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 R16 Regulations

(Applicable for 2016-2017 Regular Students & 2017-2018 Lateral Students)

Department of Mechanical Engineering

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

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 2016-2017onwards)

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 176 credits and secure all 176 credits.**
iv. **Lateral entry students shall register for 134 credits and secure all 134 credits**

Students, who fail to fulfill 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. DISTRIBUTION AND WEIGHTAGE OF MARKS

4.1 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.

4.2 INTERNAL EXAMINATIONS:

i. For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination consists of objective paper for 10 marks and subjective paper for 20 marks with duration of 1hour 50 minutes (20 minutes for objective and 90 minutes for subjective paper).

Objective paper shall be for 10 marks. Subjective paper shall contain 5 questions of which student has to answer 3 questions evaluated* for 20 marks.

***Note 1:** The subjective paper shall contain 5 questions of equal Weightage of 10 marks and themarks obtained for 3 questions shall be condensed to 20 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 Objectivepaper, 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 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: 25
Marks obtained in Second mid: 20
Final Internal Marks: (25x0.8) + (20x0.2) = 24

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: 25

Final Internal Marks: (25x0.8)+ (0x0.2) =20

4.3 END EXAMINATIONS:

(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.

4.4 For practical subjects there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the laboratory shall be evaluated for 30 marks by the concerned laboratory teacher based on the regularity/record/ viva. 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: Electrical & Mechanical Lab), 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.

4.5 There shall one audit pass course in 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 & 2 of the regulations.

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

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And 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 and the internal test marks will be the final sessional marks for the subject.

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

4.7 There shall be two comprehensive online examinations conducted by the respective colleges, one at the end of II year and the other at the end of III year, with 100 objective questions for 100 marks on the subjects studied in the respective semesters. The Principal is given the responsibility of preparing question bank/ question paper and conducting the online examination maintaining confidentiality. A student shall acquire 1 credit assigned to the comprehensive online examination only when he/she secures 40% or more marks. In case, if a student fails in comprehensive online examination, he shall reappear at the next supplementary examination when offered.

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

5. ATTENDANCE REQUIREMENTS:

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

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

5.3 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.

5.4 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.

5.5 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.

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

6. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**5**

6.1A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total ofthe internal evaluation and end examination taken together. In case of audit courses he/she should secure 40% of the total marks.

6.2A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to II year II semester from the following examinations.

For I/I semester one regular and two supplementary examinations

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

For II/I semester one regular examinations.

For II/II semester one regular examinations.

6.3 A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied upto III year II semester from the following examinations.

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

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

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

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

For III/I semester one regular examinations.

For III/II semester one regular examinations.

And in case if student is already detained for want of credits for particular academic year by sections 6.2 and 6.3 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.

6.4MINIMUM ACADEMIC REQUIREMENTS: (For Later Entry Students)

The Following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no: 5

(i)A students 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 %

(ii)A Student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 36 credits (40%) of the subjects that have been studied up to III year II semester from

- For II/I semester one regular and two supplementary examinations.
- For II/II semester one regular and one supplementary examinations.
- For III/I semester one regular examinations.
- For III/II semester one regular examinations.

And in case if student is already detained for want of credits for particular academic year by sections 6.2 and 6.3 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.

6.5 A student shall register and put up minimum attendance in all 176 credits and earn all the 176 credits. Marks obtained in all 176 credits shall be considered for the calculation of aggregate percentage of marks obtained.

7. COURSE PATTERN:

7.1 The entire course of study is for four academic years. All years shall be on semester pattern.

7.2 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.

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

8. 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.

9. 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 „Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9.1. 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.

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

Where, Ci is the number of credits of the i^{th} subject and Gi is the grade point scored by the student in the i^{th} course.

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

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

Where „Si" is the SGPA of the i^{th} semester and C_i 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

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

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

10. 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	**≥ 6.5 <7.5**
Second Class	**≥ 5.5 < 6.5**
Pass Class	**≥ 5.0 < 5.5**

11. 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.

12 MINIMUM INSTRUCTION DAYS:

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

13. 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 **5**subjects at a time**.**

No revaluation for seminar, comprehensive Examination, practical and project work.

14. 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 behavior anywhere within or outside the campus.

(c) Willful 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 (12.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.

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

15. GENERAL:

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

15.2 Malpractices rules- nature and punishments are appended.

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

15.4 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

DISCIPLINARY ACTIONS FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

Sl. no	NATURE OF MALPRACTICES/ IMPROPER CONDUCT IF THE CANDIDATE	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.
(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.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate 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. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him/her.

Sl. no	NATURE OF MALPRACTICES/ IMPROPER CONDUCT	PUNISHMENT
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.	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 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.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates 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.

