
CO2	Determine the deflection and stresses in 2D and 3D trusses and beams	**PO2**
CO3	Determine the thermo-mechanical stresses of a 3D component	**PO3**
CO4	Estimate the natural frequencies and mode shapes, harmonic response of 2D beam	**PO4**
CO5	write Part programming exercise on turning, milling, drilling	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to manufacturing process in future.	**PO12**

Text Books: Lab manual provided by the department.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	3	-	-	-	-	-	-	-	-	-	-
CO.3	-	-	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3	-	-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO.6	-	-	-	-	-	-	-	3	-	-	-	-
CO.7	-	-	-	-	-	-	-	-	3	-	-	-
CO.8	-	-	-	-	-	-	-	-	-	3	-	-
CO.9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	-	**3**	**3**	**3**	-	**3**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC421 POWER PLANT ENGINEERING

Course Educational Objectives:

1. To understand the working principles of steam power plants and analyzes its performance.
2. To understand the working principles of diesel and gas turbine power plant
3. To explain the working of nuclear power plant and safety measures.
4. To know the working of hydroelectric power plant and other renewable energy sources
5. To learn the economics, Energy management and environmental issues of power generation.

UNIT – 1: STEAM POWER PLANT (9)

Introduction to the sources of energy – Resources and development of power in India. **Steam Power Plant**: Plant layout – Working of different circuits – Types of coal – Properties of coal – Coal handling system – Ash handling system – Feed water treatment. **Combustion Process**: Stages of combustion – Overfeed and underfeed stoker firing – Stoker firing of coal – Pulverized coal firing system – Cyclone furnace – Fluidized bed combustion system – Cooling towers and heat rejection.

UNIT – 2: DIESEL AND GAS TURBINE POWER PLANT (9)

Diesel Power Plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – Fuel supply system, air starting equipment, lubrication and cooling system – Super charging. **Gas Turbine Power Plant**: Introduction – Classification – Construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines – Combined cycle power plants and comparison.

UNIT – 3: NUCLEAR POWER PLANT (9)

Basics of nuclear engineering– Fuels and nuclear reactions – Layout and subsystems – Reflectors – Pressurized water reactor (PWR) – Boiling water reactor (BWR) – CANada Deuterium- Uranium reactor (CANDU) – Gas cooled and liquid metal fast breeder reactor – Heavy water reactor – Working and comparison – Safety measures for nuclear power plants.

UNIT – 4: HYDROELECTRIC POWER PLANT AND RENEWABLE ENERGY SOURCES (9)

Hydroelectric Power Plant: Water power – Hydrological cycle – Hydrographs – Storage and pondage – Classification of dams and spill ways – Hydroelectric typical plant layout and components – Pumped storage power plants – Selection of turbines. **Renewable Energy Sources: C**onstruction and working principle of wind, tidal, solar photo voltaic, solar thermal, geo thermal, biogas and fuel cell systems.

UNIT – 5: ENERGY MANAGEMENT, ECONOMICS AND ENVIRONMENTAL ISSUES (9)

Energy Management: Types of loads – Load distribution and sharing – Load curve – Demand factor – Average load – Load factor – Diversity factor – Cost of electrical energy – General arrangement of power distribution – Economics in power plant selection and power generation. **Environmental Issues:** Effluents from power plants – Impact on environment – Pollutants – Pollution standards – Methods of Pollution control – Control of waste disposal and recovery – Waste disposal options for coal and nuclear power plants.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Know the working principles of steam power plants and analyzes its performance.	**PO1,PO2,PO3, PO6, PO7, PO12**
CO2	Explain the working of diesel and gas turbine power plant	**PO1,PO3, PO6, PO7, PO12**
CO3	Understand the working principles of nuclear power plant and safety measures	**PO1,PO2,PO3, PO6, PO7, PO12**
CO4	Explain the working of hydroelectric power plant and other renewable energy sources	**PO1,PO2,PO3, PO6, PO7, PO12**
CO5	Describe the economics, Energy management environmental issues of power generation	**PO1,PO2,PO3, PO6, PO7, PO12**

Text books:

1. Power Plant Engineering, P.K.Nag, 4/e, 2014, McGraw-Hill Education Pvt. Ltd., New Delhi.
2. Power Plant Engineering, R.K Hegde, 1/e, 2015, Pearson Education, India.

Reference books:

1. Power Plant Technology, M. M. El-Wakil, 1/e, 2010, Tata McGraw-Hill, New Delhi.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar, 6/e, 2012, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Introduction to Power Plant Technology, G.D.Rai, 3/e, 2012, Khanna Publishers, New Delhi.
4. Power Plant Engineering, G.R. Nagpal and S.C. Sharma, 16/e, 2004, Khanna Publisher, New Delhi.
5. A Text Book of Power Plant Engineering, R.K.Rajput, 5/e, 2016, Laxmi Publications (P) Ltd., New Delhi.
6. Power Generation Handbook, Philip Kiameh, 2/e, 2013, Tata McGraw-Hill, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	1	1	-	-	-	-	1
CO.2	3	-	2	-	-	1	1	-	-	-	-	1
CO.3	3	2	1	-	-	1	1	-	-	-	-	1
CO.4	3	2	1	-	-	1	1	-	-	-	-	1
CO.5	3	2	1	-	-	1	3	-	-	-	-	2
CO*	**3**	**2**	**1.4**	-	-	**1**	**1.4**	-	-	-	-	**1.5**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC422 INDUSTRIAL ENGINEERING AND MANAGEMENT

Course Educational Objectives:

1. To learn the concepts of management and characteristics of personnel Management.
2. To understand the organizational structures and plant layout for productivity improvements
3. To know the basic need of work study, method study, time study and industrial psychology.
4. To learn the Forecasting, Process planning and control of manufacturing a product
5. To study the inventory control and personnel management in an industry.

UNIT – 1: CONCEPTS OF MANAGEMENT (9)

Management: Importance of administration and organization – Managerial skills, policies, goals and objectives – Scientific management – Management contribution of FW Taylor, Henry Foyal and Gilberth – Principles, types, process, levels and functions of management – Management chart – Basic concepts in project management and MIS – Industrial ownership – Responsibilities of supervisor/foreman – Leadership concepts and qualities. **Personnel Management:** Concepts – Recruitment, selection, training, job evaluation and merit rating – Wage plans and incentives – Safety, housekeeping and welfare measures – Promotion, lay-off, transfer and discharge.

UNIT – 2: ORGANIZATIONAL STRUCTURES AND PLANT LAYOUT (9)

Organization: Concept, importance, characteristics, elements, and process of organization – Organization theory, principle, structure, chart and committees – Project, matrix and informal organization – Departmentation – Authority and delegation – Group dynamics – Organizational change, development and conflict – Managerial leadership and communication system. **Plant Layout:** Types – Flow pattern – Work station – Storage space – Layout procedure – Consideration in factory design.

UNIT – 3: WORK STUDY AND INDUSTRIAL PSYCHOLOGY (9)

Work study – Ergonomics principles – Method study – Process chart symbols – Flow process and multiple activity chart – Flow and string diagram – Operation analysis – Analysis of motion – Motion economy – Design and layout of work place – Therbligs – SIMO chart – Time study – Standard data – Analytical estimating – Performance Rating – Allowances – PMTS. **Industrial Psychology:** Concept – Individual and group – Motivation theories – Hawthorne experiment – Morale and motivation – Working and environmental condition – Industrial fatigue.

UNIT – 4: PRODUCTION PLANNING AND CONTROL (9)

Productivity: Input output model – Factors affecting the productivity – Productivity resources and measures. **Production Planning:** Continuous and intermittent production – Job, open and closed job shop – One time large projects – Forecasting – Process planning – Economical batch quantity – Tool control – Control of production – Loading, scheduling, dispatching and routing – Progress and flow control.

UNIT – 5: MATERIALS MANAGEMENT AND INVENTORY CONTROL (9)

Materials Management: Concepts – Procurement – Purchase and order – Buying techniques. **Inventory Control:** Classification – Objectives – Functions – Economic order quantity (EOQ) – Inventory models – ABC analysis – Material requirements planning (MRP) – Manufacturing resource planning (MRP-II).

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the concepts of management and characteristics of Administration and organization	**PO1,PO11, PO12**
CO2	Explain the organizational structures and plant layout for productivity Improvements	**PO1,PO11, PO12**
CO3	Describe the basic need of work study, method study, time study and industrial psychology	**PO1,PO11, PO12**
CO4	Explain the Forecasting, Process planning and control of manufacturing a product	**PO1,PO11, PO12**
CO5	Demonstrate the inventory control and personnel management in an industry	**PO1,PO11, PO12**

Text books:

1. Industrial Engineering and Management, 17/e, 2010, O.P. Khanna, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Industrial Engineering and Management, Pravin Kumar, 1/e, 2015, Pearson Education, New Delhi.

Reference books:

1. Production and Operations Management, S. N. Chary, 6/e, 2019, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Operations Management, William J Stevenson, 12/e, 2018, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Production and Operations Management, Shailendra Kale, 1/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Production and Operations Management, Kanishka Bedi, 3/e, 2013, Oxford University Press, India.
5. Manufacturing Organization and Management, 6/e, 2004, Harold T Amrine, John A Ritchey, Colin L Moodie and Joseph F Kmec, Pearson Education, New Delhi.
6. Industrial Engineering and Production Management, Martand T Telsang, 3/e, 2018, S.Chand Publications, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	-	-	-	-	-	-	-	-	-	1	1
CO.2	2	-	-	-	-	-	-	-	-	-	1	1
CO.3	2	-	-	-	-	-	-	-	-	-	1	1
CO.4	2	-	-	-	-	-	-	-	-	-	1	1
CO.5	2	-	-	-	-	-	-	-	-	-	1	1
CO*	**2**	-	-	-	-	-	-	-	-	-	1	1

IV B.Tech II Semester

L	T	P	C
0	0	20	10

18MEC425 PROJECT WORK

Course Educational Objectives:

1. Discovering potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design / fabrication / analysis for a specific application, a research project with a focus on an application needed by the industry / society, a computer project, a management project or a design and analysis project. A project topic must be selected by the students in consultation with their guides.

To train the students in preparing project reports and to face reviews and viva voce examination. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Course Outcomes:

On successful completion of course, the student will be able to		POs related to COs
CO1	Demonstrate in-depth knowledge on the project topic	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen project problem.	**PO3**
CO4	Undertake investigation of project problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work	**PO5**
CO6	Apply project results for sustainable development of the society.	**PO6**
CO7	Understand the impact of project results in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the project work.	**PO8**
CO9	Function effectively as individual and a member in the project team	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	**PO12**

Note: Refer project work manual for preparation and method of evaluation

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	3	-	-	-	-	-	-	-	-	-	-
CO.3	-	-	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3	-	-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO.6	-	-	-	-	-	3	-	-	-	-	-	-
CO.7	-	-	-	-	-	-	3	-	-	-	-	-
CO.8	-	-	-	-	-	-	-	3	-	-	-	-
CO.9	-	-	-	-	-	-	-	-	3	-	-	-
CO.10	-	-	-	-	-	-	-	-	-	3	-	-
CO.11	-	-	-	-	-	-	-	-	-	-	3	-
CO.12	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414A RENEWABLE ENERGY SOURCES

Course Educational Objectives:

1. Describing the current energy scenario in terms of conventional renewable energy and future plan
2. To describe the solar energy sources for electricity generation
3. To understand the functions of wind turbine and Ocean Thermal Energy conversion process
4. To describe the types bio-energy for electricity generation and advancement in geothermal Energy
5. To educate the various new and alternative sources such as MHD Power and fuel cells

UNIT – 1: ENERGY SCENARIO (9)

Indian energy scenario in various sectors of domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status – Potential of various renewable energy sources – Global energy status – Per capita energy consumption in various countries – Future energy plans.

UNIT – 2: SOLAR ENERGY (9)

Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT – 3: WIND ENERGY AND OCEAN THERMAL ENERGY (9)

Wind Energy: Wind data and energy estimation – Betz limit – Site selection for wind farms – Characteristics – Horizontal and vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues – Applications. **Ocean Thermal Energy:** Tidal energy – Wave energy – Open and closed OTEC cycles.

UNIT – 4: BIOMASS ENERGY AND GEOTHERMAL ENERGY (9)

Biomass Energy: Bio resources – Biomass direct combustion – Thermochemical conversion – Biochemical conversion – Mechanical conversion – Biomass gasifier – Types of biomass gasifiers – Cogeneration – Carbonisation – Pyrolysis – Biogas plants – Digesters – Biodiesel production – Ethanol production – Applications. **Geothermal Energy**: Geothermal energy sources – Types of geothermal power plants – Applications – Environmental impact – Small hydro.

UNIT – 5: NEW AND ALTERNATIVE ENERGY SOURCES (9)

Fuel cell: Principle – Types of fuel cells – Hydrogen energy – Properties – Hydrogen production – Storage – Transport and utilization – Safety issues. **Magneto Hydro Dynamic Power:** Principles of magneto hydro dynamic (MHD) power generation – MHD systems – MHD accelerator – MHD engine, power generation systems – Electron gas dynamic conversion.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the current energy scenario in terms of conventional renewable energy and future plan	**PO1,PO2, PO6, PO12**
CO2	Describe the types solar thermal collectors and solar energy sources for electricity generation	**PO1,PO2,PO6, PO7, PO12**
CO3	Understand the functions of wind turbine and Ocean Thermal Energy conversion process	**PO1,PO6,PO7, PO12**
CO4	Illustrate the bio-energy for electricity generation and advancement in geothermal Energy	**PO1, PO6, PO7, PO12**
CO5	Demonstrate the various new and alternative sources such as MHD Power and fuel cells	**PO1, PO7, PO12**

Text books:

1. Non-Conventional Energy Sources, G.D. Rai, 6/e, 2017, Khanna Publishers, New Delhi.
2. Non-Conventional Sources, Khan, B.H., 3/e, 2017, McGraw-Hill Education Pvt. Ltd.

Reference books:

1. Non-Conventional Energy Resources, Sawhney, G. S., 2012, PHI Learning,
2. Non-Conventional Energy Sources and Utilisation (Energy Engineering), R K Rajput, 2012, S. Chand Publishing.
3. Fundamentals of Renewable Energy Processes, Aldo Vieira da Rosa, 2005, Elsevier Academic Press.
4. Solar Energy, S. P. Sukhatme and J K. Nayak, 4/e, 2017, McGraw-Hill Education Pvt. Ltd.
5. Alternative Energy Sources, Efstathios E. (Stathis) Michaelides, 2012, Springer-Verlag Berlin Heidelberg.
6. Energy Resources and Systems : Renewable Resources, Volume 2, Tushar K. Ghosh and Mark A. Prelas, 2011, Springer Science+Business Media B.V.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	2	-	-	-	-	-	1
CO.2	3	2	-	-	-	2	2	-	-	-	-	1
CO.3	3	-	-	-	-	2	2	-	-	-	-	1
CO.4	3	-	-	-	-	2	2	-	-	-	-	1
CO.5	3	-	-	-	-	-	2	-	-	-	-	1
CO*	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**1**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414B GAS DYNAMICS AND JET PROPULSION

Course Educational Objectives:

1. To understand the Basic concepts of compressible flows and Isentropic flows
2. To know the variation of flow properties in constant area ducts - Rayleigh flow and Fanno flow
3. To derive the conditions for change in pressure, density and temperature for flows through normal and oblique shock waves
4. To understand the functions, performance parameters of jet propulsion
5. To study the characteristics of rocket propulsion systems and space flights

UNIT – 1: BASIC CONCEPTS AND ISENTROPIC FLOWS (9)

Energy and momentum equations of compressible fluid flows, concepts of compressible flow – Mach waves and Mach cone – Flow regimes, effect of Mach number on compressibility – Stagnation, static, critical properties and their interrelationship – Isentropic flow and its relations – Isentropic flow through variable area ducts – Nozzles and diffusers – Use of gas tables.

UNIT – 2: COMPRESSIBLE FLOW THROUGH DUCTS (9)

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Choking – Isothermal flow with friction – Use of Gas tables.

UNIT – 3: NORMAL AND OBLIQUE SHOCKS (9)

Governing equations – Rankine-Hugoniot relation – Variation of flow parameters across the normal and oblique shocks – Prandtl-Meyer expansion and relation – Use of gas tables.

UNIT – 4: JET PROPULSION (9)

Theory of jet propulsion – Thrust equation – Performance parameters – Thrust, power and efficiency – Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines.

UNIT – 5: SPACE PROPULSION (9)

Types of rocket engines and propellants – Characteristic velocity – Thrust equation – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Liquid fuel feeding systems – Solid propellant geometries – Orbital and escape velocity – Rocket engine performance parameters and problems – Applications – Space flights.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basic concepts of compressible flows and Isentropic flows	**PO1,PO2,PO3**
CO2	Summarize the variation of flow properties in constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow)	**PO1,PO2,PO3**
CO3	Derive the conditions for change in pressure, density and temperature for flows through normal and oblique shocks.	**PO1,PO2,PO4,PO5**
CO4	Understand the types, functions of jet propulsion	**PO1, PO2, PO3,PO5**
CO5	study the characteristics of rocket propulsion systems and space flights	**PO1, PO2, PO3,PO6**

Text Books:

1. Fundamentals of Compressible Flow with Aircraft and Rocket propulsion, Yahya, S.M., 4/e, 2012, New Age International (P) Limited.
2. Modern Compressible Flow, Anderson, J.D., 3/e, 2012, McGraw Hill.

Reference Books:

1. Elements of Gas Turbine Propulsion, Jack Mattingly, 2017, McGraw Hill.
2. Aircraft Gas Turbine Engine Technology, Irwin E. Treager, 3/e, 2013, McGraw Hill.
3. Fundamentals of Gas Dynamics, Zucker, R.D and Biblarz, O, 2/e, 2011, John Wiley & Sons, Inc.
4. Introduction to Compressible Fluid Flow, Patrick H. Oosthuizen and William E. Carscallen, 2/e, 2013, CRC Press, Taylor & Francis Group
5. Rocket Propulsion Elements, George P. Sutton and Oscar Biblarz, 9/e, 2017, John Wiley & Sons, Inc.
6. Gas Dynamics, Rathakrishnan, E., 7/e, 2018, Prentice Hall of India.

Codes/Tables: Gas table is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	2	1	-	-	-	-	-	-	-
CO.4	3	2	2	-	1	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	2	-	-	-	-	-	-
CO*	**3**	**2**	**1.5**	**2**	1	2	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414C ADVANCED INTERNAL COMBUSTION ENGINE

Course Educational Objectives:

1. To understand the fuel injection systems and knock effect of Spark Ignition engine
2. To understand the fuel-injection system & turbocharging of Compression Ignition engine
3. To provide knowledge on pollutant formation, measurements, Emission norms & control
4. To provide knowledge in suitability of alternate fuels and engine modification.
5. To summarize the latest advancement in automobile and hybrid vehicles

UNIT – 1: SPARK IGNITION ENGINES (9)

Mixture requirements – Fuel injection systems – Mono-point, multipoint and direct injection – Stages of combustion – Normal and abnormal combustion – Spark – Knock – Factors affecting knock – Combustion chambers.

UNIT – 2: COMPRESSION IGNITION ENGINES (9)

Diesel fuel injection systems – Mechanical and common rail direct injection systems – Stages of combustion – Knocking – Factors affecting knock – Direct and indirect injection systems – Combustion chambers – Fuel spray behavior – Spray structure and spray penetration – Air motion – Introduction to turbocharging – Waste Gate, Variable Geometry turbochargers.

UNIT – 3: EMISSION FORMATION AND CONTROL (9)

Sources – 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.

UNIT – 4: ALTERNATIVE FUELS (9)

Properties, suitability, merits and demerits of alcohol fuels, hydrogen, compressed natural gas, liquefied petroleum gas and bio diesel – Utilisation Methods – Engine Modifications.

UNIT – 5: ALTERNATE COMBUSTION AND POWER TRAIN SYSTEM (9)

Low temperature combustion – Homogeneous Charge Compression Ignition (HCCI) – Reactivity Controlled Compression Ignition (RCCI) – Gasoline compression ignition – Spark assisted HCCI – Hybrid electric and electric vehicles – Fuel cells.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the fuel injection systems and knock effect of Spark Ignition engine	**PO1,PO2, PO6**
CO2	Understand the fuel-injection system & turbo-charging of Compression Ignition engine	**PO1,PO6**
CO3	Illustrate the pollutant formation, measurements, Emission norms & control of pollution	**PO1,PO6,PO7**

CO4	Realize the suitability of alternate fuels and engine modification	**PO1, PO2,**
CO5	Summarize the latest advancement in automobile and hybrid vehicles	**PO1, PO2,PO3**

Text Books:

1. Internal Combustion Engines, Ganesan, 4/e, 2018, Tata McGraw-Hill Education.
2. Internal Combustion Engine Fundamentals, 1/e, 2017, John B Heywood, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Introduction to Internal Combustion Engines, Richard Stone, 4/e, 2012, Palgrave Macmillan Press Ltd.
2. Internal Combustion Engines, 3/e, 2016, Colin R.Ferguson, Allan T.Kirkpatrick, Wiley India Pvt, Ltd., New Delhi.
3. Fundamentals of Internal Combustion Engines, 2/e, 2012, Gupta H.N, Prentice- Hall of India, Pvt. Ltd., New Delhi.
4. A Text Book of Internal Combustion Engines, 3/e, 2016, R.K.Rajput, Laxmi Publications (P) Ltd., New Delhi.
5. Internal Combustion Engines, V. Sajith and Shijo Thomas, 1/e, 2017, Oxford University Press, India.
6. Alternative Transportation Fuels: Utilisation in Combustion Engines, M. K. Gajendra Babu and K. A. Subramanian, 2013, CRC Press, Taylor & Francis Group.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	2	-	-	-	-	-	-
CO.2	3	-	-	-	-	2	-	-	-	-	-	-
CO.3	3	-	-	-	-	2	2	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414D FUEL CELL TECHNOLOGY

Course Educational Objectives:

1. To understand the basics of electro chemicals and performance characteristics of fuel cell
2. To know the working of Alkaline Fuel Cells and Phosphoric Acid Fuel Cells
3. To understand the working principles of solid oxide and molten carbonate fuel cells
4. To demonstrate the working of direct methanol & proton exchange membrane fuel cells
5. To understand the fuel processing and hydrogen storage

UNIT – 1: INTRODUCTION AND BASIS OF ELECTRO CHEMISTRY (9)

Fuel Cells: Relevance and importance – Historical highlights – Definition – Differentiation from other batteries – Fuel choice – Classification of fuel cells. **Electrochemistry Basis:** Thermodynamic aspects of electrochemical energy conversion – Theoretical efficiency for conversion of liberated heat in a chemical reaction into mechanical energy – Efficiency of electrochemical energy conversion – Factors affecting the efficiency of electrochemical energy conversion – Electrode kinetics of electrochemical energy conversion.

UNIT – 2: ALKALINE AND PHOSPHORIC ACID FUEL CELLS (9)

Alkaline Fuel Cells: Description of the alkaline fuel cell – Working principle – Components of an alkaline fuel cell – Modules – Fuel cell stacks – General performance characteristics – attempts towards advancements – System issues – Ammonia as AFC fuel. **Phosphoric Acid Fuel Cells**: Science underlying the technology – Electrodes: Materials and manufacturing - stacks and systems.

UNIT – 3: SOLID OXIDE AND MOLTEN CARBONATE FUEL CELLS (9)

Solid Oxide Fuel Cells: History of solid oxide fuel cells - Benefits and limitations – Cell components – Cathode materials – Anode materials – Interconnects – Fuel – Configurations and performance – Environmental impact of solid oxide fuel cells – Applications and future of SOFCs. **Molten Carbonate Fuel Cells:** General principle – Cell components – Mechanisms of electrode reactions – Status of MCFCs.