Sl. no	NATURE OF MALPRACTICES/ IMPROPER CONDUCT	PUNISHMENT
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 in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying 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.

Note

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.

CURRICULUM and SYLLABUS – R 2016

I B.Tech- I Semester

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16SAH111	Functional English-I	SH	3	1	-	3	30	70	100
2	16SAH114	Mathematics-I	SH	3	1	-	3	30	70	100
3	16CSE111	Computer Programming	ES	3	1	-	3	30	70	100
4	16EEE113	Basic Electrical and Electronics Engineering	ES	3	1	-	3	30	70	100
5	16MEC111	Engineering Drawing	ES	1	-	5	3	30	70	100
6	16SAH116	English Communication Skills Lab	SH	-	-	3	2	30	70	100
7	16CSE112	Computer Programming Lab	ES	-	-	3	2	30	70	100
8	16EEE114	Basic Electrical and Electronics Engineering Lab	ES	-	-	3	2	30	70	100
Contact periods per week				13	4	14	-	-	-	-
Total periods per week				31			-	-	-	-
Total credits (5 Theory + 3 Labs)							21	-	-	-
Total Marks								240	560	800

I B.Tech- II Semester

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16SAH121	Functional English-II	SH	3	1	-	3	30	70	100
2	16SAH122	Mathematics-II	SH	3	1	-	3	30	70	100
3	16SAH112	Engineering Physics	SH	3	1	-	3	30	70	100
4	16SAH113	Engineering Chemistry	SH	3	1	-	3	30	70	100
5	16CIV121	Engineering Mechanics*	ES	3	1	-	3	30	70	100
6	16MEC121	Computer Aided Drafting and Modeling Lab*	ES	-	-	3	2	30	70	100
7	16SAH115	Engineering Physics and Engineering Chemistry Lab	SH	-	-	3	2	30	70	100
8	16MEC112	Engineering Workshop and IT Workshop Lab	ES	-	-	3	2	30	70	100
Contact periods per week				15	5	9	-	-	-	-
Total periods per week				29			-	-	-	-
Total credits (5 Theory + 3 Labs)							21	-	-	-
Total Marks								240	560	800

* Subject Offered only for Mechanical and Civil Engineering Departments.

II B.Tech- I Semester

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16SAH211	Mathematics-III	SH	3	1	-	3	30	70	100
2	16MEC211	Material Science and Engineering	PC	3	1	-	3	30	70	100
3	16MEC212	Mechanics of Solids	PC	3	1	-	3	30	70	100
4	16MEC213	Fluid Mechanics and Machinery	ES	3	1	-	3	30	70	100
5	16MEC214	Engineering Thermodynamics	PC	3	1	-	3	30	70	100
6	16MEC215	Machine Drawing	PC	-	-	6	3	30	70	100
7	16MEC216	Material Science and Testing Lab	PC	-	-	3	2	30	70	100
8	16MEC217	Fluid Mechanics and Machinery Lab	ES	-	-	3	2	30	70	100
9	16AUD211	Professional Ethics	AC	2	-	-	-	-	-	-
10	16PAT219	English Communication Skills	EEC	2	-	-	-	-	-	-
11	16PAT220	Personality Development Program-I	EEC	2	-	-	-	-	-	-
Contact periods per week				21	5	12	-	-	-	-
Total periods per week				38			-	-	-	-
Total credits (6 Theory + 2 Labs)							22	-	-	-
Total Marks								240	560	800

II B.Tech- II Semester

S. No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16SAH222	Probability and Statistics	SH	3	1	-	3	30	70	100
2	16SAH212	Environmental Science	SH	3	1	-	3	30	70	100
3	16MEC221	Thermal Engineering-I	PC	3	1	-	3	30	70	100
4	16MEC222	Kinematics of Machinery	PC	3	1	-	3	30	70	100
5	16MEC223	Manufacturing Technology	PC	3	1	-	3	30	70	100
6	16MEC224	Automobile Technology	PC	3	1	-	3	30	70	100
7	16MEC225	Thermal Engineering and Automobile Technology Lab	PC	-	-	3	2	30	70	100
8	16MEC226	Manufacturing Technology Lab	PC	-	-	3	2	30	70	100
9	16MEC227	Online Comprehensive Test-I	EEC	2	-	-	1	-	-	-
10	16PAT228	Personality Development Program-II	EEC	2	-	-	-	-	-	-
Contact periods per week				22	6	6	-	-	-	-
Total periods per week				34			-	-	-	-
Total credits (6 Theory + 2 Labs)							23	-	-	-
Total Marks								240	560	800

Note: SH- Science and Humanities; PC – Professional Core; ES – Engineering Science; CE- Core Elective; OE- Open Elective; EEC- Employability Enhancement Courses; AC – Audit Course

I B.Tech I Semester

L	T	P	C
3	- 0	3	

16SAH111 FUNCTIONAL ENGLISH - I
(Common to All Branches)

Course Educational Objectives:

CEO1: To provide knowledge on behavioral aspects, developing vocabulary by deriving various ways of Functional English words used.
CEO2: To acquire Entrepreneurship skills, usage of grammar aspects.
CEO3: To cultivate self confidence in one's life
CEO4: Get contextual knowledge to recognize the need of ability to engage in independent and life-long learning in the broadest context of Technological change.
CEO5: To cultivate Individual, Team work and Adaptability skills in work place.