UNIT – 4: DIRECT METHANOL AND PROTON EXCHANGE MEMBRANE FUEL CELLS (9)

Direct Methanol Fuel Cells: Direct methanol fuel cell technology – The noble metal issue – The catalysis aspect – Electro-oxidation of methanol – Electrolyte – Non-catalytic aspects – State-of-the-art of methanol crossover in DMFC – Catalyst optimization and scale-up. **Proton Exchange Membrane Fuel Cells**: Fundamental scientific aspects and challenges – Technology development – Fuel processing – Modeling studies of PEMFC performance – Applications.

UNIT – 5: FUEL PROCESSING AND HYDROGEN STORAGE (9)

Fuel Processing: Processing hydrogen from alcohols – Producing hydrogen from hydrocarbons – Hydrogen from other sources – Gas clean-up – Hydrogen storage – Challenges and opportunities. **Hydrogen Storage:** Hydrogen production – Relevant properties – Hydrogen as an Engine fuel – Methods of hydrogen storage – Rediction of hydrogen uptake in carbon materials – Critical analysis.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Illustrate the basics of electro chemicals and performance characteristics of fuel cell	**PO1,PO2**
CO2	Understand the working of Alkaline Fuel Cells and Phosphoric Acid Fuel Cells	**PO1,PO2,PO3**
CO3	Demonstrate the working principles of solid oxide and molten carbonate fuel cells	**PO1,PO2,PO3**
CO4	Summarize the working of direct methanol and proton exchange membrane fuel cells	**PO1, PO2, PO3**
CO5	Recognize the fuel processing and hydrogen storage in fuel cells	**PO1, PO2, PO3**

Text Books:

1. Fuel Cell Systems Explained, James Larminie and Andrew Dicks, 2/e, 2003, John Wiley & Sons Ltd
2. Fuel Cells Principles and Applications, B.Viswanathan and Aulice Scibioh, 2006, Universities Press, Hyderabad.

Reference Books:

1. Fuel Cell Engines, Matthew M. Mench, 2008, John Wiley & Sons, Inc.
2. Fuel Cell Technology Handbook (FCTH), Gregor Hoogers, 2003, CRC Press LLC.
3. Fuel Cells: Technologies for Fuel Processing, Dushyant Shekhawat, James J. Spivey and David A. Berry, 2011, Elsevier B.V.
4. Fuel Cells: From Fundamentals and Applications, Supramaniam Srinivasan, 2006, Springer.
5. Fuel Cells: Current Technology Challenges and Future Research Needs, Noriko Hikosaka Behling, 2013, Elsevier B.V.
6. Principles of Fuel Cells, Xianguo Li, 2005, Taylor and Francis.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	2	2	-	-	-	-	-	-	-	-	-
CO.3	2	2	2	-	-	-	-	-	-	-	-	-
CO.4	2	2	2	-	-	-	-	-	-	-	-	-
CO.5	2	2	2	-	-	-	-	-	-	-	-	-
CO*	**2**	**2**	**2**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414E COMPUTATIONAL FLUID DYNAMICS

Course Educational Objectives:

1. To formulate the Governing equation and boundary conditions of fluid dynamics
2. To derive and solve the finite difference equations of fluid dynamics
3. To formulate the Finite volume formulation for steady state one, two and three dimensional diffusion
4. To study the pressure-velocity corrections and equation of computational fluid dynamics
5. To learn the turbulence models and mesh generation

UNIT – 1: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS (9)

Basics of computational fluid dynamics – 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 PDEs on CFD – Elliptic, parabolic and hyperbolic equations.

UNIT – 2: FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION (9)

Derivation of finite difference equations– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems – Example problems – Use of finite difference and finite volume methods.

UNIT – 3: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION (9)

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes – Conservativeness, boundedness, trasnportiveness, hybrid, power-law, quick schemes.

UNIT – 4: FLOW FIELD ANALYSIS (9)

Stream function and vortices – Representation of the pressure gradient term – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure correction equation – SIMPLE algorithm and its variants – PISO Algorithms.

UNIT – 5 TURBULENCE MODELS AND MESH GENERATION (9)

Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models – Mesh Generation and refinement Techniques – Software tools.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Solve the Governing equation and boundary conditions of fluid dynamics	**PO1,PO2,PO3, PO4**
CO2	Derive and solve the finite difference equations of fluid dynamics	**PO1,PO2,PO3, PO4**
CO3	Formulate the Finite volume formulation for steady state one, two and three dimensional diffusion problems	**PO1,PO2,PO3, PO4**
CO4	Study the pressure-velocity corrections and equation of computational fluid dynamics	**PO1,PO2,PO3, PO4**
CO5	Learn the turbulence models and mesh generation	**PO1,PO2,PO3, PO4**

Text books:

1. Computational Fluid Dynamics, Basics with Applications, John. D. Anderson, 1/e, 2017, McGraw-Hill Education Pvt. Ltd., Noida.
2. Computational Fluid Dynamics: A Practical Approach, Jiyuan Tu, Guan Heng Yeoh and Chaoqun Liu 3/e, 2018, Butterworth-Heinemann.

Reference books:

1. An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekra, 2/e, 2008, Pearson Education, India.
2. Applied Computational Fluid Dynamics, S C Gupta, 2019, Wiley India.
3. Computational Fluid Dynamics, John F. Wendt, 3/e, 2009, Springer-Verlag Berlin Heidelberg.
4. Introduction to Computational Fluid Dynamics, Anil W. Date 1/e, 2005, Cambridge University Press, UK.
5. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, 1/e, 2004, University Press (India) Private Ltd., Hyderabad.
6. Computational Fluid Dynamics and Heat Transfer, P.S. Ghoshdastidar, 1/e, 2017, Cengage Learning.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	2	2	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC414F HYDRAULICS AND PNEUMATICS

Course Educational Objectives:

1. To study the basic principles of fluid power system and hydraulic pumps
2. To know the hydraulic actuators and control components of a fluid power system
3. To understand the hydraulic circuits and systems for industrial purposes
4. To study the fluidics and pneumatic logic circuits of pneumatic and electro pneumatic systems.
5. To learn the trouble shooting and application of fluid power system

UNIT – 1: FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS (9)

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids – Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems. **Sources of Hydraulic power :** Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT – 2: HYDRAULIC ACTUATORS AND CONTROL COMPONENTS (9)

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT – 3: HYDRAULIC CIRCUITS AND SYSTEMS (9)

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative – Pump unloading – Double- Pump – Pressure Intensifier – Air-over oil – Sequence – Reciprocation – Synchronization – Fail-Safe – Speed Control – Hydrostatic transmission – Electro hydraulic circuits – Mechanical hydraulic servo systems.

UNIT – 4: PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS (9)

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems – Introduction to fluidics and pneumatic logic circuits.

UNIT – 5: TROUBLE SHOOTING AND APPLICATIONS (9)

Installation – Selection – Maintenance – Trouble Shooting and Remedies in Hydraulic and Pneumatic systems – Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications – Design of pneumatic circuits for pick and place applications – Tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the basic principles of fluid power system and hydraulic pumps	**PO1,PO2,PO3**
CO2	Summarize the hydraulic actuators and control components of a fluid power system	**PO1,PO2,PO3**
CO3	Explain the hydraulic actuators and control components of a fluid power system	**PO1,PO2,PO3,PO4**
CO4	Explain the hydraulic circuits and systems for industrial purposes	**PO1,PO2,PO3,PO4**
CO5	Summarize the various trouble shooting methods and applications of hydraulic	**PO1,PO2,PO3**

	and pneumatic systems.	

Text books:

1. Fluid Power with Applications, Anthony Esposito, 7/e, 2013, Pearson Education, India.
2. Fluid Power: Generation, Transmission and Control, Jagadeesha T and Thammaiah Gowda, 2019, Wiley India.

Reference books:

1. Hydraulic Fluid Power: Fundamentals, Applications, and Circuit Design, Andrea Vacca and Germano Franzoni, 2020, Wiley
2. Fluid Power Engineering, M. Galal Rabie, 2009, McGraw-Hill Companies, Inc.
3. Hydraulic and Pneumatic Controls, Shanmugasundaram.K, 2006, S.Chand & Co.
4. Oil Hydraulics Systems- Principles and Maintenance, Majumdar S.R., 1/e, 2001, Tata McGraw-Hill.
5. Design of Fluid Thermal Systems, William S. Janna, 4/e, 2015, Cengage Learning.
6. Hydraulics and Pneumatics: A Technician's and Engineer's Guide, E.A. Parr, 3/e, 2011, Butterworth-Heinemann is an imprint of Elsevier

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	2	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	**-**	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC415A PRODUCT DESIGN AND DEVELOPMENT

Course Educational Objectives:

1. To develop the Characteristics of successful product design and development in an organization
2. To evaluate the product planning and product specification of a product
3. To understand the generation, selection and testing of a concept in the product design.
4. To develop product architecture and design for manufacturing new product
5. To understand the principles of prototypes, economics and project management.

UNIT – 1: INTRODUCTION TO PRODUCT DESIGN (9)

Characteristics, duration, challenges and cost of successful product development – Product development process – Generic development process – Concept development – Adaptation of the generic product development – Product development process flow and organization – Structure of opportunity identification – Opportunity identification process – Establish a charter – Generate and sense many opportunities – Screening of opportunities – Develop promising opportunities – Select exceptional opportunities – Reflect on the results and the process.

UNIT – 2: PRODUCT PLANNING AND PRODUCT SPECIFICATION (9)

Product planning process – Identification of opportunities – Evaluation and prioritization of projects – Allocation of resources and plan timing – Completion of pre-project planning – Reflect on the results and process – Identification of customer needs – Collection and Interpretation of raw data from customers – Organization of the needs – Establishment of relative importance of needs – Product specifications – Establishment of target specifications – Setting-up of final specifications.

UNIT – 3: CONCEPT GENERATION, SELECTION, TESTING (9)

Concept generation – Clarification of the problem – Searching externally and internally – Systematic exploration and reflect on the solutions – Concept selection – Steps for concept screening and concept scoring – Concept testing – Purpose of concept test – Survey population and format – Communicating the concept – Measuring the customer response – Interpretation of results.

UNIT – 4: PRODUCT ARCHITECTURE AND DESIGN FOR MANUFACTURE (9)

Product architecture – Modularity – Implications – Establishing the architecture – Delayed differentiation – Platform planning – System-level design issues – Need, impact, management and quality of industrial design – Design for environment process – Setting the DFE agenda – Identify potential environmental impacts – Select and apply the DFE guidelines to the product design – Assessing and elimination of environmental impacts – Reflect on the DFE process – Design for manufacturing – Estimation of manufacturing costs – Reduction of costs of components, assembly, supporting production – Impact decisions of DFM.

UNIT – 5: PRODUCT DEVELOPMENT ECONOMICS AND MANAGING PROJECTS (9)

Principles, technologies and Planning of prototypes – Robust design process – Identify the performance metrics, control and noise factors – Formulate an objective function and experimental plan – Run the experiment, select, reflect and repeat and confirm factor – Overview, formulation, strategy and utility of patents – Study prior inventions – Outline and refine claims – Description of the invention – Pursue application and reflect on the results – Product development economics and elements analysis – Financial model – Perform and use of sensitivity analysis – Qualitative factors on project success – Managing projects – Baseline project planning – Project execution.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the Characteristics of successful product development in an organization	**PO1,PO2,PO3**
CO2	Evaluate the product planning and product specification of a product	**PO1,PO2,PO3**
CO3	Understand the generation, selection and testing of a product concept	**PO1,PO2,PO3**
CO4	Develop product architecture and design for manufacturing new product	**PO1,PO2,PO3**
CO5	Understand the principles of prototypes, economics and project management	**PO1,PO2,PO3,PO11**

Text Books:

1. Product Design and Development, Ulrich K.T. and Eppinger S.D., 6/e, 2015, McGraw-Hill Education.
2. Product Design: Techniques in Reverse Engineering and New Product Development, Kevin Otto and Kristin Wood, 1/e, 2003, Pearson Education.

Reference Books:

1. New Products Management, Merle Crawford and Anthony Di Benedetto, 11/e, 2020, McGraw-Hill Education.
2. Innovation Management and New Product Development, Paul Trott, 6/e, 2016, Pearson Education.
3. Product Design and Manufacturing, Chitale.A.K and Gupta.R.C, 2011, Prentice Hall of India, New Delhi.
4. Managing Innovations and New Product Development: Concepts and Cases, Mukesh Chaturvedi, Aseem Kumar and Rahul Manmohan, 2009, PHI Learning.
5. Designing the Future, James M. Morgan and Jeffrey K. Liker, 1/e, 2019, McGraw-Hill Education.
6. Successful Product Design and Management Toolkit, David Fradin, 2019, Wiley India Pvt. Ltd.,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	2	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	**2**	-

IV B.Tech I Semester **L T P C**
3 0 0 3

18MEC415B DESIGN CONCEPTS IN ENGINEERING

Course Educational Objectives:

1. To learn the various methods and forms of design in engineering fields.
2. To evaluate Basic modules in design process by Scientific method and design method
3. To develop the creativity and innovation in design to solve problems by vertical and lateral thinking.
4. To study the design in human machine interface for developing the product.
5. To understand the selection of material for performance characteristics for new design

UNIT – 1: DESIGN TERMINOLOGY (9)

Definition – Various methods and forms of design – Importance of product design – Static and dynamic products – Various design projects – Morphology of design – Requirements of a good design – Concurrent engineering – Computer aided engineering – Codes and standards – Product and process cycles – Bench marking.

UNIT – 2: DESIGN PROCESS (9)

Basic modules in design process – Scientific method and design method – Need identification, importance of problem definition – Structured problem, real life problem – Information gathering – Customer requirements – Quality function deployment (QFD) – Product design specifications generation of alternative solutions – Analysis and selection – Detail design and drawings – Prototype, modeling, simulation, testing and evaluation.

UNIT – 3: CREATIVITY IN DESIGN (9)

Creativity and problem solving – Vertical and lateral thinking – Invention – Psychological view, mental blocks – Creativity methods – Brainstorming, synectics, force fitting methods, mind map, concept map – Theory of innovative problem solving (TRIZ) – Conceptual decomposition creating design concepts.

UNIT – 4: HUMAN AND SOCIETAL ASPECTS IN PRODUCT DEVELOPMENT (9)

Human factors in design – Ergonomics – User friendly design – Aesthetics and visual aspects – environmental aspects – Marketing aspects – Team aspects – Legal aspects – Presentation aspects.

UNIT – 5: MATERIALS AND PROCESSES IN DESIGN (9)

Material selection for performance characteristics of materials – Selection for new design substitution for existing design – Economics of materials – Selection methods – Recycling and material selection types of manufacturing process, process systems – Design for manufacturability (DFM) – Design for assembly.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Learn the various methods and forms of design in engineering fields	**PO1,PO2,PO3**
CO2	Evaluate basic modules in design process by Scientific method and design method	**PO1,PO2,PO3**
CO3	Develop the creativity and innovation in design to solve problems by vertical and lateral thinking.	**PO1,PO2,PO3**
CO4	Develop the design in human machine interface for the product development.	**PO1,PO2,PO3**
CO5	Understand the selection of material for performance characteristics for new	**PO1,PO2,PO3**

	design	

Text Books:

1. Engineering Design, George Dieter and Linda Schmidt, 6/e, 2020, McGraw Hill International.
2. Concepts in Engineering Design, Mohit S. Maheshwarkar and Pallavi Maheshwarkar, 1/e, 2016, S.K.Kataria & Sons Publishers, New Delhi.

Reference Books:

1. Concepts in Engineering Design, Sumesh Krishnan and Dr.Mukul Shukla, 1/e, 2016, Notion Press.
2. Concepts in Engineering Design, Aziz, Atif, 2017, New Age International.
3. Engineering Design Process, Yousef Haik, 2/e, 2011, Cengage Learning.
4. Engineering of Creativity: Introduction to TRIZ Methodology of Inventive Problem Solving, Semyon D. Savransky, 2000, CRC Press.
5. The Design of Everyday Things: Revised and Expanded Edition, Don Norman, 2014, Basic Books, A Member of the Perseus Books Group, Don Norman
6. Design Engineering: A Manual for Enhanced Creativity, W Ernst Eder and Stanislav Hosnedl, 2008, CRC Press.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	-	-	-	-	-	-	-	-	-
CO.2	3	2	3	-	-	-	-	-	-	-	-	-
CO.3	3	2	3	-	-	-	-	-	-	-	-	-
CO.4	3	2	3	-	-	-	-	-	-	-	-	-
CO.5	3	2	3	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**3**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC415C INDUSTRIAL TRIBOLOGY

Course Educational Objectives:

1. To understand the principles of friction between different surfaces and materials.
2. To explain the phenomenon of wear between surfaces in contact and its implications.
3. To understand the principles, methods, purpose and selection of lubricants.
4. To know the lubrication theory and the flow of film lubricants with different applications.
5. To brief the surface treatment methods to improve the wear resistance and friction properties.

UNIT – 1: SURFACES AND FRICTION (9)

Topography of engineering surfaces – Contact between surfaces – Sources of sliding friction – Adhesion-Ploughint – Energy dissipation mechanisms friction characteristics of metals – Friction of non metals – Friction of lamellar solids – Friction of ceramic materials and polymers – Rolling friction – Source of rolling friction – Stick slip motion – Measurement of friction.

UNIT – 2: WEAR (9)

Types of wear – Simple theory of sliding wear mechanism of sliding wear of metals – Abrasive wear – Materials for adhesive and abrasive wear situations – Corrosive wear – Surface fatigue wear situations – Brittle fracture – Wear – Wear of ceramics and polymers – Wear measurements.

UNIT – 3: LUBRICANTS AND LUBRICATION TYPES (9)

Types and properties of lubricants – Testing methods – Hydrodynamic lubrication – Elasto hydrodynamic lubrication – Boundary lubrication – Solid lubrication – Hydrostatic lubrication.

UNIT – 4: FILM LUBRICATION THEORY (9)

Fluid film in simple shear – Viscous flow between very close parallel plates – Shear stress variation Reynolds equation for film lubrication – High speed unloaded journal bearings – Loaded journal bearings – Reaction torque on the bearings – Virtual co-efficient of friction – The Sommerfield diagram.

UNIT – 5: SURFACE ENGINEERING AND MATERIALS FOR BEARINGS (9)

Surface Engineering: Surface modifications – Surface properties – Transformation Hardening, surface fusion – Hydrophobic – Super hydrophobic – Hydrophilic – Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Thermo chemical processes – Plating and anodizing – Fusion processes.
Materials for Bearings: Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings –Biomaterials – Bio Tribology – Nano tribology.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the importance of friction between different surfaces and should know to calculate the friction	**PO1,PO2,PO3**
CO2	Evaluate the phenomenon of wear between surfaces in contact and its implications	**PO1,PO2,PO3**
CO3	Understand the principles, methods, purpose and selection of lubricants for the reduction of friction.	**PO1,PO2,PO3**
CO4	Summarize the lubrication theory and the flow of film lubricants with different applications	**PO1,PO2,PO3**
CO5	Brief the surface treatment methods to improve the wear resistance and friction properties.	**PO1,PO2,PO3**

Text Books:

1. Industrial Tribology, R.B.Patil, 1/e, 2012, Tech-Max Publications, Pune.
2. Applied Tribology: Bearing Design and Lubrication, Michael M. Khonsari and E. Richard Booser, 3/e, 2017, John Wiley & Sons Ltd.

Reference Books:

1. Bearing Design in Machinery, Harnoy, Avraham Harnoy, 1/e, 2002, Marcel Dekker Publishers, New York.
2. Engineering Tribology, Gwidon W. Stachowiak and Andrew W. Batchelor, 3/e, 2005, Elsevier Butterworth-Heinemann.
3. Modern Tribology Handbook: Principles of Tribology - Volume I, Bharat Bhushan, CRC Press LLC.
4. Principles and Applications of Tribology, Bharat Bhushan, 2/e, 2013, John Wiley & Sons, Ltd.
5. Tribology in Machine Design, T. A. Stolarski, 2000, Butterworth-Heinemann.
6. Engineering Tribology, SahooPrasantha, 1/e, 2009, Prentice-Hall of India, Pvt, Ltd., New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC415D DESIGN OF PRESSURE VESSELS AND PIPING

Course Educational Objectives:

1. To know cylindrical shell and various closures in the design of pressure vessels and piping
2. To explain the stress concentration in plate having circular hole due to bi-axial loading
3. To understand the design of base plate and support lugs for vertical and horizontal pressure vessels
4. To know the importance of buckling under combined external pressure and axial loading.
5. To brief the piping layout and piping stress analysis in pressure vessels and piping

UNIT – 1: CYLINDRICAL SHELL AND VARIOUS CLOSURES (9)

Membrane theory for thin shells – Stresses in cylindrical, spherical and conical shells, dilation of above shells, general theory of membrane stresses in vessel under internal pressure and its application to ellipsoidal and torispherical end closures – Bending of circular plates and determination of stresses in simply supported and clamped circular plate – Introduction to ASME code and formulae.

UNIT – 2: JUNCTION STRESSES, OPENING AND REINFORCEMENTS (9)

Discontinuity stresses – Stress concentration in plate having circular hole due to bi-axial loading – Theory of reinforced opening and reinforcement limits.

UNIT – 3: SUPPORT DESIGN (9)

Supports for vertical and horizontal vessels – Design of base plate and support lugs – Types of anchor bolt, its material and allowable stresses – Design of saddle supports.

UNIT – 4: BUCKLING IN VESSELS (9)

Buckling of vessels under external pressure – Elastic buckling of long cylinders, buckling modes, collapse under external pressure – Design for stiffening rings – Buckling under combined external pressure and axial loading.

UNIT – 5: PIPING STRESS ANALYSIS (9)

Flow diagram, piping layout and piping stress analysis – Flexibility factor and stress intensification factor – Design of piping system as per B31.1 piping code – Piping components – Bends, tees, bellows and valves – Types of piping supports and their behavior.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the importance of cylindrical shell and various closures in the design of pressure vessels and piping	**PO1,PO2,PO3, PO4**
CO2	Evaluate the stress concentration in plate having circular hole due to bi-axial loading	**PO1,PO2,PO3, PO4**
CO3	understand the design of base plate and support lugs for vertical and horizontal pressure vessels	**PO1,PO2,PO3, PO4**
CO4	Describe the design for stiffening rings, buckling under combined external pressure and axial loading	**PO1,PO2,PO3, PO4**
CO5	Explain the piping layout and piping stress analysis in pressure vessels and piping	**PO1,PO2,PO3, PO4**

Text Books:

1. Theory and Design of Pressure Vessels, John F. Harvey, 2001, CBS Publishers and Distributors.
2. Pressure Vessels: Design and Practice, Somnath Chattopadhyay, 2004, CRC Press.

Reference Books:

1. Pressure Vessels: External Pressure Technology, Carl T. F. Ross, 2/e, 2011, Woodhead Publishing Limited
2. Pressure Vessel Design Manual, Dennis R. Moss and Michael M. Basic, 2013, Butterworth-Heinemann.
3. Process Piping Design Handbook: The Fundamentals of Piping Design, Peter Smith, 2007, Gulf Publishing Company.
4. Piping and Pipeline Engineering: Design Construction Maintenance Integrity and Repair, George A Antaki, 2003, Marcel Dekker, Inc.
5. Piping Systems Pipeline: The ASME Code Simplified, J. Phillip Ellenberger, 2004, McGraw-Hill Publications.
6. Pressure Vessels: The ASME Code Simplified, J. Phillip Ellenberger, Robert Chuse and Bryce E Carson, 2004, McGraw-Hill Publications.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	2	-	-	-	-	-	-	-	-
CO.2	3	3	2	2	-	-	-	-	-	-	-	-
CO.3	3	3	2	2	-	-	-	-	-	-	-	-
CO.4	3	3	2	2	-	-	-	-	-	-	-	-
CO.5	3	3	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	2	2	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC415E DESIGN OF HEAT EXCHANGERS

Course Educational Objectives:

1. To understand the fundamental principles of heat exchanger and classifications.
2. To analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger
3. To learn thermal and stress analysis on various parts of the heat exchangers.
4. To study the design of condenser, surface and evaporative condensers.
5. To develop a design of evaporative condensers and Cooling towers.

UNIT – 1: 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 – 2: 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 – 3: STRESS ANALYSIS, DESIGN OF COMPACT AND PLATE HEAT EXCHANGER (9)

Stress Analysis: Stress in tubes – Header sheets and pressure vessels – Thermal stresses, shear stresses – Types of failures, buckling of tubes, flow induced vibration. **Design of Compact and Plate Heat Exchanger**: Types – Merits and demerits – Design of compact heat exchangers, plate heat exchangers, performance influencing parameters and limitations.

UNIT – 4: DESIGN OF CONDENSERS (9)

Design of Condensers: Overall heat transfer coefficients – Temperature distribution and heat flow in condenser – Pressure drop in condenser – Extended fin surfaces – Fouling factor – Correction factor – Design of surface and evaporative condensers.

UNIT – 5: DESIGN OF COOLING TOWERS AND SPRAY PONDS (9)

Design of Cooling Towers and Spray Ponds: Classification – Performance – Analysis of counter flow – Cross flow cooling towers – Temperature diagram of air and water – Cooling ponds – Types of cooling ponds – Procedure for Calculation of Outlet Conditions – Cooling tower – Performance characteristics.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamental principles of heat exchanger and classifications	**PO1, PO2, PO3, PO4**
CO2	Analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger	**PO1, PO2, PO3, PO4**
CO3	Illustrate the thermal and stress analysis on various parts of the heat exchangers	**PO1, PO2, PO3, PO4**
CO4	Understand the design of condenser, surface and evaporative condensers	**PO1, PO2, PO3, PO4**

CO5	Develop a design of evaporative condensers and Cooling towers.	**PO1, PO2, PO3, PO4**

Text Books:

1. Heat Exchangers Selection, Rating and Thermal Design, SadikKakac, Hongtan Liu, Anchasa Pramuanjaroenkij, 3/e, 2012, CRC Press.
2. Fundamentals of Heat Exchanger Design, Ramesh K. Shah and Dusan P. Sekulic, 2003, John Wiley & Sons, Inc.

Reference Books:

1. Heat Exchanger Design Hand Book, T. Kuppan, Marcel Dekker, 2009, New York.
2. Compact Heat Exchangers: Selection, Design and Operation, John E. Hesselgreaves, 2001, Elsevier science Ltd.
3. Compact Heat Exchangers Analysis, Design and Optimization Using FEM and CFD Approach, C. Ranganayakulu and K.N. Seetharamu, 2018, John Wiley & Sons Ltd.
4. Process Heat Transfer Principles and Applications, Robert W. Serth, 2010, Academic press, Elesevier.
5. Advances in Thermal Design of Heat Exchangers: A Numerical Approach: Direct-sizing, Step-wise Rating and Transients, Eric M. Smith, 2005, John Wiley & Sons.
6. Heat Exchanger Design, Arthur P. Fraas, 2/e, 2011, John Wiley & Sons Ltd.

Codes/Tables: Data book is permitted in the examinations.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	-	-	-	-	-	-	-	-
CO.2	3	3	3	2	-	-	-	-	-	-	-	-
CO.3	3	3	3	2	-	-	-	-	-	-	-	-
CO.4	3	3	3	2	-	-	-	-	-	-	-	-
CO.5	3	3	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**3**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18MEC415F COMPOSITE MATERIALS AND MECHANICS

Course Educational Objectives:

1. To know the fundamentals of composite, lamina constitutive equations and manufacturing
2. To learn the flat plate laminate constitute equations
3. To study the lamina strength analysis of flat plates
4. To drive the modification of Laminate Constitutive Equations for thermal analysis.
5. To understand the analysis of laminated flat plates.

UNIT – 1: INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING (9)

Introduction: Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. **Lamina Constitutive Equations:** Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. **Manufacturing:** Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT – 2: FLAT PLATE LAMINATE CONSTITUTE EQUATIONS (9)

Definition of stress and Moment Resultants – Strain Displacement relations – Basic Assumptions of Laminated anisotropic plates – Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates – Laminate Structural Moduli – Evaluation of Lamina Properties from Laminate Tests – Quasi-Isotropic Laminates – Determination of Lamina stresses within Laminates.

UNIT – 3: LAMINA STRENGTH ANALYSIS (9)

Introduction – Maximum Stress and Strain Criteria – Von-Misses Yield criterion for Isotropic Materials – Generalized Hill's Criterion for Anisotropic materials – Tsai-Hill's Failure Criterion for Composites – Tensor Polynomial (Tsai-Wu) Failure criterion – Prediction of laminate Failure.

UNIT – 4: THERMAL ANALYSIS (9)

Assumption of Constant C.T.E's – Modification of Hooke's Law – Modification of Laminate Constitutive Equations – Orthotropic Lamina C.T.E's – C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

UNIT – 5: ANALYSIS OF LAMINATED FLAT PLATES (9)

Equilibrium Equations of Motion – Energy Formulations – Static Bending Analysis. – Buckling Analysis. Free Vibrations – Natural Frequencies.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamentals of composite, lamina constitutive equations and manufacturing	**PO1,PO2,PO3**
CO2	Demonstrate the flat plate laminate constitute equations	**PO1,PO2,PO3**
CO3	Understand the lamina strength analysis of flat plates	**PO1,PO2,PO3**
CO4	Drive the modification of Laminate Constitutive Equations for thermal	**PO1,PO2,PO3**

	analysis.	
CO5	Analysis of laminated flat plates for natural and free vibrations.	**PO1,PO2,PO3**

Text Books:

1. Principles of Composite Material Mechanics, Gibson, R.F., 4/e, 2016, CRC Press, Taylor & Francis Group.
2. Advanced Mechanics of Composite Materials, Valery V. Vasiliev and Evgeny V. Morozov, 4/e, 2018, Elsevier Ltd.

Reference Books:

1. Composite Structures: Design, Mechanics, Analysis, Manufacturing, and Testing, Manoj Kumar Buragohain, 2017, CRC Press, Taylor & Francis Group.
2. Engineering Mechanics of Composite Materials, Issac M. Daniel and Ori Ishai, 2/e, 2013, Oxford University Press, Inc.
3. Micromechanics of Composite Materials, 2013, Jacob Aboudi, Steven M Arnold & Brett A. Bednarcyk, Butterworth-Heinemann is an imprint of Elsevier
4. Mechanics of Laminated Composite Plates and Shells: Theory and Analysis, J.N.Reddy, 2/e, 2003, CRC Press, Taylor & Francis Group.
5. Composite Materials: Science and Applications, Chung D.L. Deborah., 2/e, 2010, Springer Ltd..
6. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, Reprint 2008, University Press (India) Pvt. Ltd., Hyderabad.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC423A ADVANCED MACHINING PROCESS

Course Educational Objectives:

1. To understand the working principles of mechanical energy based machining process.
2. To learn electric discharge machining and wire cut EDM process for machining
3. To understand the working of Laser beam and Electron machining process.
4. To know the chemical based and electro chemical based machining process.
5. To learn advanced finishing processes and recent developments in the non- traditional machining.

UNIT – 1: MECHANICAL ADVANCED MACHINING PROCESS (9)

Introduction: Need for non-traditional machining methods – Classification of modern machining processes – Considerations in process selection materials and applications. **Abrasive Jet:** Basic principles, equipments, process variables and mechanics of metal removal, MRR, application and limitations. **Abrasive Water Jet Machining and Water Jet Cutting:** Basic principles, equipments, process variables and mechanics of metal removal, MRR, application and limitations. **Ultrasonic machining:** Elements, mechanics of metal removal, process parameters, economic considerations, applications, limitations and recent development.

UNIT – 2: THERMO ELECTRIC ADVANCED MACHINING PROCESS (9)

Electric Discharge Machining: Principle of working – Power supply, dielectric system, electrodes and servo system – Circuit analysis – Material removal rate – Process variables and characteristics – Applications. **Wire-Electric Discharge Machining:** Principle of working, process variables and characteristics and applications – Principle and working of Electric Discharge grinding, electric discharge diamond grinding and micro electric discharge machining. **Electric Discharge Grinding:** Principle of working and applications.

UNIT – 3: LASER BEAM AND ELECTRON BEAM ADVANCED MACHINING PROCESS (9)

Laser Beam Machining: General principle and application of laser beam machining – Thermal features, cutting speed and accuracy of cut. **Electron Beam Machining:** Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes. **Plasma Arc Machining:** Principle and working – Metal removal mechanism, process parameters, accuracy and surface finish and Applications.

UNIT – 4: ELECTRO CHEMICAL AND CHEMICAL ADVANCED MACHINING PROCESS (9)

Electro Chemical Machining: Principle, ECM system, advantages, limitations and applications. **Electro Chemical Grinding:** Principle and working, process characteristics and applications. **Chemical Machining:** Fundamentals of chemical machining – Principle – Maskants – Etchants – Advantages and applications. **Electro Chemical Streaming and Deburring:** Principle, process characteristics and applications.

UNIT – 5: OTHER ADVANCED MACHINING PROCESS (9)

Magnetic Abrasive Finishing: Principle and working, material removal and surface finish and applications. **Abrasive Flow Finishing:** Principle and working – Process performance. **Electro Stream Drilling:** Principle and working – Process performance. **Shaped Tube Electrolytic Machining:** Principle and working, applications.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the working principles of mechanical energy based machining process	**PO1,PO2**
CO2	Explain electric discharge machining and wire cut EDM process for machining	**PO1,PO2**
CO3	Understand the working of Laser beam and Electron machining process	**PO1,PO2**
CO4	Explain the chemical based and electro chemical based machining process.	**PO1,PO2**
CO5	Summarize the advanced surface finishing processes and recent developments in the non-traditional machining processes.	**PO1,PO12**

Text Books:

1. Advanced Machining Processes, V. K. Jain, 2007, Allied Publishers Pvt. Ltd., New Delhi.
2. Unconventional Machining Process, M Adithan, 2014, Atlantic Publications, New Delhi

Reference Books:

1. Non-traditional Micromachining Processes: Fundamentals and Applications, Golam Kibria, B. Bhattacharyya and J. Paulo Davim, 2017, Springer.
2. Micromanufacturing Processes, V. K. Jain, 2013, CRC Press, Taylor & Francis Group.
3. Micromanufacturing Engineering and Technology, Yi Qin, 2/e, 2015, Elsevier Inc.
4. Manufacturing Engineering and Technology (SI Edition), Serope Kalpakjian and Steven R. Schmid, 7/e, 2018, Pearson Education, India.
5. Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, Hassan El-Hofy, 2005, McGraw Hill.
6. Modern Machining Processes, Pandey P.C. and Shan H.S., 1980, Tata McGraw Hill, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	-	-	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	-	-	-	**-**	-	-	-	-	-	**2**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC423B ADDITIVE MANUFACTURING TECHNOLOGY

Course Educational Objectives:

1. To understand the need and development of additive manufacturing technology.
2. To learn the design for additive manufacturing, CAD modeling and printing process.
3. To know the parameters and process of liquid and solid based additive manufacturing processes
4. To explain the powder based additive manufacturing process and material jetting
5. To demonstrate the post processing techniques and applications of AM process

UNIT – 1: OVERVIEW OF ADDITIVE MANUFACTURING (AM) (9)

Overview – Additive V/s Conventional Manufacturing / CNC – Rapid prototyping – Rapid Tooling – Rapid manufacturing – Generic AM process – Development of AM technology – Use of layers – Classification of AM process – AM process chain – Basic steps for AM process – Differentiation between photopolymer system, powder based system, molten material system, solid sheets and metal system.

UNIT – 2: CAD MODELING AND DESIGN FOR ADDITIVE MANUFACTURING (DFAM) (9)

CAD Modeling: Preparation of CAD models – Data processing – STL format. **DFAM:** Part orientation and support structure generation – Removal supports – Hollowing out parts – Undercuts – Inter locking features – Reduction of part and identification – Model slicing – Tool path generation – Data translation and loss **–** Customized design and fabrication for medical applications – AM unique capabilities – DFAM concepts for complex geometry, integrated assemblies, customized geometry, multifunctional design and constraints – Part consolidation, redesign, structures and industrial applications – Light weight structure, optimization methods and topology. **Printing Processes:** Droplet formation technologies – Continuous mode – Drop on demand mode – Bioplotter.

UNIT – 3: LIQUID AND SOLID BASED ADDITIVE MANUFACTURING PROCESS (9)

Stereolithography (SLA): Polymerization materials – Process – Patterns – Vat photo polymerization process – Benefits – Applications. **Poly Jet:** Materials – Process – Process benefits – Applications. **Fused Deposition Modeling (FDM):** Principle – Materials – Limitations – Benefits – Applications. **Laminated Object Manufacturing (LOM):** Bonding process – Adhesive bonding and thermal bonding – Materials – Limitation – Application. **Ultrasonic Consolidation:** Principle – Materials and properties – Process – Applications.

UNIT – 4: POWDER BASED ADDITIVE MANUFACTURING PROCESS (9)

Selective Laser Sintering (SLS): Process – Materials – Powder fusion mechanism – Powder handling – Applications. **Selective Laser Melting (SLM) and Electron Beam Melting (EBM):** Principle – Materials – Process – Benefits – Applications. **Laser Engineered Net Shaping (LENS)**: Materials – Material delivery – Process parameters – Benefits – Applications. **Binder Jetting:** Materials – Process – Benefits. **Material Jetting:** Materials – Process – Multijet modeling – Benefits.

UNIT – 5: POST PROCESSINGTECHNIQUES AND APPLICATIONS OF AM PROCESS (9)

Product Quality: Support material removal – Surface texture improvements – Accuracy improvements – Aesthetic improvements – Preparation for use of pattern – Property enhancement using thermal and non thermal techniques – Inspection and testing – Defects and their causes. **Applications:** Additive Manufacturing application of aerospace, electronics, healthcare, defense, automotive, construction, food processing, machine tool – Business opportunities and future directions of AM.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the need and development of additive manufacturing technology	**PO1, PO2**
CO2	Explain the design for additive manufacturing, CAD modeling, printing process	**PO1, PO2, PO3**
CO3	Illustrate the process of liquid and solid based additive manufacturing processes	**PO1, PO2, PO3**
CO4	Explain the powder based additive manufacturing process and material jetting	**PO1, PO2, PO3**
CO5	Summarize the post processing techniques and applications of AM process	**PO1, PO2, PO3**

Text Books:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Ian Gibson, David W.Rosen and Brent Stucker, 2/e, 2015, Springer.
2. Rapid Prototyping: Principles and Applications, Chee Kai Chua, Kah Fai Leong and Chu Sing Lim 3/e, 2010, World Scientific Publishers.

Reference Books:

1. Additive manufacturing: Innovations, Advances, and Applications, T.S. Srivatsan and T.S. Sudarshan, Taylor & Francis Group, LLC.
2. Additive Manufacturing of Emerging Materials, Bandar AlMangour, 2018, Springer.
3. 3D Printing and Additive Manufacturing Technologies, L. Jyothish Kumar, Pulak M. Pandey and David Ian Wimpenny, 2019, Springer Nature Singapore Pte Ltd.
4. 3D Printing: Technology, Applications, and Selection, Rafiq Noorani, 2018, CRC Press, Taylor & Francis Group.
5. Design for Additive Manufacturing, Martin Leary, 2019, Elsevier.
6. Additive Manufacturing Handbook: Product Development for the Defense Industry, Adedeji B. Badiru, Vhance V. Valencia, and David Liu, 2017, CRC Press, Taylor & Francis Group.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-

IV B.Tech II Semester **L T P C**
3 0 0 3

18MEC423C SUSTAINABLE AND GREEN MANUFACTURING

Course Educational Objectives:

1. To learn concept of triple bottom line, environmental, economic and social dimensions of sustainability.
2. To evaluate the performance and environmental impact assessments of Sustainability
3. To know the concepts of competitive strategy and manufacturing strategies
4. To learn the basics involved in Green manufacturing,
5. To study the importance of recycling and life cycle assessment

UNIT – 1: INTRODUCTION TO SUSTAINABLE MANUFACTURING (9)

Sustainable manufacturing – Concept of triple bottom line – Environmental, economic and social dimensions of sustainability – Sustainable product development – Various phases.

UNIT – 2: EVALUATING SUSTAINABILITY (9)

Sustainability performance evaluators – Frameworks and techniques – Environmental management systems – Life cycle assessment – Strategic and environmental impact assessments – Carbon and water foot-printing.

UNIT – 3: MANUFACTURING STRATEGY FOR SUSTAINABILITY (9)

Concepts of competitive strategy – Manufacturing strategies and development of a strategic improvement program – Manufacturing strategy in business success strategy formation and formulation – Structured strategy formulation – Sustainable manufacturing system design options – Approaches to strategy formulation – Realization of new strategies/system designs.

UNIT – 4: GREEN MANUFACTURING (9)

Green manufacturing – Definition, motivation and barriers to green manufacturing – Environmental impact of manufacturing – Waste generation – Energy consumption – Strategies for green manufacturing – Green manufacturing by design – Life cycle assessment.

UNIT – 5: RECYCLING (9)

Reclamation and recycling of waste – Recycling as universal resource policy – Innovation towards environmental sustainability – Systematic framework for conscious design – International green manufacturing standards and compliance.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand concept of triple bottom line, environmental, economic and social dimensions of sustainability.	**PO1, PO6, PO7, PO12**
CO2	Evaluate the performance and Strategic environmental impact assessments of sustainability	**PO1, PO6, PO7, PO12**
CO3	Understand the concepts of competitive strategy and manufacturing strategies	**PO1, PO6, PO7, PO12**
CO4	Explain the basics involved in Green manufacturing	**PO1, PO6, PO7, PO12**
CO5	Summarize the importance of recycling and life cycle assessment	**PO1, PO6, PO7, PO12**

Text Books:

1. Sustainable Manufacturing, Davim, J.P., 2010, John Wiley & Sons.
2. Green Manufacturing: Fundamentals and Applications, Dornfield David, 2012, Springer.

Reference Books:

1. Sustainable Manufacturing: Shaping Global Value Creation, Seliger, G, 2012, Springer.
2. Advances in Sustainable Manufacturing, Günther Seliger, Marwan M.K. Khraisheh and I.S. Jawahir, 2011, Springer-Verlag Berlin Heidelberg
3. Sustainable Manufacturing: Challenges, Solutions and Implementation Perspectives, Rainer Stark, Günther Seliger and Jérémy Bonvoisin, 2017, Springer.
4. Green Manufacturing Processes and Systems, Davim.J.Pauls, 2013, Springer.
5. Green Manufacturing Processes and Systems, Davim, J.P, 2012, Springer.
6. Environmentally Conscious Mechanical Design, Kutz, M., 2007, John Wiley & Sons.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	1	2	-	-	-	-	1
CO.2	3	-	-	-	-	1	2	-	-	-	-	1
CO.3	3	-	-	-	-	1	2	-	-	-	-	1
CO.4	3	-	-	-	-	1	2	-	-	-	-	1
CO.5	3	-	-	-	-	1	2	-	-	-	-	1
CO*	**3**	-	-	-	-	**1**	**2**	-	-	-	-	**1**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC423D CASTING AND WELDING PROCESSES

Course Educational Objectives:

1. To learn the basics of ferrous cast alloys their merits and applications.
2. To discover the basics of Non-ferrous cast alloys their merits and applications.
3. To learn the physical metallurgy of welding process and functions
4. To know the welding of alloy steel and Non-ferrous metals.
5. To impart knowledge on weldability, Defects of welding and welding Standard.

UNIT – 1: FERROUS CAST ALLOYS (9)

Solidification of pure metals and alloys and eutectics – Nucleation – Growth Process and critical nucleus size – Supercooling – Niyama Criterion – G/R ratio cell – Dendritic – Random dendritic structure – Segregation and coring – Eutectics – Compositions and alloys in cast irons, FG-CGI- SG structures, metallic Glass – Mold dilation and mold metal reactions – Structure and section sensitivity cast irons- family and microstructures – Alloying effects – Malleable iron, ADI, Charge calculations – Effect of normal elements and alloying elements in steels – Compositional aspects and properties of alloy steels – Melting procedure and composition control for carbon steels – Low alloy steels – Stainless steels – Composition control – Slag – Metal reactions – Desulphurization – Dephosphorisation, specifications for carbon steels – Low alloy steels and stainless steels.

UNIT – 2: NON FERROUS CAST ALLOYS (9)

Copper – Aluminium – Magnesium – Zinc – Nickel base alloys – Melting practices – Al alloys, Mg alloys, nickel alloys, zinc alloys and copper alloys – Modification and grain refinement of Al alloys – Problems in composition control – Degassing techniques – Heat treatment of aluminium alloys – Basics of solution and precipitation process – Applications of aluminium alloy castings in various fields – Residual stresses – Defects in castings.

UNIT – 3: PHYSICAL METALLURGY OF WELDING (9)

Welding of ferrous materials – Iron- Iron carbide diagram – TTT and CCT diagrams – Effects of steel composition, formation of different microstructural zones in welded plain-carbon steels – Welding of C-Mn and low-alloy steels – Phase transformations in weld and heat – Affected zones, cold cracking, role of hydrogen and carbon equivalent, formation of acicular ferrite and effect on weld metal toughness.

UNIT – 4: WELDING OF ALLOY STEELS AND NON-FERROUS METALS (9)

Welding of stainless steels – Types of stainless steels – Overview of joining ferritic and martensitic types, welding of austenitic stainless steels, Sensitisation, hot cracking, sigma phase and chromium carbide formation, ways of overcoming these difficulties – Welding of cast iron – Welding of non-ferrous materials – Joining of aluminium, copper, nickel and titanium alloys – Problems encountered and solutions.

UNIT – 5: DEFECTS, WELDABILITY AND STANDARDS (9)

Defects in welded joints – Defects such as arc strike, porosity, undercut, slag entrapment and hot cracking, causes and remedies in each case – Joining of dissimilar materials – Weldability and testing of weldments – Introduction to national and international welding standards and codes.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basics of ferrous cast alloys their merits and applications	**PO1, PO2**
CO2	Explain the basics of Non-ferrous cast alloys their merits and applications	**PO1, PO2**
CO3	Understand the physical metallurgy of welding process and functions	**PO1, PO2**
CO4	know the welding of alloy steel and Non-ferrous metals.	**PO1, PO2,PO3**
CO5	Understand the weldability, Defects of welding and welding Standard.	**PO1, PO2,PO3**

Text Books:

1. Principles of Metal Casting, Richard W. Heine, Carl R. Loper, Philip C. Rosenthal, 2/e, 2004, McGraw Hill Publishing Co., Ltd., New Delhi.
2. Welding and Welding Technology, Richard Little, 34/e, 2008, McGraw Hill Publishing Co., Ltd., New Delhi.

References:

1. Welding: Principles & Practices, Edward R. Bohnart, 4/e, 2017, McGraw Hill Publishing Ltd.,
2. Casting Technology and Cast Alloys, A.K.Chakrabarthi, 2005, Prentice Hall.
3. Welding: Principles and Applications, Larry Jeffus, 8/e, 2017, Cengage Learning.
4. Casting, John Campbell, 2/e, 2003, Butterworth-Heinemann.
5. Foundry Technology, Peter Beeley, 2/e, 2001, Butterworth-Heinemann, 2001.
6. Welding Process, 8/e, Vol-2, AWS- Welding Hand Book.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC423E NON-DESTRUCTIVE TESTING AND EVALUATION

Course Educational Objectives:

1. To learn the basics of non-destructive testing and selection of visual inspection methods.
2. To know the liquid penetrate testing and magnetic particle testing in NDT
3. To describe the contact and non-contact inspection in thermographs and eddy current testing.
4. To develop the knowledge in ultrasonic testing and acoustic emission testing
5. To impart knowledge on various sources of radiography in non-destructive evaluation methods.

UNIT – 1: INTRODUCTION AND VISUAL INSPECTION METHODS (9)

NDT versus mechanical testing – Need for NDT – Relative merits and limitations – Various physical characteristics of materials and their applications in NDT. **Visual Inspection:** Unaided, aided – Borescopes – Videoscopes – Special features in borescopes – Selection of borescopes – Optical sensors – Microscopes and replication microscopy technique and applications.

UNIT – 2: LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING (9)

LPT: Principle – Types – Procedures – Penetrants and their characteristics – Emulsifiers – Solvent cleaners/removers – Developers – Properties and their forms – Equipments – Advantages and – Limitations – Inspection and interpretation – Applications. **MPT:** Principle – Theory of magnetism – Magnetizing current – Magnetization methods – Magnetic particles – Procedure – Interpretation – Relevant and non-relevant indications – Residual magnetism – Demagnetization – Methods – Advantages and limitations, applications – Magnetic rubber inspection – Magnetic printing – Magnetic painting.

UNIT – 3: THERMOGRAPHY AND EDDY CURRENT TESTING (9)

Thermography: Introduction – Principle – Contact and non-contact inspection methods, active and passive methods – Liquid crystal – Concept – Advantages and limitations – Electromagnetic spectrum – Infrared thermography – Approaches – IR detectors – Instrumentation and methods and applications. **Eddy Current Testing:** Principle – Properties of eddy currents – Eddy current sensing elements –Probes – Instrumentation – Types of arrangement – Advantages and limitations – Interpretation of results and applications.

UNIT – 4: ULTRASONIC TESTING AND ACOUSTIC EMISSION TESTING (9)

Ultrasonic Testing: Principle – Basic equipment – Transducers – Couplants – Ultrasonic wave – Variables in UT – Transmission and pulse-echo method, straight beam and angle beam, A-scan, B-scan and C-scan, phased array ultrasound and time of flight diffraction, advantages and limitations –Interpretation of results and applications. **Acoustic Emission Testing:** Introduction – Types of AE signal – AE wave propagation – Source location – Kaiser effect – AE transducers – Principle – AE parameters – AE instrumentation – Advantages and limitations – Interpretation of results – Applications.

UNIT – 5: RADIOGRAPHY (9)

Introduction – Principle – X-ray production – Gamma ray sources – Tubing materials – X-raytubing characteristics – Interaction of X-ray with matter – Imaging, film techniques, filmless techniques, types and uses of filters and screens, real time radiography, geometric factors, inverse square law, characteristics of film, graininess, density, speed, contrast, characteristic curves, penetrameters – Exposure charts – Radiographic equivalence – Fluoroscopy – Xero-radiography, – Ddigital radiography – Film digitization – Direct radiography and computed radiography – Computed tomography – Gamma ray radiography – Safety in X-rayand gamma ray radiography.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basics of non-destructive testing and selection of visual inspection methods.	**PO1, PO2, PO3**
CO2	Describe the liquid penetrate testing and magnetic particle testing in NDT	**PO1, PO2**
CO3	Understand the contact and non-contact inspection methods in thermographs and eddy current testing.	**PO1, PO2**
CO4	Develop the knowledge in ultrasonic testing and acoustic emission testing	**PO1, PO2, PO5**
CO5	Summarize various sources of radiography in non-destructive evaluation and testing methods.	**PO1, PO2,PO5**

Text Books:

1. Handbook of Nondestructive Evaluation, Charles, J. Hellier, 2/e, 2012, McGraw Hill, New York.
2. Non-Destructive Test and Evaluation of Materials, J Prasad and C G K Nair, 2/e, 2018, Tata McGraw Hill Education Private Ltd.

Reference Books:

1. Introduction to Nondestructive Testing: A Training Guide, Paul E Mix, 2/e, 2005, Wiley, New Jersey.
2. Nondestructive Evaluation: Theory, Techniques, and Applications, Peter J. Shull, 2002, CRC Press.
3. Non-Destructive Testing Techniques, Ravi Prakash, 1/e, 2010, New Age International Publishers.
4. Introduction to the Non-Destructive Testing of Welded Joints, R. Halmshaw, 2/e, 1997, Woodhead Publishing Series in Welding and Other Joining Technologies.
5. Handbook of Advanced Nondestructive Evaluation, Nathan Ida and Norbert Meyendorf, 2019, Springer Series.
6. Non-Destructive Evaluation and Quality Control, ASM Metals Handbook Vol-17, American Society of Metals, Metals Park, 2000, Ohio, USA.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	2	-	-	-	-	-	-	-
CO.5	3	2	-	-	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	-	**1.5**	-	-	-	-	-	-	-

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC423F MICRO ELECTRO MECHANICAL SYSTEMS

Course Educational Objectives:

1. To know the development and functions of MEMS and Microsystems
2. To explain the various micro-manufacturing processes and techniques.
3. To apply the working principle of electrostatic and thermal based MEMS sensors and actuators in the design of MEMS devices.
4. To apply the working principle of piezo-resistive, piezo-electric and magnetic effect in the design of MEMS devices.
5. To design the elements of Micro-fluidic systems, and select suitable MEMS devices for Industrial applications.

UNIT – 1: BASIC ENGINEERING FOR MEMS (9)

History of MEMS –Development – Multidisciplinary nature of microsystems – Energy domains – Scaling laws in miniaturization – Essential electrical and mechanical concepts in MEMS – Materials for MEMS and Microsystems.

UNIT – 2: MICROMANUFACTURING TECHNIQUES (9)

Photolithography – Ion implantation – Diffusion – Oxidation – Chemical vapour deposition – Physical vapour deposition sputtering – Deposition by epitaxy – Etching – Bulk micro manufacturing – Micromachining processes –LIGA Process –Microsystem assembly and testing.

UNIT – 3: ELECTROSTATIC AND THERMAL BASED MEMS (9)

Introduction to electrostatic sensors and actuators – Parallel-plate capacitor –Application of parallel-plate capacitors – Inter digitized finger capacitors –Applications of comb-drive devices – Introduction to thermal sensors and Actuators –Sensors and actuators based on thermal expansion –Thermocouples – Thermal resistors –Shape Memory Alloy –Applications of thermal sensors and actuators.

UNIT – 4: PIEZO-RESISTIVE / ELECTRIC AND MAGNETIC BASED MEMS (9)

Introduction to Piezoresistive – Piezoelectric effects – Piezoresistive and Piezoelectric materials – Stress analysis of mechanical Elements – Applications of piezoresistive – Piezoelectric sensors and actuators – Essential concepts and principles of magnetic sensors and actuators – Fabrication of micro magnetic components – Applications of magnetic sensors and actuators.

UNIT – 5: MICROFLUIDICS AND APPLICATIONS OF MEMS (9)

Microfluidics –Fluid Mechanics Concepts – Design and fabrication of channels – Valves – Pumps – Case Studies – Accelerometer – Gyros – RF MEMS – MOEMS.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Select suitable material for MEMS and Microsystems, and explain the scaling laws involved in miniaturization	**PO1**
CO2	Explain the various micro-manufacturing processes and techiques	**PO1, PO3, PO5**
CO3	Apply the working principle of electrostatic and thermal based MEMS sensors and actuators in the design of MEMS devices	**PO1, PO2, PO5**
CO4	Apply the working principle of piezo-resistive, piezo-electric and magnetic effect in the design of MEMS devices	**PO1, PO3, PO5**
CO5	Design the elements of Micro-fluidic systems, and select suitable MEMS devices for Industrial applications	**PO1, PO3, PO5**

Text Books:

1. Foundations of MEMS, Chang Liu, 2/e, 2011, Pearson Education, India.
2. MEMS and Microsystems: Design and Manufacture, Tai-Ran Hsu, 2017, McGraw Hill Education.

Reference Books:

1. Smart Sensors and MEMS - Intelligent Sensing Devices and Microsystems for Industrial Applications, S Nihtianov and A. Luque, 2/e, 2018, Woodhead Publishing, Elsevier.
2. MEMS: Design and Fabrication, Mohamed Gad-el-Hak, 2/e, 2005, CRC Press.
3. Introductory MEMS: Fabrication and Applications, Thomas M. Adams and Richard A. Layton, 2010, Springer.
4. Microsystem Design, Stephen D Senturia, 2001, Springer International Edition.
5. MEMS, A Practical Guide to Design, Analysis and Applications, Jan Korvink and Oliver Paul, William Andrew, Elsevier.
6. Introduction to Microfabrication, Sami Franssila, Wiley India

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	3	-	1	-	1	-	-	-	-	-	-	-
CO.3	3	2	-	-	1	-	-	-	-	-	-	-
CO.4	3	-	3	-	1	-	-	-	-	-	-	-
CO.5	3	-	3	-	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**2.33**	-	**1**	-	-	-	-	-	-	-

IV B.Tech II Semester **L T P C**

3 0 0 3

18MEC424A TOTAL QUALITY MANAGEMENT

Course Educational Objectives:

1. To understand the concepts of total quality management, and Contributions of TQM
2. To learn TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.
3. To study the basic need of quality control and process control in an organization
4. To learn the traditional and modern TQM tools and techniques
5. To study the quality standard, requirements and elements in Quality management system

UNIT – 1: INTRODUCTION **(9)**

Introduction – Need for quality – Evolution of quality – Definition of quality – Dimensions of manufacturing and service quality – Basic concepts of TQM – Definition of TQM – TQM frame work – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT – 2: TQM PRINCIPLES **(9)**

Leadership – Strategic quality planning – Quality statements – Customer focus, customer orientation, customer satisfaction, customer complaints and customer retention – Employee involvement – Motivation – Empowerment – Teams and teamwork – Recognition and reward – Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership, partnering, supplier selection and supplier rating.

UNIT – 3: QUALITY CONTROL **(9)**

Control chart for attributes – Control chart for non-conforming – *p* chart and *np* chart – Control chart for nonconformities: C and U charts – Control chart for variables: X chart, R chart and σ chart – State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT – 4: TQM TOOLS AND TECHNIQUES **(9)**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector – Bench marking – Bench marking process – FMEA – Stages – Types – Quality circles – Quality function development (QFD) – Taguchi quality loss function – TPM concepts – Reliability fundamentals – Reliability concepts.

UNIT – 5: QUALITY SYSTEMS **(9)**

Need for ISO 9000 – ISO 9001-2008 Quality System – Benefits of ISO registration – ISO 9000 series of standards – AS 9100, TS16949 and TL 9000 – ISO 9001 Requirements – Implementation – Documentation – Internal and external audits – Registration – TQM implementation in manufacturing and service sectors. **Environmental Management System:** Introduction – ISO 14000 Series Standards – Concepts of ISO 14001—Requirements of ISO 14001 – Benefits of EMS.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the concepts of total quality management, and Contributions of TQM	**PO1,PO11, PO12**
CO2	Understand the TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.	**PO1,PO11, PO12**
CO3	Illustrate the basic need of quality control and process control in an organization	**PO1,PO2, PO11, PO12**
CO4	Summarize the traditional and modern TQM tools and techniques	**PO1,PO3, PO11, PO12**
CO5	Realize the quality standard, requirements and elements in Quality management system	**PO1,PO11, PO12**

Text Books:

1. Total Quality Management, Besterfield Dale H, Besterfield Carol, Besterfield Glen H, Besterfield Mary, Urdhwareshe Hemant and Urdhwareshe Rashmi, 5/e, 2018, Pearson Education, New Delhi.
2. Introduction to Statistical Quality Control, Douglas.C. Montgomery, 7/e, 2013, John Wiley.

Reference Books:

1. Total Quality Management, D.R. Kiran, 1/e, 2016, Butterworth-Heinemann.
2. Total Quality Management, Poornima M. Charantimath, 3/e, 2017, Pearson Education, New Delhi.
3. Total Quality of Management, Tapan K. Bose, 2010, Pearson Education India.
4. Quality Management, Bedi Kanishka, 2006, Oxford University Press, India.
5. Total Quality Management, Ramasamy Subbura, 2011, McGraw Hill Education
6. Total Quality Management: Text and Cases, Janakiraman, B. and Gopal, R. K, 2006, PHI Learning, India.

Codes/Tables: Use of approved statistical table permitted in the examination.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	1	2
CO.2	3	-	-	-	-	-	-	-	-	-	1	2
CO.3	3	2	-	-	-	-	-	-	-	-	1	2
CO.4	3	-	1	-	-	-	-	-	-	-	1	2
CO.5	3	-	-	-	-	-	-	-	-	-	1	2
CO*	**3**	**2**	**1**	-	-	-	-	-	-	-	**1**	**2**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC424B PRODUCTION AND OPERATIONS MANAGEMENT

Course Educational Objectives:

1. To Understand the scope of operations management and it's functional areas
2. To study the requirement and selection of good forecasting methods and techniques
3. To understand the concept of aggregate planning and material requirement planning
4. To study the systematic approach to capacity planning and capacity management techniques
5. To understand the production activity control and lean manufacturing in an operational management

UNIT – 1: INTRODUCTION (9)

Overview of production system – Objectives of operation management – Scope of operations management – Operations management frame work – Relationship of operations with other functional areas – Manufacturing Vs service sector – Operations decision making – Production design process and process choices

UNIT – 2: FORECASTING (9)

Need – Determinants of demand – Demand patterns – Measures of forecast error – Qualitative forecasting methods – Delphi techniques – Market research – Nominal group technique quantitative forecasting methods – Moving average methods – Exponential smoothing methods – Regression methods – Monitoring and control of forecasts – Requirements and selection of good forecasting methods.

UNIT – 3: AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING (9)

Role of aggregate product planning – Managerial inputs to aggregate planning – Pure and mixed strategies, Mathematical models for aggregate planning – Transportation method – Linear programming formulation – Linear decision Rues – Master production schedule(MPS) – Procedure for developing MPS – MRP – Lot sizing methods – Implementation issues – MRP-II – Introduction to ERP.

UNIT – 4: CAPACITY MANAGEMENT (9)

Measures of capacity – Factors affecting capacity – Capacity planning – Systematic approach to capacity planning – Long-term and short-term capacity decisions – Tools for capacity planning – Capacity requirement planning – Business process outsourcing – Introduction TOC.

UNIT – 5: PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING (9)

Objectives – Activities of Production Activity Control – JIT – Kanban – Introduction to Scheduling in different types of Production Systems – Lean Manufacturing – Principles – Activities – Tools and techniques – Case studies.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the scope of operations management and it's functional areas	**PO1, PO11**
CO2	Understand the requirement and selection of good forecasting methods and techniques.	**PO1,PO2, PO11**
CO3	Illustrate the concept of aggregate planning and material requirement planning	**PO1,PO2, PO11**
CO4	Summarize the systematic approach to capacity planning and capacity management techniques	**PO1, PO2, PO11**

CO5	Understand the production activity control and lean manufacturing in an operational management	**PO1, PO11**

Text Books:

1. Production and Operations Management, S.N.Chary, 6/e, 2012, Tata Mcgraw Hill, New Delhi.
2. Operations Management, William J. Stevenson, 12/e, 2002, Tata Mcgraw Hill, New Delhi.

Reference Books:

1. Production and Operations Management, Alan Muhlemann, Keith Lockyer and J.S. Oakland, 6/e, 2007, Pearson Edcation, India.
2. Production and Operations Management, Panneerselvam. R, 3/e, 2012, PHI Learning, New Delhi.
3. Production and Operations Management, Kanishka Bedi, 2013, Oxford University Press.
4. Operations Management, Nigel Slack and Alistair Brandon-Jones, 9/e, 2019, Pearson Education India.
5. Production and Operations Management, K.Aswathappa, K.Shridhara Bhat, 2/e, 2010, Himalaya Publishing House, New Delhi.
6. Production and Operations Management Systems, Sushil Gupta and Martin Starr, 1/e, 2014, CRC Press.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	-	-	-	-	-	-	-	-	-	2	-
CO.2	2	2	-	-	-	-	-	-	-	-	2	-
CO.3	2	2	-	-	-	-	-	-	-	-	2	-
CO.4	2	2	-	-	-	-	-	-	-	-	2	-
CO.5	2	-	-	-	-	-	-	-	-	-	2	-
CO*	**2**	**2**	-	-	-	-	-	-	-	**-**	**2**	**-**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC424C PROCESS PLANNING AND COST ESTIMATION

Course Educational Objectives:

1. To know the basics principles of process planning and methods of material selection process
2. To understated the fundamental principles of cost estimation and elements of cost.
3. To evaluate the concepts of allocation of overhead charges and depreciation cost
4. To estimation of production cost for all manufacturing Process
5. To estimate the machining time and cost in different machining operations, in machine shop

UNIT – 1: PROCESS PLANNING (9)

Defining process planning – Drawing interpretation – Material selection process and methods – Selection of production processes from tables – Selection of process parameters from tables – Factors to be considered in selecting the processes, process sequencing, operation sequencing, equipment, tool selection, tool holding devices and measuring instruments – Computer Aided Process Planning – Retrieval / variance CAPP and generative CAPP – Case study in process planning.

UNIT – 2: FUNDAMENTAL OF ESTIMATING AND ELEMENTS OF COST (9)

Concept and purpose of estimating – Functions of estimating department – Concept of costing – Costing versus Estimating – Types of estimates – Importance of estimates – Estimating procedure – Cost estimators and their qualifications – Principal constituents in a cost estimate – Elements of cost – Material cost – Labour cost – Expenses and cost of product (Ladder Cost).

UNIT – 3: OVERHEADS AND DEPRECIATION (9)

Cost Estimation: Overheads – Allocation or distribution of overhead cost. **Depreciation**: Depreciation and Methods to calculate the interest on capital, idleness costs, repair and maintenance cost.

UNIT – 4: ESTIMATION OF CASTING, FORGING & WELDING COSTS (9)

Estimation of cost for casting processes, welding processes and forging processes.

UNIT – 5: ESTIMATION OF MACHINING TIME AND COST (9)

Cost estimation and machining time for lathe operations, drilling operations, milling operations, shaping operations, planning operations and grinding operations – Over head expenses – Types of over head costs – Allocation of over head expenses.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the process planning and Material selection process and methods	**PO1, PO2, PO3, PO11**
CO2	Explain the fundamental principles of cost estimation and elements of cost.	**PO1, PO2, PO3, PO11**
CO3	Evaluate the concepts of allocation of overhead charges and depreciation.	**PO1, PO2, PO3, PO11**
CO4	Estimate the production cost for all the manufacturing Process	**PO1, PO2, PO3, PO11**
CO5	know the machining time and cost of lathe Operations, in a machine shop	**PO1, PO2, PO3, PO11**

Text Books:

1. Process Planning and Cost Estimation, R. Panneerselvam and P. Sivasankaran, PHI Learning, India.
2. Mechanical Estimating and Costing, Sinha.B.P, 1995, Tata McGraw-Hill.

Reference Books:

1. Mechanical Estimating and Costing: Including Contracting, T.R Banga and S.C.Sharma, 2003, Khanna Publishers.
2. Production and Costing, G.B.S. Narang, V. Kumar, 2000, Khanna Publishers.
3. Estimating and Costing for the Metal Manufacturing Industries, Robert Creese, and M. Adithan, 1/e, 2019, CRC Press.
4. Process Planning and Cost Estimation, M. Adithan, 2007, New Age International Publishers.
5. Manufacturing Processes and Systems, Phillip F. Ostwald and Jairo Munoz, 9/e, 2002, Wiley student edition.
6. Product Design and Manufacturing, Chitale, A, K., and Gupta, R. C, 6/e, 2014, Prentice Hall of India, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	1	-
CO.2	3	2	1	-	-	-	-	-	-	-	1	-
CO.3	3	2	2	-	-	-	-	-	-	-	1	-
CO.4	3	2	2	-	-	-	-	-	-	-	1	-
CO.5	3	2	2	-	-	-	-	-	-	-	1	-
CO*	**3**	**2**	**1.6**	-	-	-	-	-	-	-	**1**	-

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC424D PRODUCT LIFECYCLE MANAGEMENT

Course Educational Objectives:

1. To explain the concepts and elements of Product Lifecycle Management.
2. To study the functions and features of Product Data Management and Product Lifecycle Management.
3. To apply different modules offered in commercial PLM/PDM modern software tools.
4. To know the role of PLM/PDM approaches for industrial applications.
5. To integrate PLM/PDM with legacy data bases and ERP systems.

UNIT – 1: INTRODUCTION TO 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 – 2: PLM PLM/PDM FUNCTIONS AND FEATURES (9)

User Functions – Data Vault and Document Management – Workflow and Process Management – Product Structure Management – Product Classification and Program Management –Utility Functions – Communication and Notification – Data transport – Data translation – Image services – System administration and application integration.

UNIT – 3: DETAILS OF MODULES IN A PDM/PLM SOFTWARE (9)

Case studies based on top few commercial PLM/PDM tools – Team center – Wind chill – ENOVIA – Aras PLM – SAP PLM – Arena – Oracle Agile PLM – Autodesk Vault.

UNIT – 4: ROLE 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 for organization, users, product or service, process performance.

UNIT – 5: BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE (9)

PLM Customization – Use of EAI technology (Middleware) – Integration with legacy data base – CAD – SLM – ERP.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the concepts and elements of Product Lifecycle Management.	**PO1**
CO2	Express the functions and features of Product Data Management and Product Lifecycle Management	**PO1, PO2**
CO3	Apply different modules offered in commercial PLM/PDM modern software tools.	**PO1, PO2, PO3, PO4, PO5**
CO4	Implement PLM/PDM approaches for industrial applications.	**PO1, PO2, PO3**

CO5	Integrate PLM/PDM with legacy data bases and ERP systems	**PO1, PO2, PO3, PO4, PO5**

Text Books:

1. Product Lifecycle Management, Antti Saaksvuori and Anselmi Immonen, 2008, Springer Publisher.
2. Product Life Cycle Management, 2006, Michael Grieves, Tata McGraw Hill.

Reference Books:

1. Product Lifecycle Management: 21st Century Paradigm for Product Realization, John Stark, Volume-1, 3/e, 2011, Springer Publisher.
2. Product Lifecycle Management: Decision Engineering, John Stark, Volume-2, 3/e, 2011, Springer Publisher.
3. The Lean Product Lifecycle, Tendayi Viki, Craig Strong and Sonja Kresojevic , 2019, Pearson Education.
4. Managing the Dynamics of New Product Development Processes: A New Product Lifecycle Management Paradigm, ArieKarniel and Yoram Reich, 2011, Springer-Verlag, London.
5. Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question, John Stark, 2007, Springer Publisher.
6. Product Lifecycle Management (PLM): A Digital Journey Using Industrial Internet of Things (IIoT), Uthayan Elangovan, 1/e, 2020, CRC Press.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	1	1	-	-	-	-	-	-	-
CO.4	2	2	2	-	-	-	-	-	-	-	-	-
CO.5	2	2	2	1	1	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC424E INDUSTRIAL SAFETY MANAGEMENT

Course Educational Objectives:

1. To explain the fundamental concept and principles of industrial safety
2. To apply the functions and principles of maintenance engineering
3. To analyse the wear, corrosion and its reduction.
4. To evaluate faults in various tools, equipments and machines
5. To apply the periodic maintenance procedures and preventive maintenance.

UNIT – 1: INDUSTRIALSAFETY (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 color codes. – Fire prevention and firefighting – Equipment and methods.

UNIT – 2: 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 – 3: WEAR, CORROSION AND THEIR PREVENTION (9)

Wear – Types – Causes and effects –Wear reduction methods – Lubricants-types and applications – Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion – Corrosion prevention methods.

UNIT – 4: FAULT TRACING (9)

Fault tracing-concept and importance – Decision tree concept, need and application – 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, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors –Types of faults in machine tools and their general causes.

UNIT – 5: 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 and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps iii. Air compressors, iv. Diesel generating (DG) sets, – Program and schedule of preventive maintenance of mechanical and electrical equipment – Advantages of preventive maintenance – Repair cycle concept and importance.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the fundamental concept and principles of industrial safety	**PO1, PO2, PO3, PO6, PO7, PO12**
CO2	Apply the principles of maintenance engineering.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO3	Analyze the wear, corrosion and its reduction.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO4	Evaluate faults in various tools, equipments and machines.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO5	Apply periodic maintenance procedures in preventive maintenance	**PO1, PO2, PO3, PO6, PO7, PO12**

Text Books:

1. Industrial Safety Management, L M Deshmukh, 2005, Tata McGraw-Hill Education.
2. Industrial Safety and Maintenance Management, M. P. Poonia and S. C. Sharma, 2019, Khanna Publisher.

Reference Books:

1. Maintenance Engineering, Sushil Kumar Srivastava, S. Chand Publishing, New Delhi.
2. Maintenance Engineering and Management, Mishra, R. C. and Pathak, K., 2/e, 2012, PHI Learning, India.
3. Occupational Health and Safety Management: A Practical Approach, Charles D. Reese, 3/e, 2012, CRC Press.
4. Maintenance Engineering Handbook, Keith Mobley 8/e, 2014, Tata McGraw-Hill Education.
5. Corrosion Prevention and Protection: Practical Solutions, Edward Ghali, V. S. Sastri, M. Elboujdaini, 2007, John Wiley & Sons.
6. Safety Management - A Comprehensive Approach Todeveloping A Sustainable System, Chitram Lutchman, Rohanie Maharaj and Waddah Ghanem, 2012, CRC Press, CRC Press, Taylor & Francis Group.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	1	2	-	-	2	1	-	-	-	-	1
CO.2	2	1	2	-	-	2	1	-	-	-	-	1
CO.3	2	1	2	-	-	2	1	-	-	-	-	1
CO.4	2	1	2	-	-	2	1	-	-	-	-	1
CO.5	2	1	2	-	-	2	1	-	-	-	-	1
CO*	**2**	**1**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**1**

IV B.Tech II Semester

L	T	P	C
3	0	0	3

18MEC424F ENGINEERING ECONOMICS AND COST ANALYSIS

Course Educational Objectives:

1. To explain the fundamental concept of engineering economics and elementary economic analysis
2. To understand the economy principles of value engineering
3. To study the revenue dominated and cost dominated cash flow analysis
4. To evaluate the replacement of assets and maintenance analysis.
5. To understand the fundamental concept of depreciation and economic life of asset

UNIT – 1: INTRODUCTION TO ECONOMICS (9)

Introduction to Economics – Flow in an economy – Law of supply and demand – Concept of Engineering Economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost – Break-even analysis – V ratio – Elementary economic Analysis – Material selection for product Design selection for a product – Process planning.

UNIT – 2: VALUE ENGINEERING (9)

Make or buy decision – Value engineering function and aims – Value engineering procedure – Interest formulae and their applications – Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples in all the methods.

UNIT – 3: CASH FLOW (9)

Methods of comparison of alternatives – Present worth method (Revenue dominated cash flowdiagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flowdiagram) – Annual equivalent method (Revenue dominated cash flow diagram –Cost dominated cashflow diagram) – Rate of return method – Examples in all the methods.

UNIT – 4: REPLACEMENT AND MAINTENANCE ANALYSIS (9)

Replacement and Maintenance analysis – Types of maintenance –Types of replacement problem – Determination of economic life of an asset – Replacement of an asset with a new asset – Capital recovery with return and concept of challenger and defender – Simple probabilistic model for items which fail completely.

UNIT – 5: DEPRECIATION (9)

Depreciation – Straight line method of depreciation – Declining balance method of depreciation – Sum of the years digits method of depreciation – Sinking fund method of depreciation/Annuity method of depreciation – Service output method of depreciation – Evaluation of public alternatives, introduction and examples – Inflation adjusted decisions – Procedure to adjust inflation – Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Explain the fundamental concept principles of economics in engineering applications	**PO1, PO2, PO11**
CO2	Apply the principles of economics in value engineering.	**PO1, PO2, PO4, PO11**
CO3	Analyze the economy principles through cash flow analysis.	**PO1, PO2, PO3, PO11**
CO4	Analyze the replacement and maintenance analysis.	**PO1, PO2, PO3, PO11**
CO5	Apply economic principles in depreciation.	**PO1, PO2, PO4, PO11**

Text Books:

1. Engineering Economics, Panneer Selvam, R, 2/e, 2013, Prentice Hall of India Ltd, New Delhi.
2. Engineering Economics, James L Riggs, David D Bedworth and Sabah U Randhawa, 4/e, 2004, Tata McGraw-Hill Education.

References:

1. Principles of Engineering Economics with Applications, Zahid A khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi, 2/e, 2018, Cambridge University Press.
2. Contemporary Engineering Economics, Chan S.Park, 5/e, 2015, Pearson Education, India.
3. Fundamentals of Engineering Economics, Pravin Kumar, 2012, Wiley India Pvt.Ltd.,
4. Engineering Economics and Analysis, Donald.G. Newman, Jerome.P.Lavelle, 2010, Engineering Press, Texas.
5. Managerial Economics, Suma Damodaran, 2/e, 2010, Oxford University Press.
6. Engineering Economy, Leland Blank and Anthony Tarquin, 2019, Tata McGraw-Hill Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	1	-	-	-	-	-	-	-	-	1	-
CO.2	2	1	-	2	-	-	-	-	-	-	1	-
CO.3	2	1	2	-	-	-	-	-	-	-	1	-
CO.4	2	1	2	-	-	-	-	-	-	-	1	-
CO.5	2	1	-	2	-	-	-	-	-	-	1	-
CO*	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

III B.Tech II Semester **L T P C**
3 0 0 3

18OSAH321 MATHEMATICAL MODELLING - ANALYSIS AND APPLICATIONS (OPEN ELECTIVE-I)

Course Educational Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. To learn the need and techniques of mathematical modeling, to design mathematical models through trigonometry and calculus.
3. To understand, familiarize the knowledge of the significance of ordinary differential equations of second order based mathematical models through linear.
4. To explore the practical utility of mathematical models through linear programming including transportation and assignment models.
5. To learn the concepts of Partial differential equations and its nature. To explore the knowledge on practical utility of mathematical models through mass balance equations and momentum balance equations

UNIT – 1: INTRODUCTION **(9)**

The technique of mathematical modeling – Classification of mathematical models – Some characteristics of mathematical models – Mathematical modeling through trigonometry, calculus – Limitations of mathematical modeling.

UNIT – 2: MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF SECOND ORDER **(9)**

Mathematical Modeling of planetary motions, circular motion and motion of satellites – Mathematical Modeling through linear differential equations of second order.

UNIT – 3: MATHEMATICAL MODELING THROUGH LINEAR PROGRAMMING **(9)**

Mathematical modeling through linear programming – Graphical method – Simplex method – Transportation – Assignment models.

UNIT – 4: MATHEMATICAL MODELING THROUGH DIFFERENCE EQUATIONS **(9)**

The need for mathematical modeling through difference equations: some simple models – Basic theory of linear difference equations with constant coefficients – Solution by Z-transformation – Mathematical modeling through difference equations in probability theory.

UNIT – 5: MATHEMATICAL MODELING THROUGH PARTIAL DIFFERENTIAL EQUATIONS **(9)**

Mass-Balance Equations: The first method of getting PDE models – Momentum-balance equations: The second method of obtaining PDE Models – Nature of partial differential equations.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire knowledge in necessity and techniques of mathematical modeling, to develop analytical and designing skills in mathematical models through trigonometry and calculus.	**PO1,PO2,PO3 PO4**
CO2	Demonstrate knowledge in Ordinary differential equations of second order, mathematical modeling through differential equations, and Develop analytical skills in modeling geometrical problems through Ordinary differential equations of second order	**PO1,PO2,PO3 PO4**
CO3	Demonstrate knowledge in Linear programming and various techniques including Graphical method and Simplex method. Develop analytical and designing skills in modeling and solving Transportation and assignment models	**PO1,PO2,PO3 PO4**
CO4	Acquire knowledge in difference equations, theory of difference equations with constant coefficients. Develop designing and analytical skills in modeling and solving mathematical models difference equations in probability theory.	**PO1,PO2,PO3 PO4**
CO5	Acquire knowledge in partial differential equations and develop designing and analytical skills in modeling and solving mathematical models through Mass-Balance equations and Momentum-Balance equations	**PO1,PO2,PO3 PO4**

Text Books:

1. Mathematical Modelling, J.N. Kapur, New Age International (P) Limited Publishers, New Delhi
2. Advanced Engineering Mathematics, Kreysig, , John Wiley, NewYork, 1999.

Reference Books:

1. Principles of Mathematical Modelling (2004)-Clive L. Dyne, Elsevier Publication
2. Mathematical Modelling – A case study approach , R Illner, C Sean Bohun, S McCollum, T van Roode, AMS publication, 2005
3. Mathematical Modelling , D N P Murthy, N W Page, E Y Rodin, Pergamon Press,1990
4. OR Theory & Applications, J.K. Sharma , Mac Milian India Ltd., 1998
5. Mathematical Modelling(A Comprehensive Introduction), Gerhard Dangelmayr and Michael Kirby, Prentice Hall,New Jersey

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	-	-	-	-	-	-	-	-
CO.2	3	3	3	2	-	-	-	-	-	-	-	-
CO.3	3	3	3	2	-	-	-	-	-	-	-	-
CO.4	3	3	3	2	-	-	-	-	-	-	-	-
CO.5	3	3	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**3**	2	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OSAH322 BUSINESS COMMUNICATION AND CAREER SKILLS
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To enhance the communication skills.
2. To enable students to understand the nuances of corporate communication
3. To develop the writing skills for business purposes
4. To develop the presentation skills for corporate situations.
5. To enable students to manage interviews successfully.

UNIT – 1: NATURE AND SCOPE OF COMMUNICATION (9)

Introduction: Functions of Communication – Roles of a Manager – Communication Basics – Communication Networks – Informal Communication – Interpersonal Communication –Communication Barriers.

UNIT – 2: CORPORATE COMMUNICATION (9)

Introduction: What is Corporate Communication? – Corporate Citizenship and Social Responsibility – Corporate Communication Strategy – Crisis Management/Communication – Cross-Cultural Communication.

UNIT – 3: WRITING BUSINESS DOCUMENTS (9)

Introduction: Importance of Written Business Communication, Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing - Email writing skills – Effective Business Correspondence – Common Components of Business Letters – Strategies for Writing the Body of a Letter- Business Communication and different cultures.

UNIT – 4: CAREERS AND RESUMES (9)

Introduction – Career Building – Business Presentations and Speeches – Resume Formats – Traditional, Electronic and Video Resumes – Sending Resumes – Follow-up Letters – Online Recruitment Process.

UNIT – 5: INTERVIEWS (9)

Introduction – Fundamental Principles of Interviewing – General Preparation for an Interview – Success in an Interview – Types of Interviewing Questions – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the concept of communication, its methods and types.	**PO10, PO12**
CO2	Demonstrate knowledge of Corporate Communication	**PO10, PO11**
CO3	Apply written and oral communication techniques in preparing and presenting various documents in technical writing.	**PO10,PO11, PO12**
CO4	Exhibit the presentation skills in business situations	**PO10,PO12**
CO5	Apply verbal and nonverbal aspects in the most appropriate way in interviews	**PO10, PO12**

Text Book:

1. Meenakshi Raman and Prakash, Singh Business Communication, Oxford University Press, New Delhi, Second Edition, 2012.

Reference Books:

1.Neera Jain and Sharma Mukherji, Effective Business Communication, Tata Mc Graw-Hill Education, Pvt. Ltd., New Delhi, 2012.
2. Courtland L.Bovee et al., Business Communication Today, Pearson, New Delhi, 2011.
3. Krizan, Effective Business Communication, Cengage Learning, New Delhi, 2010.
4. R.K. Madhukar, Business Communication, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	-	-	-	-	-		-			3	-	2
CO.2	-	-	-	-	-		-			3	2	-
CO.3	-	-	-	-	-		-			3	2	2
CO.4	-	-	-	-	-		-			3	-	2
CO.5	-	-	-	-	-		-			3	-	2
CO*	**-**	**-**	**-**	**-**	**-**		**-**			**3**	**2**	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OSAH323 LASERS AND FIBER OPTICS
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To acquire knowledge on fundamentals of LASERS
2. To study the working of different types of LASERS
3. To develop knowledge on applications of LASERS in various fields
4. To gain knowledge in fundamentals of Optical fiber, construction, types and attenuations
5. To develop knowledge on applications of Optical fibers in various fields

UNIT – 1: LASER INTRODUCTION (9)

Introduction- Spontaneous and stimulated emission of radiation- Properties of lasers (monochromacity, directionality, coherence and brightness) - Conditions for laser action: population inversion- Pumping and different pumping mechanisms- Einstein coefficients and relation among the coefficients.

UNIT – 2: TYPES OF LASERS (9)

Types of Lasers: Nd-YAG laser- He:Ne laser- Semiconductor laser(GaAs)- Argon Ion Laser-CO2 Laser.

UNIT – 3: APPLICATIONS OF LASERS (9)

Lasers in Holography- Laser in fusion reaction- Lasers in Raman spectroscopy- Lasers in industry -Lasers in isotope separation- Lasers in medicine.

UNIT – 4: OPTICAL FIBERS (9)

Introduction- Construction of fiber – Working principle of optical fiber (total internal reflection)- Propagation of light through the fibers- Numerical aperture , Acceptance angle and Acceptance cone -Fiber types: Refractive index profile and ray propagation-Step and graded index fibers -Attenuation in fibers: Attenuation coefficient and different loss mechanisms.

UNIT – 5: APPLICATIONS OF FIBERS (9)

Fiber optic communication system(block diagram)- Sensing applications of fibers: Pressure sensor, Liquid level sensor, Displacement sensor, Chemical sensor – Optical fibers in medicine (endoscopes) - Optical fibers in computer networks (block diagram).

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire the basic knowledge on LASERS	**PO1, PO12**
CO2	Understand different types of LASERS	**PO1, PO12**
CO3	Develop knowledge on different applications of LASERS	**PO1, PO12**
CO4	Acquire the basic knowledge on Optical Fibers	**PO1,PO12**
CO5	Develop knowledge on different applications of Optical Fibers	**PO1,PO12**

Reference Books:

1 .Lasers Theory and Applications By K.Thyagarajan and A.K.Ghatak: Macmillan India Limited, New Delhi.,

2.Lasers And non-Linear Opics, second edition, By BBLaud. NewAge International(P) limited,Publishers,New Delhi,

3. An Introduction to Fiber Optic Systems ,Second Edition,By John Powers,Richard D Irwin ,a Times Mirror Higher education,Inc Company,USA,

4. Physics for Engineers - M.R.Srinivasan , New Age International, 2009

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	1
CO.2	3	-	-	-	-	-	-	-	-	-	-	1
CO.3	3	-	-	-	-	-	-	-	-	-	-	1
CO.4	3	-	-	-	-	-	-	-	-	-	-	1
CO.5	3	-	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCSE321 OBJECT ORIENTED PROGRAMMING
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To study the syntax, semantics and features of Java Programming Language.
2. To understand the principles of packages and inheritance.
3. To develop Java application programs using exceptions and interfaces.
4. To gain knowledge on multithreading and applets
5. To create GUI applications & perform event handling.

UNIT – 1 BASICS OF JAVA (9)

History of Java - Java Buzzwords - Overview of Java - Data Types - Variables - Arrays - Operators - Control Statements – Introducing Classes &Objects - Constructors - Methods - Access Control – this Keyword - Garbage Collection - Overloading Methods and Constructors - Parameter Passing - Recursion – Reading input-Command Line Arguments – Buffer Reader – Scanner.

UNIT – 2 STRING HANDLING, INHERITANCE AND PACKAGES (9)

String Handling-Using String Class – String Buffer Class Inheritance-Basics of Inheritance-Using super-Creating a multilevel hierarchy-Method overriding- Dynamic method dispatch - Using abstract classes - Using final. Packages-Defining - Creating and Accessing a Package - Understanding CLASSPATH – Importing Packages - Exploring Packages.

UNIT – 3 INTERFACES AND EXCEPTION HANDLING (9)

Interfaces- Differences between Classes and Interfaces - Defining an Interface – Implementing Interface - Applying Interfaces - Variables in Interfaces and Extending Interfaces. Exception Handling- Introduction – Exception Types – Uncaught Exception – Using Try and Catch – Multiple Catch clauses – Nested Try Statements – Throw – Throws – Finally – Built-in Exceptions – Creating Own Exception Subclass – Checked and Unchecked Exceptions.

UNIT – 4 MULTITHREADING AND APPLETS (9)

Multithreading -Differences between Multithreading and Multiprocessing - Thread Life Cycle - Creating Threads - Synchronizing Threads. Applets- Concepts of Applet - Differences between Applet and Application - Life Cycle of an Applet- Types of Applets - Creating Applet - Passing Parameters to Applet – Using Graphics Class.

UNIT – 5 EVENT HANDLING AND AWT AND SWINGS (9)

EVENT HANDLING A ND AWT - Delegation Event Model - Event Classes - Sources of Events - Event Listeners - Handling Mouse and Keyboard Events - Adapter Classes - Inner Classes - The AWT Class Hierarchy - AWT Controls : Label – Button – Text Field - Checkbox - Layout Managers. Swings - Limitations of AWT – Components - Containers - Exploring Swing - JApplet - JFrame and JComponent - JLabel and Imageicon –JTextfield - JButton - JCheck Box - JRadioButton - JCombobox - JTabbedpane - JScrollpane - JTable.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basic principles of object oriented programming	**PO1, PO2, PO3, PO4, PO5, PO12**
CO2	Develop Java programs with the concepts of inheritance and packages	**PO1, PO2, PO3, PO4, PO5, PO12**
CO3	Build Java applications using exceptions and interfaces	**PO1, PO2, PO3, PO4, PO5, PO12**
CO4	Use multithreading and applet concepts in developing the object oriented programming	**PO1, PO2, PO3, PO5**
CO5	Develop the interactive Java programs using event handling and swings	**PO1, PO2, PO3, PO5**

Text Books:

1. Java; The complete reference, Herbert schildt, 11th editon, TMH.
2. Beginning Java2 JDK , Ivor Horton's, 5 th Edition, WILEY Dream Tech.

Reference Books:

1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley & sons.
2. An Introduction to OOP, T. Budd, second edition, Pearson education.
3. Introduction to Java programming ,Y. Daniel Liang, 6 th edition, Pearson education.
4. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.
5. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, 7 th Edition, Pearson Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	2	-	-	-	-	-	-	2
CO.2	3	3	3	3	3	-	-	-	-	-	-	2
CO.3	3	3	2	3	3	-	-	-	-	-	-	2
CO.4	3	3	2	-	3	-	-	-	-	-	-	-
CO.5	3	3	2	-	3	-	-	-	-	-	-	-
CO*	**3**	**3**	**2.4**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCSE322 OPERATING SYSTEMS
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To understand main components of OS, System structures and the operations performed by OS as a resource manager.
2. To Study process concurrency and synchronization.
3. To analyze the different memory management techniques.
4. To gain knowledge about concepts of input/ output systems and storage management
5. To manage different file systems, protection and security to the systems

UNIT – 1 OPERATING SYSTEMS OVERVIEW (10)

Introduction - What Operating system do - Operating system operations - Process management - Memory management - Storage management - Protection and Security - Distributed Systems - Special purpose systems. **System Structures:** Operating system services - user operating system interface - System calls - Types of system calls - Operating system design and implementation - Operating system structure - Operating system generation - System boot.

UNIT – 2 PROCESS MANAGEMENT AND CONCURRENCY (8)

Process Management: Process concepts – threads - scheduling-criteria – algorithms and their evaluation - Thread scheduling. **Concurrency:** Process synchronization - the critical- section problem - Peterson's Solution - Synchronization Hardware – semaphores - classic problems of synchronization - monitors.

UNIT – 3 MEMORY MANAGEMENT (9)

Memory Management and Virtual Memory : Logical & physical Address Space – Swapping - Contiguous Allocation – Paging - Structure of Page Table – Segmentation - Virtual Memory - Demand Paging - Performance of Demanding Paging - Page Replacement - Page Replacement Algorithms - Allocation of Frames - Thrashing.

UNIT – 4 PRINCIPLES OF DEADLOCK AND MASS-STORAGE STRUCTURE & I/O SYSTEMS (9)

Principles of deadlock - system model - deadlock characterization - deadlock prevention - detection and avoidance - recovery form deadlock. **Mass-storage structure** - overview of Mass – storage structure - Disk structure - disk attachment - disk scheduling - swap-space management - RAID structure - stable-storage implementation - Tertiary storage structure.

UNIT – 5 FILE SYSTEM INTERFACE (9)

File system Interface- the concept of a file - Access Methods - Directory structure - File system mounting - file sharing – protection - File System implementation - File system structure - file system implementation - directory implementation - allocation methods - free-space management - efficiency and performance.Protection and Security - Goals of protection - Principles of protection - Access matrix - The security problem - program threats - System and network threats.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Analyze operating system operations ,system design and implementation	**PO1, PO2**
CO2	Implement Thread scheduling , solutions to synchronize problems	**PO1, PO4,**
CO3	Apply memory management techniques, virtual memory concepts	**PO1,PO3,PO4**
CO4	Manage process execution without deadlock, mass storage structure	**PO1,PO4**
CO5	Understand file system interface, protection and security in System and Network	**PO1, PO2, PO4**

Text Books:

1. Operating System Principles,8th Edition, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Wiley Student Edition.
2. Operating systems - Internals and Design Principles, 6th Edition,W. Stallings, Pearson.

Reference Books:

1. Modern Operating Systems, 3rd Edition ,Andrew S Tanenbaum PHI.
2. Operating Systems A concept - based Approach, 2nd Edition, D. M. Dhamdhere, TMH.
3. Principles of Operating Systems, B. L. Stuart, Cengage learning, India Edition.
4. Operating Systems, 2nd Edition,A. S. Godbole, TMH
5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	2	-	-	3	-	-	-	-	-	-	-	-
CO.3	3	-	3	3	-	-	-	-	-	-	-	-
CO.4	3	-	-	3	-	-	-	-	-	-	-	-
CO.5	2	3	-	3	-	-	-	-	-	-	-	-
CO*	**2.6**	**3**	**3**	**3**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCSE323 WEB PROGRAMMING
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To familiar with client server architecture and able to develop a web application using java technologies.
2. To gain the skills and project-based experience needed for entry into web application and development careers.

UNIT – 1 INTRODUCTION TO HTML (9)

HTML Common tags- Block Level and Inline Elements, Lists,Tables, Images, Forms, Frames; Cascading Style sheets, CSS Properties; Java Script: Introduction to Java Script, Objects in Java Script, Dynamic HTML with Java Script

UNIT – 2 JAVA DATA BASE CONNECTIVITY (9)

JDBC: Data Base, Database Schema, A Brief Overview Of The JDBC Process, JDBC Driver Types, JDBC Packages, Database Connection, Associating The JDBC-ODBC Bridge With Database, Creating, Inserting, Updating And Deleting Data In Database Tables, Result Set, Metadata.

UNIT – 3 WEB SERVERS AND SERVLETS (11)

Tomcat web server, Introduction to Servlets: Servlets, the Advantage of Servlets over "Traditional" CGI, Basic Servlet Structure, Simple Servlet Generating Plain Text, Compiling and Installing the Servlet, Invoking the Servlet, Lifecycle of a Servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Context Parameters, Handling Http Request & Responses, Using Cookies-Session Tracking, Servlet with JDBC.

UNIT – 4 INTRODUCTION TO JSP (8)

Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing, JSP Application Development: Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Declaring Variables and Methods , Sharing Data Between JSP pages, Users Passing Control and Data between Pages, JSP application design with JDBC, JSP Application Design with MVC.

UNIT – 5 INTRODUCTION TO PHP (8)

Basics of PHP, Functions, Error Handling, Interaction between PHP and MySQL, Database using Forms,Using PHP to manipulate and Retrieve Data in MySQL.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Write a well formed / valid XML document.	**PO1, PO2, PO3, PO5**
CO2	Connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.	**PO1, PO2, PO3, PO5**
CO3	Develop a dynamic webpage by the use of java script and DHTML.	**PO1, PO2, PO3**
CO4	Write a server side java application called Servlet to catch form data sent from client, process it and store it on database.	**PO1, PO2, PO3, PO5**
CO5	Write a server side java application called JSP to catch form data sent from client and store it on database	**PO1, PO2, PO3, PO5**

Text Books:

1. Jon Duckett "Beginning Web Programming with HTML, XHTML, and CSS (Wrox Programmer to Programmer)
2. Marty Hall and Larry Brown "Core Servlets and Java Server pages Vol. 1: Core Technologies", Pearson.

Reference Books:

1. DanWoods and GautamGuliani,"Open Source for the Enterprise: Managing Risks, Reaping Rewards", O'Reilly, Shroff Publishers and Distributors, 2005.
2. Sebesta,"Programming world wide web" Pearson.
3. Dietel and Nieto,"Internet and World Wide Web – How to program",PHI/Pearson Education Asia.
4. Murach,"Murach's beginning JAVA JDK 5", SPD
5. Wang,"An Introduction to web Design and Programming",Thomson.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	3	-	-	-	-	-	-	-
CO.2	2	3	3	-	3	-	-	-	-	-	-	-
CO.3	2	3	3	-	3	-	-	-	-	-	-	-
CO.4	2	3	3	-	3	-	-	-	-	-	-	-
CO.5	3	3	-	2	3	-	-	-	-	-	-	-
CO*	**2.4**	**2.8**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCIV321 CONSTRUCTION AND PROJECT MANAGEMENT (OPEN ELECTIVE-I)

Course Educational Objectives:

1. To study the fundamentals of construction technology
2. To study the earth work methods
3. To study the concepts of project management and milestones
4. To study the concept of elements of network and development of network
5. To study the concept of network analysis

UNIT – 1: FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY (9)

Definitions and Discussion – Construction Activities – Construction Processes - Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations

UNIT – 2: EARTHWORK (9)

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging. Excavation By Blasting: Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting.

UNIT – 3: PROJECT MANAGEMENT AND BAR CHARTS AND MILESTONE CHARTS (9)

Introduction – Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts – Development of PERT network problems.

UNIT – 4: ELEMENTS AND DEVELOPMENT OF NETWORK (9)

Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems – Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies – Illustrative examples – Problems.

UNIT – 5: NETWORK ANALYSIS (9)

CPM : process – CPM : Networks – Activity time estimate – Earliest event time – Latest allowable occurrence time – Combined tabular computations for TE and TL - Start and finish times of activity – Float – Critical activities and critical path – Illustrative examples Problems.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Apply theoretical and practical aspects of project management techniques to achieve project goals.	**PO1,PO3**
CO2	Exhibit organizational and leadership capabilities for effective management of construction projects.	**PO2,PO3**
CO3	Apply knowledge and skills of modern construction practices and techniques.	**PO2,PO5, P11**
CO4	Demonstrate the basic of project management	**PO2 PO4**
CO5	Develop the network for construction projects and examine the critical path	**PO2,PO3**

Text Books:

1. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher Education-Univ.Press, Delhi.
2. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi.
3. Construction project management by Jha, Pearson pubilications, New Delhi

Reference Books:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by: P.K.Joy- Mac Millan Publishers India Limited.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	-	3	-		-	-	-	-	-	-	-
CO.2	-	2	3	-		-	-	-	-	-	-	-
CO.3	-	2	-	-	2	-	-	-	-	-	1	-
CO.4	-	2	-	2		-	-	-	-	-	-	-
CO.5	-	2	2			-	-	-	-	-	-	-
CO*	**1**	**2**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCIV322 REMOTE SENSING AND GIS (OPEN ELECTIVE-I)

Course Educational Objectives:

1. To know the basics, importance, analysis and applications of RS and GIS
2. To study the various types of operating systems of RS and GIS
3. To know the applications of RS and GIS

UNIT – 1: INTRODUCTION TO REMOTE SENSING (10)

Concept and scope of remote sensing: Definitions, Process and Characteristics of Remote Sensing System, Advantages and limitations. **Concept of electromagnetic radiation (EMR):** Wavelength-frequency-energy relationship of EMR, EMR Spectrum and its properties, EMR wavelength regions and their applications, Spectral signatures. **Energy interaction in the atmosphere and with earth surface features:** Scattering, absorption, transmission, atmospheric windows Spectral Reflectance Curve, Concept of signatures.

UNIT – 2: PLATFORMS AND SENSORS (12)

Introduction: Sensor materials, Sensor System - Framing and Scanning System, Whiskbroom scanners, Push-broom scanners. **Types and characteristics of sensor:** Imaging and non-imaging sensors, Active and passive sensors, Resolution of Sensors - Spectral, Spatial, Radiometric & Temporal, Scale, Mapping unit, Multi-band concepts and False Colour Composites. **Remote sensor platforms and satellite orbits:** Ground, Airborne and Space borne Platforms, Orbital Characteristics – Coverage, Passes, Pointing Accuracy, Geostationary, Sun synchronous, shuttle orbit. **Space imaging satellites:** Early history of space imaging; Multispectral and Hyperspectral sensors, Radar, Lidar; Specification of some popular satellites – IRS, Landsat and SPOT series; High resolution satellites – IKONOS, Cartosat, Quick bird, Orb View, Geo Eye, Pléiades, World View; Other latest earth resource satellites.

UNIT – 3: REMOTE SENSING APPLICATIONS (9)

Scope of Remote Sensing Applications - Potentials and Limitations. Applications in land use and land cover analysis. Resource evaluation - Soils, forest and agriculture. Water Resource Applications - Mapping, monitoring of surface water bodies, tanks, lakes/reservoirs. Environmental applications.

UNIT – 4: GEOGRAPHIC INFORMATION SYSTEM (7)

Basic Concepts: Definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Areas of GIS application, Advantage and Limitation of GIS

UNIT – 5: GIS DATA (9)

Spatial and Attribute Data, Information Organization and Data Structures – Raster and Vector data structures, Data file and database. **Creating GIS Database**: GIS Software's, file organization and formats, Geo-database, Database model, Rectification, Digitization and Map Composition

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the principles and applications of Remote Sensing and various types of platforms used in Remote Sensing.	**PO1, PO2, PO3,**
CO2	Understand the principles of remote sensing and digital image processing;	**PO1**
CO3	Understand the principles of geographic information systems (GIS)	**PO1, PO2, PO4,**
CO4	Demonstrate the applications of remote sensing and GIS to solving problems in the environmental and life sciences;	**PO1, PO3**
CO5	Demonstrate the use of image processing and GIS software	**PO3**

Text Books:

1. Text Book of Remote Sensing and Geographic Information System, M. Anji Reddy, BS Publication.
2. Concepts and Techniques of GIS, Lo C.P. &Yeung A.K.W., Prentice-Hall of India, New Delhi, 2004

Reference Books:

1. Remote sensing and Geographic Information System, B.Bhatta, Oxford Publications.
2. Introduction to Geographical Information System, Siddiqui, M.A., ShardaPustak , Bhavan, Allahabad, 2006
3. Principles of Remote Sensing, Curran, Paul J, Longman, London, 1985.
4. Data User Handbook, NRSA, IRS, Hyderabad

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	-	-	-	-	-	-	-	-	-	-	-
CO.3	1	2	-	2	-	-	-	-	-	-	-	-
CO.4	1	-	2	-	-	-	-	-	-	-	-	-
CO.5	-	-	2	-	-	-	-	-	-	-	-	-
CO*	**1.5**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OCIV323 GREEN BUILDINGS AND ENERGY CONSERVATION (OPEN ELECTIVE-I)

Course Educational Objectives:

1. To introduces green building concepts.
2. To explain the design process of green buildings
3. To teach the thermal flow in buildings
4. To demonstrate the materials required .for green house construction
5. To analyze the costs involved in green buildings

UNIT – 1: GREEN BUILDING CONCEPTS (9)

Orientation – Introduction to bioclimatic architecture, sustainability in building science functional planning – Elements of building design and drawing, regulations and bylaws –Traditional Vs vernacular architecture – Climate zones, design charts, sun path diagram, solar angles, indices of thermal comfort, vernacular buildings in different climate zones.

UNIT – 2: CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN (9)

Introduction, various steps, site planning , plan form building envelope landform, topography, vegetation, water bodies; orientation, S/V ratio, P/A ratio, walls, fenestration, roof and floors active Vs passive, passive solar architecture.

UNIT – 3: THERMAL FLOW IN BUILDINGS (9)

Calculation of thermal conductance, heat flow through different building elements; various software ventilation and day lighting – Design and placement of openings – Water management in buildings techniques to recycle, reuse and harvest water.

UNIT – 4: GREEN BUILDING MATERIALS AND CONSTRUCTION (9)

Material properties, energy efficiency using various materials, emerging new materials construction techniques – Techniques for roof, wall and foundations.

UNIT – 5: ECONOMY OF GREEN BUILDING (9)

Cost of building, operation and maintenance – Green building rating system, evaluation criteria of LEED, TERI GRIHA case studies, and case studies in different climate zones.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the green building concepts	**PO1**
CO2	explain the design process of green buildings	**PO1**
CO3	Demonstrate the thermal flow in buildings	**PO1, PO2**
CO4	Demonstrate the materials required .for green house construction	**PO1,**
CO5	Identify the costs involved in green buildings	**PO1**

Text Books:

1. Climate Responsive Architecture, A Design Handbook For Energy Efficient Buildings, Krishnan, A., Baker, N., Yannas, S., and Szokolay, S., Eds., 2001, Tata McGraw–HillPublishing Company, New Delhi.
2. Sustainable building design manual (Vol.II), TERI & ICAEN (InstitutCataladEnergia), 2004, The Energy and Resources Institute (TERI) Press, New Delhi.

Reference Books:

1. Bureau of Indian Standards, SP:41, Handbook on Functional Requirements of Buildings (Other Than Industrial Buildings) 1/e rp,1995, Bureau of Indian Standards, New Delhi.
2. Indian Green Building Council, LEED-India, 2011, LEED 2011 for India- Green building Rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Manual of Tropical Housing and Building, Koenigsberger, O., ingersoll, T. G., Mayhew, A., &Skozolay, S. V., 2011, Universities Press, Hyderabad.
4. Building Design and Drawing, Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan, 2008, Calicut:Spades Publishers.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	3	-	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	-	-	-	-	-	-	-	-	-	-	-
CO.5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OEEE321 SCADA SYSTEM AND APPLICATIONS
(OPEN ELECTIVE-I)

Course Educational Objectives

1. To understand the fundamentals of SCADA.
2. To analyze the SCADA Components, Communication, Monitoring and Control
3. To analyze the application of SCADA in power System
4. Understand the Energy efficient motors and power factor improvement.
5. Know the concept Energy Measuring Instruments.

UNIT – 1: INTRODUCTION TO SCADA (9)

Evolution of SCADA, SCADA definitions, SCADA Functional requirements and Components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits.

UNIT – 2: SCADA SYSTEM COMPONENTS (9)

Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels.

UNIT – 3: SCADA COMMUNICATION (10)

SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like Fiber optic, PLCC etc. Interface provisions and communication extensions, synchronization with NCC, DCC.

UNIT – 4: SCADA MONITORING AND CONTROL (8)

Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording. Control function: Station control, bay control, breaker control and disconnector control.

UNIT – 5: SCADA APPLICATIONS IN POWER SYSTEM (9)

Applications in Generation, Transmission and Distribution sector, Substation SCADA system Functional description, System specification, System selection such as Substation configuration, IEC61850 ring configuration, SAS cubicle concepts, gateway interoperability list, signal naming concept. System Installation, Testing and Commissioning.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the fundamentals of SCADA.	**PO1, PO2.**
CO2	Describe the system components of SCADA	**PO1,PO2**
CO3	Elucidate the SCADA communication	**PO1,PO2**
CO4	Acquire knowledge on the monitoring and control of SCADA	**PO1,PO2**
CO5	Describe the applications of SCADA in power system.	**PO1**

Text Books:

1. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications, USA.

Reference Books:

1. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newness Publications, Oxford, UK, 2004.
2. William T. Shaw, Cybersecurity for SCADA systems, PennWell Books, 2006

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	3	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	3	-	-	-	-	-	-	-	-	-	-
CO.5	3	3	-	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OEEE322 SERVICING OF ELECTRICAL APPLIANCES (OPEN ELECTIVE-I)

Course Educational Objectives:

1. To learn the servicing of various Electrical appliances.
2. To understand the importance of Earthing for safe operation
3. To Know the concept of different electrical appliances
4. To understand the concept of Protection devices
5. To know the concept of Electrical Safety

UNIT – 1: INTRODUCTION (9)

Introduction to electrical appliances-Importance of electrical wiring – Principle of domestic wiring- Wiring system using casing & capping, PVC, and concealed system- wiring connections: tube light wiring, staircase wiring, house wiring.

UNIT – 2: TESTING AND FAULT IDENTIFICATION OF LOW POWER APPLIANCES (9)

Maintenance and repair of domestic equipments - electric iron box- - ceiling fan - electric kettle, Heater/immersion heater-washing machine- grinder-mixer.

UNIT – 3: SERVICING OF HIGH POWER APPLIANCES (9)

Testing of different electrical appliances-geyser-hot plates-pumps– induction stove- refrigerator etc.

UNIT – 4: PROTECTION DEVICES AND TESTING EQUIPMENTS (9)

Study of fuses- Contactors-Circuit Breakers- Relays - Measurement of voltage, current and resistance using multi meter and Clamp meter - Usage of continuity tester- line tester - test lamp.

UNIT – 5: PRACTICE ON EARTHING AND ELECTRICAL SAFETY (9)

Basic principles of earthing-different methods of earthing-importance of earthing- fundamental of safe installation of equipments – precautions & prevention of electrical shock- Types of Shocks - first Aid.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamental concepts of Electrical appliances.	**PO1,PO2,PO3,PO12**
CO2	Apply the concept to trace and identify the fault in low power appliances.	**PO1,PO2,PO3,PO12**
CO3	Apply the concept to trace and identify the fault in power appliances	**PO1,PO2,PO3,PO12**
CO4	Illustrate the concept of protective devices and measuring instruments.	**PO1,PO2,PO3,PO12**
CO5	Understand the importance of earthing for safe operations and Analyze any electrical connection and rectify the fault	**PO1,PO2,PO3,PO12**

Text Books:

1. Troubleshooting and Repairing Commercial Electrical Equipment by David Herres, Mc Graw Hill Publications, 2013
2. Elements of Induction Heating design and control application by S. Zinn, S. L. Semiatin, ASM International Publications.

Reference Books:

1. Elstan A. Fernandez, Marine Electrical technology.
2. Electrical Safety, Fire Safety Engineering and Safety Management by S. Rao, R.K. Jain, H.L. Saluja

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	2
CO.2	3	2	2	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	-	-	-	-	-	-	-	-	2
CO.4	3	2	2	-	-	-	-	-	-	-	-	2
CO.5	3	2	2	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OEEE323 POWER SYSTEM REFORMS
(OPEN ELECTIVE-1)

Course Educational Objectives:

1. To study fundamentals of power system deregulation and restructuring.
2. To study available transfer capability.
3. To study congestion management
4. To study various electricity pricing methods.
5. To study operation of power system in deregulated environment.

UNIT – 1: OVER VIEW OF KEY ISSUES IN ELECTRIC UTILITIES (9)

Introduction – Restructuring models – Independent system operator (ISO) – Power Exchange– Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT – 2: AVAILABLE TRANSFER CAPABILITY (ATC) (9)

Structure of OASIS – Processing of Information – Transfer capability on OASIS –Definitions Transfer Capability Issues – ATC – TTC – TRM – CBM calculations –Methodologies to calculate ATC.

UNIT – 3: CONGESTION MANAGEMENT (9)

Introduction to congestion management – Methods to relieve congestion

UNIT – 4: ELECTRICITY PRICING (9)

Introduction – Electricity price volatility electricity price indexes – Challenges to electricity pricing – Construction of forward price curves – Short–time price forecasting.

UNIT – 5: POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT (9)

Introduction – Operational planning activities of ISO – The ISO in pool markets – The ISO in bilateral markets – Operational planning activities of a GENCO.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Will understand importance of power system deregulation and restructuring.	**PO1,PO2,PO3**
CO2	Able to compute Available Transfer Capability**.**	**PO1,PO2,PO3,**
CO3	Will understand transmission congestion management.	**PO1,PO2, PO3**
CO4	Able to compute electricity pricing in deregulated environment.	**PO1,PO2,PO3**
CO5	Will be able to understand power system operation in deregulated environment.	**PO1,PO2,PO3**

Text Books:

1. Kankar Bhattacharya, Math H.J. Boller, JaapE.Daalder, 'Operation of Restructured Power System' Kluver Academic Publisher – 2001.
2. Mohammad Shahidehpour, and Muwaffaqalomoush, – "Restructured electrical Power systems" Marcel Dekker, Inc. 2001

Reference Books:

1. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.
2. Electrical Power Distribution Case studies from Distribution reform, upgrades and Management (DRUM) Program, by USAID/India, TMH

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	2
CO.2	3	2	2	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	-	-	-	-	-	-	-	-	2
CO.4	3	2	2	-	-	-	-	-	-	-	-	2
CO.5	3	2	2	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OECE321 MACHINE VISION SYSTEM
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To introduce theory, applications and techniques of machine vision to students
2. Provide the students with an understanding of the problems involved in the development of machine vision systems.
3. Introduces the "low-level" algorithms of image processing that are necessary for the "mid-level" vision or feature extraction.
4. To describe and analyze the pattern recognition, and 3D analysis and modeling of objects and scenes.
5. Tolay emphasis on the practical integration of machine vision systems, and the related applications in real time.

UNIT – 1: INTRODUCTION **(9)**

Human vision – Machine vision and Computer vision – Benefits of machine vision - Block diagram and function of machine vision system implementation of industrial machine vision system – Physics of Light – Interactions of light – Refraction at a spherical surface – Thin Lens Equation.

UNIT – 2: IMAGE ACQUISITION **(9)**

Scene constraints – Lighting parameters – Lighting sources, Selection – Lighting Techniques – Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection – Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and Digital Cameras – Digital Camera Interfaces – Camera Computer Interfaces, Specifications and Selection – Geometrical Image formation models – Camera Calibration, line and progressive scan.

UNIT – 3: IMAGE PROCESSING` **(9)**

Machine Vision Software – Fundamentals of Digital Image – Image Acquisition Modes – Image Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection – Binary Morphology.

UNIT – 4: IMAGE ANALYSIS **(9)**

Feature extraction – Region Features, Shape and Size features – Texture Analysis – Template Matching and Classification – 3D Machine Vision Techniques – Decision Making.

UNIT – 5: MACHINE VISION APPLICATIONS **(9)**

Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile, applications in non-visible spectrum, metrology and gauging, OCR and OCV, vision guided robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented reality, surveillance, bio-metrics, automobile industries, Food packaging industry, research and aeronautics.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Formulate the concepts of machine vision system and its applications	**PO1, PO2**
CO2	Determine the geometrical image formation model and analyze the lighting effects for image acquisition	**PO1,PO2**
CO3	Demonstrate various the image acquisition and processing techniques in spatial and frequency domain	**PO1, PO2,PO3**
CO4	Analyze the digital image for feature extraction and 3D vision techniques for decision making.	**PO1, PO2,PO3, PO4**
CO5	Apply machine vision concepts and visual sensing technologies in real time applications	**PO1, PO2**

Text Books:

1. Handbook of Machine Vision, First Edition, Alexander Hornberg,2006, Wiley VCH.
2. Machine Vision Theory, Algorithms and Practicalities, Davis E.R., 2005, Elsevier.

Reference Books:

1. Understanding and Applying Machine Vision, NelloZuech,, 2000,Marcel Decker.
2. Introductory Techniques For 3D Computer Vision, first Edition.,EmanueleTrucco, Alessandro Verri,
3. Digital Image Processing Using MATLAB, Rafael C.Gonzales, Richard.E.Woods, 2014, Mc. Graw Hill Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	2
CO.2	2	3	-	-	-	-	-	-	-	-	-	2
CO.3	2	3	2	-	-	-	-	-	-	-	-	2
CO.4	3	2	2	2	-	-	-	-	-	-	-	2
CO.5	3	2	-	-	-	-	-	-	-	-	-	2
CO*	**2.6**	**2.4**	**2**	**2**	-	-	-	-	-	-	-	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OECE322 FOUNDATION OF NANO-ELECTRONICS
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To learn the basic fundamentals of Nano electronics
2. To better understand the of the Nano-micro fabrication.
3. To classify the different Nano materials depending on the properties.
4. To Understand the phenomena using the characterization techniques
5. To provide a foundation for the device fabrication and various applications in the field of sensors technology, optoelectronics, communication and nanotechnology etc.

UNIT – 1: INTRODUCTION TO TUNNELING (9)

Tunnel junction and applications of tunneling, Tunneling Through a Potential Barrier, Metal-Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source.

UNIT – 2: TUNNELING DEVICES (9)

Field Emission, Gate—Oxide Tunneling and Hot Electron Effects in nano MOSFETs, Theory of Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode.

UNIT – 3: LITHOGRAPHY TECHNIQUES (9)

Introduction to lithography- Contact, proximity printing and Projection Printing, Resolution Enhancement techniques, Positive and negative photo resists, Electron Lithography, Projection Printing. Lithography based on Surface Instabilities: Wetting, De-wetting, Adhesion, Limitations, Resolution and Achievable / line widths, Lift off process, Bulk Micro machining.

UNIT – 4: MEMS DEVICES (9)

Introduction to MEMS and NEMS, working principles, micro sensors, micro actuation- thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Pizoresistivity, Pizoelectricity and thermoelectricity.

UNIT – 5: NANO ELECTRONIC DEVICES (9)

Scaling of physical systems – Geometric scaling & Electrical system scaling. The Single-Electron Transistor: The Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Molecular SETs and Molecular Electronics. Graphenes, fullerenes- Structure and Properties.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To understand and analyze the fundamental physics of nano electronics	**PO1**
CO2	Discuss various Properties of electrons in nanostructures	**PO1,PO2**
CO3	Describe deep insight to fabrication and characterization techniques in Nanostructures.	**PO1,PO2**
CO4	Familiarize with concepts of electronics transportation in nanostructures, understanding the working principles of MEMS and NEMS	**PO1**
CO5	Demonstrate the working of various nano electronics devices	**PO1,PO2,PO3**

Text Books:

1. Stephen D. Senturia, "Microsystem Design, Springer Verlag", 2001.
2. Marc Madou, "Fundamentals of microfabrication & Nano Technology", Taylor and Francis, 2011.
3. T. Fukada & W.Mens, "Micro Mechanical system Principle & Technology", Elsevier, 1998.
4. Julian W.Gardnes, Vijay K. Varda, "Micro sensors MEMS & Smart Devices", 2001.

Reference Books:

1. Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springer.
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.
3. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices by Karl Goser, Peter Glosekotter, Jan Dienstuhl
4. Quantum-Based Electronic Devices and Systems by M. Dutta and M.A. Stroscio, World Scientific.
5. Micro sensors MEMS& Smart Devices, Julian W.Gardnes, Vijay K. Varda, 2001

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	2
CO.2	3	2	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	-	-	-	-	-	-	-	-	-	2
CO.4	3	-	-	-	-	-	-	-	-	-	-	2
CO.5	3	2	2	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**2**

III B.Tech II Semester

L	T	P	C
3	0	0	3

18OECE323 MEDICAL ELECTRONICS
(OPEN ELECTIVE-I)

Course Educational Objectives:

1. To gain knowledge and analyze the various physiological parameters.
2. To understand the respiratory, Blood pressure, temperature measurements etc.
3. To study about the various assist devices used in the hospitals.
4. To gain knowledge about equipment used for various diagnostic and therapeutic techniques.
5. To know the recent trends in tele medicine and laser in medicine.

UNIT – 1: ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9)

The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG,PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT – 2: BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT (9)

PH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, and Blood cell counters.

UNIT – 3: ASSIST DEVICES (9)

Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart lung machine.

UNIT – 4: PHYSICAL MEDICINE AND BIOTELEMETRY (9)

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radio pill, electrical safety.

UNIT – 5: RECENT TRENDS IN MEDICAL INSTRUMENTATION (9)

Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Distinguish and analyze the various physiological parameters and its recording methods, signal characteristics.	**PO1,PO2**
CO2	Describe the respiratory, Blood pressure, temperature measurements etc.	**PO1,PO2,PO5**
CO3	Analyze function of various assist devices used in the hospitals.	**PO1,PO2, PO5**
CO4	Demonstrate knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.	**PO1,PO2, PO5**
CO5	Extend knowledge on recent trends in tele medicine and laser in medicine.	**PO1,PO2, PO5**

Text Books:

1. Leslie Cromwell, ―Biomedical instrumentation and measurement‖, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster,‖ Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India Edition, 2007.

Reference Books:

1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation‖, TATA McGraw-Hill, New Delhi, 2003.
2. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical equipment Technology‖, John Wiley and Sons, New York, 2004.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	-	-	2	-	-	-	-	-	-	-
CO.3	3	3	-	-	2	-	-	-	-	-	-	-
CO.4	3	3	-	-	2	-	-	-	-	-	-	-
CO.5	3	3	-	-	2	-	-	-	-	-	-	-
CO*	**3**	3	-	-	2	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OSAH411 GRAPH THEORY WITH APPLICATIONS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. To learn the representation of graphs and understanding the Graph Isomorphism, Sub graph-Vertex degrees, Walk, Paths, Cycles-graph connection, Bipartite graphs.
3. To understand the Trees concepts, digraphs, binary relations, Shortest path algorithms and to familiarize the knowledge of graph theory
4. To understand the matrix representation of graphs, designing incidence matrix, Adjacency matrix and circuit matrix
5. To explore the use of graphs in various applications in Switching and Coding Theory. Also, to identify the important graph based real time applications of electrical networks such as RLC Networks with Independent sources, LOOP circuits

UNIT – 1: GRAPH THEORY INTRODUCTION (9)

Graph and simple graphs (Complete graphs, Complement of graph) - Graph isomorphism–Sub graph- Vertex degrees, walk, paths, cycles-graph connection and components-Bipartite graphs.

UNIT – 2: DIRECTED GRAPHS AND SHORTEST PATH ALGORITHMS (9)

Trees – Cut edges- Cut vertices-Blocks , Directed graphs types of directed graphs - digraphs and binary relations – directed paths and connectedness - Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm

UNIT – 3: MATRIX REPRESENTATION OF GRAPHS (9)

Introduction - Adjacency matrix -Applications of Adjacency matrix-sufficient condition for isomorphism of graphs-power of an adjacency matrix-Adjacency matrix of a digraph-incidence matrix-circuit matrix-cut set matrix.

UNIT – 4: GRAPHS IN SWITCHING AND CODING THEORY (9)

Contact Networks – Analysis of Contact Networks – Synthesis of Contact Networks – Sequential Switching Networks – Unit Cube and its Graph – Graphs in Coding Theory.

UNIT – 5: ELECTRICAL NETWORK ANALYSIS BY GRAPH THEORY (9)

Introduction - Kirchhoff's current and Voltage laws-Loop currents and Node Voltages- RLC Networks with Independent sources: Nodal analysis, Loop analysis.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate knowledge in reading and writing rigorous mathematical proofs involving introductory aspects of graphs and develop analytical skills in solving graph theoretic problems	**PO1,PO2,PO3 PO4**
CO2	Demonstrate knowledge in Trees concepts, digraphs, binary relations, and Develop analytical skills in solving problems involving directed graphs and shortest path algorithm	**PO1,PO2,PO3 PO4**
CO3	Demonstrate knowledge in matrix representation of graphs, designing incidencematrix, Adjacency matrix and circuit matrix and explore analytical skills in solving problems involving adjacency matrix and incidence matrix	**PO1,PO2,PO3 PO4**
CO4	Demonstrate knowledge in significant practical applications of graphs in Switching and Coding Theory; explore analytical skills in solving practical problems using graph theory concepts and Develop skills in designing Mathematical models for real time applications in coding theory.	**PO1,PO2,PO3 PO4**
CO5	Demonstrate knowledge in significant real time applications of electrical networks such as RLC Networks Independent sources; explore analytical skills in solving practical problems involving using graph theory concepts and Develop skills in designing Mathematical models for real time electrical networks.	**PO1,PO2,PO3 PO4**

Text Books:

1. Discrete mathematical structures with applications to computer science. J.P.Trimblay and R.Manohar , 27/e, Tata Mc Graw Hill Publications , 2006, New Delhi.
2. Graph Theory with applications to engineering and computer Science, NarasinghDeo, 25/e, Printice – Hall of India Private Limited, 2003, New Delhi

Reference Books:

1. Clark J. And Holton D.A., " A first look at Graph theory", Allied Publishers, 1990.
2. R.B.Bapat , Graphs and Matrices, Springer, London Dordrecht Heidelberg, New York, 2010
3. Gary Haggard John Schlipf, Sue Whitesides, Discrete Mathematics for Computer Science, 4/e, 2007, Thomson Publication, 2008, New Delhi.
4. S.D Sharma ,KedarNath Ram Nath Operation Research & Co, Meerut . 2007.
5. J.A.Bonday and U.S.R. Murty, Graph Theory with application (2nd Edition), North Holland, 1976 .

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	-	-	-	-	-	-	-	-
CO.2	3	3	3	2	-	-	-	-	-	-	-	-
CO.3	3	3	3	2	-	-	-	-	-	-	-	-
CO.4	3	3	3	2	-	-	-	-	-	-	-	-
CO.5	3	3	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**3**	2	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OSAH412 BANKING AND INSURANCE
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To introduce students to the banking sector and its operations.
2. To provide elaborate knowledge on functions of banking
3. To enable students to understand the digital technology in banking
4. To provide an understanding of insurance and risk management
5. To enable students to gain knowledge on various insurance organizations.

UNIT – 1: INTRODUCTION TO BANKING (9)

Meaning and functions of banking, importance of banking, Reserve Bank of India- Functions.

UNIT – 2: BANK-CUSTOMER RELATIONSHIP (9)

Debtor-creditor relationship, deposit products or services, payment and collection of cheques. Accounts – Types of accounts, procedure for opening and closing an account. Loans and Advances- Principles of lending, Types of loans.

UNIT – 3: BUSINESS MODELS & ELECTRONIC PAYMENT SYSTEM (9)

Features, types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards. Business models- B2B, B2C, C2C, and B2G.

UNIT – 4: INTRODUCTION TO RISK AND INSURANCE (9)

Concept of risk, risk Vs uncertainty. Insurance definition, Insurance as risk mitigation mechanism, elements of insurance.

UNIT – 5: INSURANCE OVERVIEW (9)

Principles of insurance, insurance types, LIC & GIC, insurance - functions, IRDA, Insurance Players in India.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate Knowledge in Tools and concepts of Banking.	**PO11, PO12**
CO2	Explain the operations and functions of banking towards customers	**PO7, PO11**
CO3	Apply skills in providing solutions for Online banking and e payment	**PO7,PO11, PO12**
CO4	Employ the risk management practices especially the insurance mechanism.	**PO9,PO11**
CO5	Classify the various types of Insurance and understand the principles behind insurance	**PO7, PO11**

Text Book:

1. A.V. Ranganadha Chary, R.R. Paul, Banking and Financial System, Kalyani Publisher, New Delhi, 2nd Edition.
2. P.K.Gupta, Insurance and Risk Management, Himalaya Publishing House, New Delhi.

Reference Books:

1. Diwan, Praq and Sunil Sharma, Electronic Commerce- A Manager's Guide to E-Business, Vanity Books International, Delhi, 2002.
2. Kalakota Ravi and Whinston Andrew B, Frontiers of Electronic Commerce, Pearson Education India, 1996 New Delhi.
3. Schneider, Gr ey P, Ele ctron ic Com merce , Cou rse Technology, Cengage Learning, 8th Edition, New Delhi, 2008.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	-	-	-	-	-	-	-	-	-	-	2	2
CO.2	-	-	-	-	-	-	2	-	-	-	3	-
CO.3	-	-	-	-	-	-	3	-	-	-	3	2
CO.4	-	-	-	-	-	-	-	-	2	-	3	-
CO.5	-	-	-	-	-	-	2	-	-	-	3	-
CO*	-	-	-	-	-	-	**2.33**	-	**2**	-	**2.8**	**2**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OSAH413 MANAGING INNOVATION AND ENTREPRENEURSHIP (OPEN ELECTIVE-II)

Course Educational Objectives:

1. To enable students understand the importance of innovation in business practices
2. To enable students to innovate new methods and practices in business using innovation approaches
3. To provide knowledge on raising finance for starting new business
4. To enable students to protect their innovation through patent and copyright
5. To motivate students to become successful entrepreneurs through constant innovation

UNIT – 1: CREATIVITY AND INNOVATION (9)

Introduction, Levels of Innovation, the Sources of Innovative Opportunity, The Innovation Process, Innovative Strategies, Creativity – Inbound, Outbound; Context and Process of New Product Development.

UNIT – 2: PARADIGMS OF INNOVATION (9)

Innovation in the Context of Developed Economies and Emerging Economies, Performance gap, Infrastructure gap, Sustainability gap, Regulatory gap, Preference gap.

UNIT – 3: INTELLECTUAL PROPERTY INNOVATION AND ENTREPRENEURSHIP (9)

Introduction to Entrepreneurship, Managerial and Entrepreneurial Competencies, Entrepreneurial Growth and Development, Intellectual Property – Forms of IP, Patents, Trademarks, Design Registration, Copy Rights, and Patent Process in India.

UNIT – 4: OPEN INNOVATION FRAMEWORK & PROBLEM SOLVING (9)

Concept of Open Innovation Approach, Limitations and Opportunities of Open Innovation Framework, Global Context of Strategic Alliance, Problem Identification and Problem Solving, Innovation and Diversification.

UNIT – 5: SOURCES OF FINANCE AND VENTURE CAPITAL (9)

Importance of Finance, Strategies of Venture Funding, Investment Process, Advantages and Disadvantages of Venture Capital, Venture Capital Developments in India.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate the principles of business innovation and entrepreneurship for establishing industrial ventures..	**PO9,PO11**
CO2	Apply the approaches to innovation for developing successful ventures	**PO9, PO11**
CO3	Develop a comprehensive and well planned acquisition of finance for a new venture	**PO9,PO10,PO11**
CO4	Exhibit entrepreneurial competencies and protect the innovations	**PO9,PO11**
CO5	Apply ethics in constructive innovation framework.	**PO8, PO11,PO12**

Text Books:

1. Vi nn ie Ja uha ri , S ud han sh u B hu sha n, I nn ov at ionManagement, Oxford University Press, 1st Edition, 2014.
2. Drucker, P. F., Innovation and Entrepreneurship, Taylor & Francis, 2nd Edition, 2007.

Reference Books:

1. Robert D Hisrich, Claudine Kearney, Managing Innovation and Entrepreneurship, Sage Publications, 1st Edition, 2014.
2. V.K.Narayanan, Managing Technology and Innovation for Competitive Advantage, Pearson India, 1st Edition, 2002.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	1
CO.2	3	-	-	-	-	-	-	-	-	-	-	1
CO.3	3	-	-	-	-	-	-	-	-	-	-	1
CO.4	3	-	-	-	-	-	-	-	-	-	-	1
CO.5	3	-	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCSE411 FUNDAMENTALS OF DBMS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. Discuss the basic database concepts, applications, data models, schemas and instances and design Entity Relationship (E-R) model for a database.
2. Demonstrate the use of integrity constraints, relational algebra operations and relational calculus.
3. Describe the basics of SQL, construct queries using SQL, SQL functions, trigger and cursor concepts in PL/SQL.
4. Understand reasoning about functional dependency and to make the students to identify the role of normalization in database management systems.
5. To present the students with the knowledge of Transaction, concurrency and recovery strategies of DBMS.

UNIT – 1: DATABASE SYSTEMS AND ENTITY RELATIONSHIP MODELING (8)

Database System Applications - Purpose of Database Systems - View of Data - Database Languages - Database Users and Administrators - Database Architecture - The Entity-Relationship Model - Attributes and Entity Sets - Relationship Sets - Entity-Relationship Diagrams - Extended E-R Features.

UNIT – 2: RELATIONAL DATA MODEL (7)

Introduction to the Relational Model - Integrity Constraints - Fundamental Relational Algebra Operations - Tuple Relational Calculus - Domain Relational Calculus.

UNIT – 3: INTRODUCTION TO SQL (12)

Characteristics of SQL - advantages of SQL - SQL Data types and Literals.-Types of SQL Commands - SQL Operators and their Procedures - Form of Basic SQL Query - Examples of Basic SQL Queries - Relational Set Operators – SQL Join operators - Introduction to Nested Queries - Views - Indexes - SQL Functions - Database Triggers - Cursors in SQL – PL/SQL.

UNIT – 4: NORMALIZATION (9)

Introduction to Schema Refinement - Properties of Decompositions – Functional Dependencies - Reasoning about Functional Dependencies - Normal Forms - First - Second - Third – BCNF - MVD - Fourth Normal Form.

UNIT – 5: TRANSACTION PROCESSING AND CONCURRENCY CONTROL TECHNIQUES (9)

Transaction Concept - Transaction States - Implementation of Atomicity and Durability - Serializability - Recoverability - Concurrent Executions - Lock-Based Protocols for Concurrency Control - Time Stamp-Based Protocol for Concurrency Control - Multiple Granularity.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate knowledge on Data models and Database Languages and Design Entity Relationship model for a database	**PO1, PO3**
CO2	Analyze the relational database theory, and be able to write relational algebra and relational calculus expressions for queries.	**PO1, PO2**
CO3	Analyze and evaluate the databases using SQL DML/DDL Commands	**PO1, PO2, PO3, PO5**
CO4	Analyze databases using normal forms to provide solutions for real time applications.	**PO1, PO2**
CO5	Understand the properties of transactions in a database system, Analyze concurrency control techniques for handling concurrent transactions and understand recovery of data from failures	**PO1, PO3,PO4**

Text Books:

1. Database System Concepts, 6/e, 2006, Korth, Silberschatz, Sudarshan, Tata McGrawHill, New York.
2. Database Management System, 3/e, 2000,RaghuRamakrishnan, Tata McGrawHill, New York.

Reference Books:

1. Fundamentals of Database Systems, 5/e, 2008, Elmasri, Navathe, Pearson Education, USA.
2. Database Management Systems , 5/e, 2003, Peter Rob, A.AnandaRao and Carlos Coronel, Cengage Learning, USA.
3. SQL, PL/SQL Programming, 2/e, 2011, Ivan Bayross, BPB Publications, New Delhi, India.
4. Introduction to Database Systems, 8/e, 2004, C.J.Date, Pearson Education, USA.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	3	-	-	-	-	-	-	-	-	1
CO.2	3	3	-	-	-	-	-	-	-	-	-	1
CO.3	2	2	3	-	2	-	-	-	-	-	-	1
CO.4	2	3	-	-	-	-	-	-	-	-	-	1
CO.5	3	-	2	2	-	-	-	-	-	-	-	1
CO*	**2.6**	**2.6**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	-	1

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCSE412 BASICS OF INTERNET OF THINGS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To understand the fundamentals of Internet of Things.
2. To learn about Building state of the art architecture in IoT.
3. To learn about basis of IOT protocols.
4. To build a small low cost embedded system using Raspberry Pi and ARDUINO,
5. To apply the concept of Internet of Things in the real world scenario.

UNIT – 1: INTRODUCTION TO IOT (10)

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IOT- IoT Protocols -Logical Design of IoT - IoT communication models - IoT Communication APIs - IoT enabled Technologies- Wireless Sensor Networks - Cloud Computing - Big data analytics - Communication protocols - Embedded Systems.

UNIT – 2: M2M AND IOT ARCHITECTURE (8)

The Vision - Introduction - From M2M to IoT. M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT – 3: IOT PROTOCOLS (9)

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

UNIT – 4: BUILDING IOT WITH RASPBERRY PI AND ARDUINO (10)

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms – Arduino.

UNIT – 5: CASE STUDIES AND REAL-WORLD APPLICATIONS (9)

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate knowledge on fundamentals of Internet of Things and its functionalities.	**PO1, PO2**
CO2	Demonstrate knowledge on Building state of the art architecture in IOT.	**PO1, PO2**
CO3	Analyze various protocols for IOT	**PO1, PO2,**
CO4	Design a portable IOT using Raspberry Pi	**PO1, PO2, PO3, PO4**
CO5	Deploy an IOT application and connect to the cloud using Raspberry Pi & ARDUINO and apply the concept of Internet of Things in the real world scenario.	**PO1, PO2, PO3, PO4, PO5**

Text Books:

1. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, 2015, Universities Press.
2. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, 2014, Academic Press.

Reference Books:

1. Internet of Things (A Hands-on-Approach), 1stEdition, Vijay Madisetti and ArshdeepBahga, 2014,VPT.
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Francis daCosta, Apress Publications, 2013
3. Architecting the Internet of Things, Bernd Scholz-Reiter, Florian Michahelles, ISBN 978- 3842-19156-5, and Springer.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2		-	-	-	-	-	-	-	-	-
CO.2	3	3	-	-	-	-	-	-	-	-	-	-
CO.3	2	2	3	3	-	-	-	-	-	-	-	-
CO.4	2	2	3	3	-	-	-	-	-	-	-	-
CO.5	3	3	2	2	3	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2.6**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCSE413 INFORMATION SECURITY
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. The course will incorporate the foundational understanding of Information Security.
2. The course will incorporate the threats and network perimeter security design principles.
3. Provide abilities to review procedures for installation.
4. Troubleshooting and monitoring of network devices to maintain integrity, confidentiality and availability of data and devices.

UNIT – 1: INTRODUCTION (9)

Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets.

UNIT – 2: CRYPTOGRAPHIC PROTOCOLS (9)

Introduction to Protocols, Communications using Symmetric Cryptography, Substitution Ciphers and Transposition Cipher, Block cipher, Stream cipher, Modes of operation, Symmetric and Asymmetric cryptography.

UNIT – 3: INFORMATION SECURITY THREATS (9)

Virus, Malware, DDoSattack, Trojan, Worm, Spyware, Social Engineering, and Phishing attacks, man-in-middle attack, DNS poisoning.

UNIT – 4: PROXY AND FIREWALLS (9)

Working of Stateful Firewall, the Concept of State, Stateful Filtering and Stateful Inspection, Fundamentals of Proxying, Pros and Cons of Proxy Firewalls, Types of Proxies, and Tools for Proxying.

UNIT – 5: NETWORK INTRUSION DETECTION AND PREVENTION SYSTEMS (9)

Network Intrusion Detection Basics, the Roles of Network IDS in a Perimeter Defense, IDS Sensor Placement, IPS, IPS Limitations, NIPS ,Host Based Intrusion Prevention Systems, Traffic Monitoring.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and design real time scenarios	**PO1, PO2,PO3**
CO2	Monitor and maintain a secure network consisting of enterprise level routers and switches.	**PO1, PO2,PO3**
CO3	Analyze various protocols for IOT	**PO1, PO2,PO3**
CO4	Design/develop/ implement the security solution for a given application	**PO1, PO2, PO3**
CO5	Detect the different types of intrusions	**PO1, PO2, PO3, PO4**

Text Books:

1. W. Stallings, Network Security Essentials (6th Edition), Prentice Hall.
2. W. R. Stevens, TCP/IP Illustrated, Vol. 1: The Protocols, AddisonWesley 1993

Reference Books:

1. D. E. Comer, Internetworking with TCP/IP, Vol.1 (4th Edition), Prentice Hall, 2000
2. R. Oppliger, Internet and Intranet Security (2nd edition), Artech House, 2002
3. W.R.Cheswick and S.M.Bellovin, Firewalls and Internet security(2nd edition), Addison-Wesley, 2003

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	3	-	-	-	-	-	-	-	-	-
CO.2	3	3	3	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	2	3	2	-	-	-	-	-	-	-	-	-
CO.5	2	3	3	2	-	-	-	-	-	-	-	-
CO*	**2.4**	**3**	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCIV411 TRANSPORT AND ENVIRONMENT
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society.
2. To improve the environmental impact predictions
3. To study the water, air, land and noise assessment
4. To study the environmental mitigation.
5. To study the environmental case studies

UNIT – 1: INTRODUCTION (9)

Environmental inventory, environmental assessment, environmental impact assessment (EIA), environmental impact of transportation projects, need for EIA, EIA guidelines fortransportation project, historical development.

UNIT – 2: METHODOLOGIES (9)

Elements of EIA – Screening and scoping – Methods of impact analysis – Applications –appropriate methodology.

UNIT – 3: ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT (9)

Prediction and assessment of impact of transportation project at various stages on water, air, noise, land acquisition and resettlement, socio economic impact, indigenous people, aesthetics, health and safety, energy studies, IRC guidelines.

UNIT – 4: ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN (9)

Mitigation of the impact on natural and man-made environment, health, water, land, noise, air, public participation, environmental management plan, energy conservation, methods to reduce global warming.

UNIT – 5: NETWORK INTRUSION DETECTION AND PREVENTION SYSTEMS (9)

EIA case studies on highway, railway, airways and waterways projects.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the impact of transportation projects on the environment	**PO1, PO2**
CO2	Demonstrate the impact of environmental laws on transportation projects	**PO1, PO2 ,**
CO3	Demonstrate the impact of transportation project on the water, air, land and noise	**PO1, PO2**
CO4	Explain the environmental mitigation	**PO1**
CO5	Analyses the environmental case studies	**PO1, PO2 ,**

Text Books:

1. Environmental Impact Assessment, Canter, L.R., 1996, McGraw Hill, New Delhi.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, 1998, Delhi.
3. Elements of Environmental Science and Engineering, P. Meenakshi, 2006, Prentice Hall of India, New Delhi.
4. Introduction to Environmental Science and Management, Thirumurthy A.M., 2005, Shroff Publishers, Bombay.

Reference Books:

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995.
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000.
3. A Handbook on Roads and Environment, World Bank, Vol.I and II, 1997, Washington DC.
4. International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, Priya Ranjan Trivedi, 1998, New Delhi, Hyderabad: Indian Green Building Council.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	-	-	-	-	-	-	-	-	-	-
CO.2	1	2	-	-	-	-	-	-	-	-	-	-
CO.3	2	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	-	-	-	-	-	-	-	-	-	-	-
CO.5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**2**	**2**	-	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCIV412 DISASTER MANAGEMENT
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To explain disasters, their significance and types.
2. To demonstrate the disaster prevention and risk reduction methods.
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
4. To enhance awareness of institutional processes in the country.
5. To explain the disaster management case studies

UNIT – 1: INTRODUCTION TO DISASTERS (9)

Definition: Disaster, hazard, vulnerability, resilience, risks – Disasters: types of disasters –Earthquake, landslide, flood, drought, fire etc – Classification, causes, impacts including social, economic, political, environmental, health, psychosocial, etc. – Differential impacts in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, climate change – Dos and don'ts during various types of disasters.

UNIT – 2: APPROACHES TO DISASTER RISK REDUCTION (DRR) (9)

Disaster cycle – Phases, culture of safety, prevention, mitigation and preparedness communitybased DRR, structural – Nonstructural measures, roles and responsibilities of community,panchayat raj institutions/urban local bodies (PRIs/ULBs), states, centre, and other stakeholders – Institutional processes and framework at state and central level – State disaster management authority (SDMA) – Early warning system – Advisories from appropriate agencies.

UNIT – 3: INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT (9)

Factors affecting vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in land use etc. – Climate change adaptation – IPCC scenario and scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT – 4: DISASTER RISK MANAGEMENT IN INDIA (9)

Hazard and vulnerability profile of India, components of disaster relief: water, food, sanitation, shelter, health, waste management, institutional arrangements (mitigation, response and preparedness, disaster management act and policy – Other related policies, plans, programs and legislation – Role of GIS and information technology components in preparedness, risk assessment, response and recovery phases of disaster – Disaster damage assessment.

UNIT – 5: DISASTER MANAGEMENT: APPLICATIONS, CASE STUDIES &FIELDWORKS (9)

Landslide hazard zonation: case studies, earthquake vulnerability assessment of buildings and infrastructure: case studies, drought assessment: case studies, coastal flooding: storm surge assessment, floods: fluvial and pluvial flooding: case studies; forest fire: case studies, man-made disasters: case studies, space based inputs for disaster mitigation and management and field works related to disaster management.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Differentiate the types of disasters, causes and their impact on environment and society	**PO1, PO2**
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation	**PO1, PO2**
CO3	Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management	**PO1, PO2**
CO4	To analyse the disaster management techniques	**PO1, PO2 ,PO3**
CO5	To describe the situations of disaster management case studies	**PO1, PO2 ,**

Text Books:

1. Disaster Management, Singhal J.P. 2010, Laxmi Publications, ISBN-10: 9380386427; ISBN-13: 978-9380386423
2. Disaster Science and Management, Tushar Bhattacharya, 2012, McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-1259007361

Reference Books:

1. Govt. of India: Disaster Management Act, Government of India, 2005, New Delhi.
2. Government of India, National Disaster Management Policy, 2009.
3. Environmental Knowledge for Disaster Risk Management, NIDM, Gupta Anil K, Sreeja S. Nair. 2011, New Delhi.
4. Vulnerable India: A Geographical Study of Disasters, KapurAnu 2010, IIAS and Sage Publishers, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	-	-	-	-	-	-	-	-	-	-
CO.2	1	3	-	-	-	-	-	-	-	-	-	-
CO.3	2	2	-	-	-	-	-	-	-	-	-	-
CO.4	1	1	3	3	-	-	-	-	-	-	-	-
CO.5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**1.6**	**2.6**	**3**	**3**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OCIV413 AIR POLLUTION AND CONTROL
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To impart knowledge on the principle and design of control of indoor.
2. To study about meteorology.
3. To learn about particulate/ gaseous air pollutant and its emerging trends.
4. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
5. Ability to identify, formulate and solve air and noise pollution problems

UNIT – 1: INTRODUCTION (9)

Structure and composition of atmosphere – Definition, scope and scales of air pollution –Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility – Ambient air quality and emission standards – Ambient and stack sampling and analysis of particulate and gaseous pollutants.

UNIT – 2: METEOROLOGY (9)

Effects of meteorology on air pollution – Fundamentals, atmospheric stability, inversion, wind profiles and stack plume patterns – Atmospheric diffusion theories – Dispersion models, plume rise.

UNIT – 3: CONTROL OF PARTICULATE CONTAMINANTS (9)

Factors affecting selection of control equipment – Gas particle interaction – Working principle, design and performance equations of gravity separators, centrifugal separators fabric filters, particulate scrubbers, electrostatic precipitators – Operational considerations.

UNIT – 4: CONTROL OF GASEOUS CONTAMINANTS (9)

Factors affecting selection of control equipment – Working principle, design and performance equations of absorption, adsorption, condensation, incineration, bio scrubbers, bio filters – Process control and monitoring – Operational considerations.

UNIT – 5: INDOOR AIR QUALITY MANAGEMENT (9)

Sources types and control of indoor air pollutants, sick building syndrome types – Radon pollution and its control – Sources and effects of noise pollution – Measurement – Standards– Control and preventive measures

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To impart knowledge on the principle and design of control of indoor.	**PO1, PO2**
CO2	To study about meteorology.	**PO1, PO2**
CO3	To learn about particulate/ gaseous air pollutant and its emerging trends.	**PO1, PO2**
CO4	An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management	**PO1, PO2 ,PO3,PO4**
CO5	Ability to identify, formulate and solve air and noise pollution problems	**PO1, PO2 ,**

Text Books:

1. Air Pollution Control Engineering, Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, 2004, Tokyo.
2. Air Pollution and Control Technologies, Anjaneyulu. Y, 2002, Allied Publishers (P) Ltd., India.

Reference Books:

1. Air Pollution, David H.F. Liu, Bela G. Liptak, 2000, Lweis Publishers.
2. Air Pollution (Vol.I – Vol.VIII), Arthur C.Stern, 2006, Academic Press.
3. Air Pollution Engineering Manual, Wayne T.Davis, 2000, John Wiley & Sons, Inc.
4. Air Pollution Control Engineering, Noel de Nevers, 1995, McGraw Hill, New York.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	-	-	-	-	-	-	-	-	-	-
CO.2	1	3	-	-	-	-	-	-	-	-	-	-
CO.3	2	3	-	-	-	-	-	-	-	-	-	-
CO.4	1	1	3	3	-	-	-	-	-	-	-	-
CO.5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**1.6**	**2.6**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OEEE411 WIND ENERGY CONVERSION SYSTEMS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To make the student know various methods of measuring wind speed and facilities available for storage of such data.
2. To train the students to design the blade of a wind turbines.
3. To make the student understand methods for sitting a wind farm.
4. To make the student understand economics of establishing wind system.
5. To make the student know the applications of wind turbine.

UNIT – 1: INTRODUCTION (9)

Modern wind turbines, wind resources, wind vs. traditional electricity generation, technology advancements, material Usage. Applications: grid connected power, industrial applications, stand-alone system, water pumping, offshore prospects Introduction of Wind Resource Assessment , spatial variation, time variations, seasonal and monthly variability, diurnal variations. Characteristics of steady wind: turbulence, types of turbulence models, turbulence intensity.

UNIT – 2: WIND MEASUREMENT (9)

Vertical profiles of the steady wind. Wind speed measurement parameters, Monitoring station instrumentation, cup anemometer, propeller anemometer, Ultrasound anemometer, wind vane, data loggers, remote wind speed sensing techniques- Sodar, Lidar, SAR, LWS, Satellite remote sensing, Aerofoil, two dimensional airfoil theory, relative wind velocity. Wind flow models, wind flow pattern. Axial momentum theory, Momentum theory, blade element theory. Wind machine characteristics.

UNIT – 3: WIND TURBINES (9)

Historical development. Classification of wind turbines. Turbine components. Wind turbine design of Wind turbine, rotor torque and power, Power control, braking systems. Turbine blade design. Blade material, SERI blade sections. Transmission and generation efficiency, Energy production and capacity factor, Torque at constant speeds, Drive train oscillations.

UNIT – 4: ELECTRICAL AND CONTROL SYSTEMS (9)

Introduction to electricity and magnetism. Classification of generators, AC circuits, Synchronous generators, Induction generators, Variable speed generators. Control systems. Power Collection system. Power quality, wind farm and generation protection, interface protection, losses in generation. Asynchronous Load: Piston water pumps, Centrifugal pumps, Paddle wheel heaters, Batteries.

UNIT – 5: WIND FARM DESIGN (9)

Introduction, wind flow modeling, use of capacity factor for wind farm design, planning of wind farm. Siting of wind turbines, ecological indicators, layout of wind farm, initial site selection, micrositing, wake model. Economics of Wind Systems: Cost calculation, annual energy output, time value of money, capital recovery factor, depreciation. Cost of wind energy, present value of annual costs, value of wind generated electricity.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Choose a method for measuring wind speed.	**PO1,PO2,,PO3**
CO2	Identify ideal wind site for wind farm	**PO1,PO2,PO3,PO4**
CO3	Understand the Design the wind turbine	**PO1,PO2,PO3**
CO4	Use the turbine for a particular application,	**PO1,PO2,PO3**
CO5	Capable to Start a wind turbine farm.	**PO1,PO3,PO4**

Text Books:

1. SirajAhmed:"Wind Energy-Theory and Practice" Second Edition, PHI Learning Pvt. Ltd, New Delhi, 2011.

Reference Books:

1. Garg L Johnson: "Wind Energy Systems" Prentice Hall. Inc, New Jersey, 1985

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**1**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OEEE412 FUNDAMENTALS OF ENERGY AUDITING
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. Learn about energy scenario
2. Learn about fundaments of Energy Auditing.
3. Learn about concept Energy Consumption.
4. Understand the Energy efficient motors and power factor improvement.
5. Know the concept Energy Measuring Instruments.

UNIT – 1: ENERGY SCENARIO (9)

Primary and Secondary Energy, Conventional and non-conventional energy, Energy Security, Energy Conservation and its importance, Energy conservation Act., Thermal Energy basics, Energy Audit its definition & methodology.

UNIT – 2: FUNDAMENTALS OF ENERGY AUDIT (9)

Energy Situation – World and India, Energy Audit Instruments, Benchmarking for energy performance, Energy Action Planning, Duties and responsibilities of Energy Manager; Energy financial management, Project Management, Energy monitoring and targeting, pinch technology.

UNIT – 3: ENERGY CONSUMPTION (9)

Energy Consumption, Conservation, Codes, Standards and Legislation. Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results.

UNIT – 4: ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT (9)

Energy Efficient Motors , Factors Affecting Efficiency, Loss Distribution , Constructional Details , Characteristics - Variable Speed , Variable Duty Cycle Systems, RMS Hp-Voltage Variation-Voltage Unbalance- Over Motoring- Motor Energy Audit. Power Factor– Methods of Improvement, Power factor With Non Linear Loads

UNIT – 5: LIGHTING AND ENERGY INSTRUMENTS FOR AUDIT (9)

Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit -Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers, Application of PLCs.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the concept basic energy scenario.	**PO1, PO2.**
CO2	Demonstrate knowledge on energy auditing and evaluate energy audit results.	**PO1,PO2**
CO3	Analyze demand side management concepts through case study	**PO1,PO2**
CO4	Acquire knowledge on motor energy audit.	**PO1,PO2**
CO5	Acquire knowledge on energy instruments.	**PO1,PO2**

Text Books:

1. Industrial Energy Management Systems, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York, 1994.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice Hall Inc,Englewood Cliffs, New Jersey, 1984.

Reference Books:

1. Economic Analysis of Demand Side Programs and Projects – California Standard Practice Manual, June 2002 – Free download available online http://www.calmac.org/events/spm_9_20_02.pdf
2. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann Publications, 2007.
3. Energy management by Paul o‟ Callaghan, Mc-graw Hill Book company-1st edition, 1998
4. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd- 2nd edition, 1995.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	3	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	3	-	-	-	-	-	-	-	-	-	-
CO.5	3	3	-	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.6**	-	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OEEE413 INTRODUCTION TO POWER QUALITY
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To introduce the fundamental of electric power quality phenomena.
2. To make students learn the voltage variations.
3. To provide detailed analysis of Transients.
4. To make students learn about Harmonics.
5. To learn the power quality conditioners.

UNIT – 1: INTRODUCTION (9)

What is power quality? Power quality – voltage quality - why are we concerned about power quality? - the power quality Evaluation procedure - Terms and Definitions - Transients - Long-duration voltage variations - short-voltage variations - voltage imbalance - wave form distortion - voltage fluctuation - power frequency variations - power quality terms CBEMA and ITI curves.

UNIT – 2: VOLTAGE SAGS AND INTERRUPTIONS (9)

Sources of sags and interruptions - Estimating voltage sag performance - fundamental principles of protection - solutions at the end-use level - Motor-starting sags - utility system fault-clearing issues.

UNIT – 3: TRANSIENT OVER VOLTAGES (9)

Sources of over voltages - principles of over voltage protection - devices for over voltage protection - utility capacitor-switching transients - utility system lightning protection.

UNIT – 4: FUNDAMENTALS OF HARMONICS& APPLIED HARMONICS (9)

Harmonic Distortion - Voltage versus current distortion - Harmonics versus Transients - power system qualities under non sinusoidal conditions - Harmonic indices - Harmonic sources from commercial loads - Harmonic sources from Industrial loads Effects of Harmonics - Harmonic distortion evaluations – Principles of Controlling Harmonics - Devices for Controlling Harmonic Distortion.

UNIT – 5: POWER QUALITY BENCH MARKING AND MONITORING (9)

Benchmarking process, Power Quality Contracts. Monitoring considerations - power quality measurement equipment, assessment of power quality measurement data, application of intelligent systems, - Power quality Monitoring standards.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to Cos
CO1	Able to understand voltage sag, swell, long and short duration voltage variations.	**PO1,PO2,,PO4,PO12**
CO2	Able to understand the sources, principle of protection of voltage sag and interruption.	**PO1,PO2,PO3,PO4,,PO12**
CO3	Able to understand the concept of capacitor switching and lightning.	**PO1,PO2,PO4,PO12**
CO4	Able to understand the controlling of harmonic distortion.	**PO1,PO2,PO3,PO4, ,PO12**
CO5	Able to understand various power quality monitoring equipment and benchmarking process.	**PO1,PO3,PO4,PO12**

Text Books:

1. Electrical Power Systems Quality - Roger C. Dugan - Mark F. McGranaghan - Surya Santoso - H.Wayne Beaty - 2nd Edition - TMH Education Pvt. Ptd.

Reference Books:

1. Electrical systems quality Assessment by J. Arrillaga - N.R. Watson - S. Chen - John Wiley & Sons
2. Understanding Power quality problems by Math H. J. Bollen IEEE Press

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	-	3	-	-	-	-	-	-	-	3
CO.2	2	2	3	3	-	-	-	-	-	-	-	3
CO.3	2	2	-	3	-	-	-	-	-	-	-	3
CO.4	2	2	3	3	-	-	-	-	-	-	-	3
CO.5	2	-	3	3	-	-	-	-	-	-	-	3
CO*	**2**	**2**	**3**	**3**								**3**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OECE411 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (OPEN ELECTIVE-II)

Course Educational Objectives:

1. To study the concepts of Artificial Intelligence.
2. To understand the search strategies and Problem solving using Artificial Intelligence.
3. To gain insight information about Logical Agents and Reasoning patterns in propositional logic
4. To study the Uncertain Knowledge and Reasoning
5. To study the Application of Robotics and predictive analytics using Rapid Miner

UNIT – 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE, PROBLEMS, PROBLEM SPACES AND SEARCH (9)

The AI Problems - The underlying assumption - The AI technique - The levels of the model - Criteria of success - Some general references - One final word and beyond - Defining the problem as a State space search - Production systems - Problem characteristics - Production system characteristics - Issues in the design of search programs.

UNIT – 2: PROBLEM SOLVING, UN-INFORMED SEARCH STRATEGIES, INFORMED SEARCH AND EXPLORATION (9)

Uninformed search strategies - Avoiding repeated states - Informed (Heuristic) search strategies - Heuristic functions - Local search algorithms and optimization problems - Local search in continuous spaces - Backtracking search for CSPs.

UNIT – 3: KNOWLEDGE AND REASONING (9)

Logical agents – Knowledge based agents - The wumpus world – Logic - Propositional logic - a very simple logic - Reasoning patterns in propositional logic - Effective propositional inference - Agents based on propositional logic.

UNIT – 4: UNCERTAIN KNOWLEDGE AND REASONING, LEARNING (9)

Uncertainty - Acting under uncertainty - Baye's rule and its use - Learning from observations - Forms of learning - Inductive learning - Learning decision trees.

UNIT – 5: ROBOTICS AND PREDICTIVE ANALYTICS (9)

Robotics: Introduction-Robot hardware - Robotic perception - Planning to move-Robotic software Architectures - Application Domains.

Case Study1: Medical Data Analysis using Rapid Miner Tool

Case Study2: Agriculture Data Analysis using Rapid Miner Tool

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Gain the basic Knowledge about AI technique and Production systems	**PO1**
CO2	Comprehend the Un informed and Informed Search Strategies.	**PO1, PO3**
CO3	Analyze and Implement Reasoning patterns in propositional logic	**PO1, PO2**
CO4	Formulate the Knowledge and Reasoning techniques in solving problems	**PO1, PO4**
CO5	Apply Robotics to Solve Real world Problems and use rapid miner applications	**PO1, PO2, PO4, PO9**

Text Books:

1. Artificial Intelligence A Modern Approach, 2/e, Stuart Russell and Peter Norvig, 2003, Pearson Education, New Delhi, India.
2. Artificial Intelligence, 3/e, Elaine Rich, Kevin Knight and Shiva Shankar B Nair, 2004, Tata McGraw Hill, Hyderabad, India.

Reference Books:

1. Artificial Intelligence Structures and Strategies for Complex Problem Solving, 5/e, George F. Luther, 2005, Pearson Education, New Delhi, India.
2. Introduction to Artificial Intelligence, 1/e, Eugene Charniak and Drew McDermott, 1985, Pearson Education, New Delhi, India.
3. Artificial Intelligence: The Basics, 1/e, Kevin Warwick, 2012, Wearset ltd, Boldon.
4. Introduction to Artificial Intelligence, 2/e, Philip C. Jackson, 1985, Dover Publications, New York, USA.
5. Our Final Invention: Artificial Intelligence and the End of the Human Era, 1/e, James Barrat, 2013, Thomas Dunne Books, New York, USA.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	-	-	-	-	-	-	-	-	-	-	-
CO.2	2	-	3	-	-	-	-	-	-	-	-	-
CO.3	2	2	-	-	-	-	-	-	-	-	-	-
CO.4	2	-	-	2	-	-	-	-	-	-	-	-
CO.5	2	2	-	2	-	-	-	-	1	-	-	-
CO*	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OECE412 FUNDAMENTALS OF EMBEDDED SYSTEMS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. To provide a basic knowledge like characteristics, classification and Application areas of Embedded Systems.
2. Students learn the Architecture, Memory Interfacing and Interrupt Structures of 8051.
3. By learning instruction sets we can write the Assembly Language Programs and get knowledge in interfacing techniques.
4. Students will learn the Real time operating systems.
5. To learn Communication and Interfacing Techniques and its buses.

UNIT – 1: INTRODUCTION (9)

History of Embedded Systems-Classification of Embedded systems-Purpose of Embedded system-Characteristics of Embedded systems- Major Application Areas of Embedded Systems- Core of the Embedded System- Sensors and Actuators- Embedded Firmware, Applications- Washing Machine.

UNIT – 2: THE 8051 ARCHITECTURE (9)

Introduction- 8051 Micro controller Hardware- Register set of 8051-Input/Output Ports and Circuits-External Memory- memory and I/O interfacing of 8051Counter and Timers- Serial data Input/Output-Interrupt structure of 8051.

UNIT – 3: BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS (9)

The Assembly Language Programming Process- Programming Tools and Techniques- Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations- Decimal Arithmetic. Jump and Call Instructions. Applications: Interfacing with Keyboards- Displays- D/A and A/D Conversions- Multiple Interrupts

UNIT – 4: REAL-TIME OPERATING SYSTEMS (RTOS) (9)

Operating System Basics- Types of Operating Systems- Tasks- Process and Threads-Multiprocessing and Multitasking- Task Scheduling- Threads- Processes and Scheduling: Putting them Altogether- Task Communication- Task Synchronization- Device Drivers- How to Choose an RTOS.

UNIT – 5: COMMUNICATION INTERFACE AND COMMUNICATION BUSES (9)

Communication interface- (Board level communication interfaces- Product level communication interfaces)-Timing -and Counting Devices- Watchdog Timer- Real Time Clock- Networked Embedded Systems- Serial Bus Communication Protocols- Parallel Bus Device Protocols- Parallel Communication Network Using ISA-PCI- PCI-X and Advanced Buses.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understanding and designing of embedded systems	**P01, P02, P03, P04,P06**
CO2	Learning the Architecture and its functions	**PO1,P02,P03,P06**
CO3	Knowledge to write the programs in Assembly Language Programs	**P01, P02, P03, P04**
CO4	Knowledge in real time operating systems	**P01, P03,P04,P05,P06**
CO5	Understanding the transmissions through different types of buses	**P01, PO2,P03,P04,P05,P06**

Text Books:

1. Introduction to Embedded System-2nd edition- 2003-Shibu KV- Mc-Graw Hill -New Delhi.
2. The 8051 Microcontroller-3rd Edition-2007- Kenneth J.Ayala- Thomson Delmar Learning-New Delhi.
3. Embedded system architecture- programming and design-sixthreprint- 2005- Rajkamal- TMH-New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	-	2	-	-	-	-	--	-
CO.2	3	2	2	-	-	3	-	-	-	-	--	-
CO.3	3	3	3	2	-	-	-	-	-	-	--	-
CO.4	3	-	3	3	2	2	-	-	-	-	--	-
CO.5	3	3	3	3	2	2	-	-	-	-	--	-
CO*	**3**	**2.75**	**2.8**	**2.5**	**2**	**2.25**	-	-	-	-	--	-

IV B.Tech I Semester

L	T	P	C
3	0	0	3

18OECE413 DATA COMMUNICATION AND NETWORKS
(OPEN ELECTIVE-II)

Course Educational Objectives:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts.
4. Preparing the student for entry Advanced courses in computer networking.
5. Allow the student to gain expertise in some specific areas of networking.

UNIT – 1: INTRODUCTION TO DATA COMMUNICATION (9)

Introduction: Network Topologies, Protocols & Standards, Layered Architecture LAN, WAN, MAN. OSI Reference Model, TCP/IP Reference Model, Guided and Unguided Media.

UNIT – 2: DATA LINK LAYER (9)

Data Link Layer: Design Issues, Framing – Error Control – Flow Control, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, ARQ schemes, HDLC. PPP. Ethernet- IEEE 802.3,4,5 Protocols, Wireless LAN- the 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The802.11 MAC Sub layer Protocol-The 805.11 Frame Structure-Services.

UNIT – 3: MAC LAYER AND ROUTING ALGORITHM (9)

The Medium Access Control Sub layer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-CSMA Protocols-Collision-Free Protocols, Need for Internetworking, Design Issues, Addressing, Internet Protocol (IPv4/IPv6), Virtual Circuit and Datagram Networks, Routing Algorithms, Congestion Control Algorithms.

UNIT – 4: TRANSPORT LAYER (9)

Transport layer: UDP, TCP, Congestion Control mechanisms, QOS, Techniques to improve QOS.

UNIT – 5: COMMUNICATION INTERFACE AND COMMUNICATION BUSES (9)

Application Layer: Cryptography and network security, DNS, Electronic Mail, FTP, HTTP, SNMP, DHCP.

TOTAL: 45 HOURS

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Independently understand basic computer network technology	**PO1, PO2,PO3**
CO2	Understand and explain Data Communications System and its components.	**PO1, PO2, PO3,PO4**
CO3	Analysis the different types of network topologies and protocols. And Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer	**PO1, PO2,PO3,**
CO4	Identify the different types of network devices and their functions within a network.	**PO1, PO2,PO4**
CO5	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.	**PO1,PO2,PO4**

Text Books:

1. Computer Networks, Tanenbaum and David J Wetherall, 5th Edition, Pearson Edu, 2010
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education.

Reference Books:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th ed), Morgan Kaufmann/ Elsevier, 2011
2. William Stallings, "Data & Computer Communication", Pearson Education India, 10th Edition, 2014.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 6th Edition, 2013.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	-	-	-	-	-	-	-	-	-
CO.2	2	3	2	3	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	3	-	-	-	-	-	-	-	-
CO.5	3	2	-	3	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.6**	**2.3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**