UNIT -1:
(a) SUBHA - a short story - by ***Rabindranath Tagore***
(b) THE ONLY AMERICAN FROM OUR VILLAGE - a short story - by ***Arun Joshi***
Exercises: 1.Creating short stories: (speaking activity by students) 2.Synonyms and Antonyms 3.Reading comprehension skills 4. Nouns - kinds and uses 5. Pronouns-kinds and uses

UNIT -2:
AZIM PREMJI – an Entrepreneur - ***web source***
Exercises: 1.what are the skills necessary for an entrepreneur-Discuss. (Speaking activity by students) 2. Synonyms and Antonyms 3.Cloze Test 4. Adjectives-Types-comparison 5. Articles

UNIT-3
THE LITTLE BLACK BOY –a poem- by ***William Blake***
Exercises: 1.which is necessary for a human being either Skin Complexion or Attitude-Discuss? (Speaking activity by students)2. Jumbled sentences. 3. Adverbs-kinds and uses.

UNIT-4
THE YEAR 2050-Reflections of a futurist- by ***Theodore J. Gordon***
Exercises: 1. what are the renewable and non renewable energy sources-Discuss? 2. Synonyms and Antonyms3. Developing Hints 4. Prepositions – Types - uses 5. Conjunctions -Types-uses

UNIT-5
(a)WHITE WASHING THE FENSE-Team work Skills-by ***Mark Twain***
(b) SENOR PAYROLL – adaptability skills- by ***William E. Barrett***
Exercises: 1. Is Soft Skills necessary for a professional-Discuss? 2. Synonyms and Antonyms 3.Letter writing-official 4. E-mail writing 5. Writing Reports.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Knowledge on behavioral aspects and communicate effectively with others.	PO1,PO10
CO2	Knowledge on acquiring entrepreneurship skills and writing skills.	PO1, PO9,PO10
CO3	Cultivate knowledge to gain confidence in one's life skills.	PO1, PO9
CO4	Knowledge in recognizing the need of ability to engage independently and life-long learning through communicating in English.	PO1,PO10, PO12
CO5	Develop knowledge on Individual, Team work skills and Adaptability skills on the usage of foreign language words.	PO1,PO9

Text Books:

The text book prepared by the Department of English of SITAMS will be issued to students.

Reference Books:

1. English for Students of Science, A. Roy, P.L.Sharma, Orient Longman, New Delhi, 2005.
2. Inspiring lives, Dr. JandhyalaRavindranath& Dr. M.SaratBabu, Maruti Publications, Guntur, 2009.
3. Technical Communication Principle and Practice, Meenakshi Raman and Sangita Sharma, Oxford University Press, New Delhi, 2009.
4. Essential Grammar in Use, (with CD) 3/e, Cambridge University Press, New Delhi,2009.
5. Communication Skills for Technical Students, Farhathullah, T.M., Orient Blackswan, Chennai,2008.
6. Murphy's English Grammar by Raymond Murphy.
7. Cambridge English Dictionary for Advanced Learners (with CD)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	3	-	-
CO.2	3	-	-	-	-	-	-	-	2	3	-	-
CO.3	3	-	-	-	-	-	-	-	3	-	-	-
CO.4	3	-	-	-	-	-	-	-	-	3	-	3
CO.5	3	-	-	-	-	-	-	-	3	-	-	-
CO*	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.66**	**3**	**-**	**3**

I B.Tech I Semester

L	T	P	C
3	1	0	3

16SAH114 MATHEMATICS – I
(Common to all Branches)

Course Educational Objectives:

CEO1: 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

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

CEO3: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 multivariable.

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 ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE AND ITS APPLICATIONS

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

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 e^{ax} , sin ax, cos ax, polynomials in x, e^{ax} v(x), x^m v(x) - Method of variation of parameters.

UNIT– 3 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– 4 LAPLACE TRANSFORM - I

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

UNIT– 5 LAPLACE TRANSFORM – II

Laplace Transform ofUnit 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 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, electrical circuits and orthogonal trajectories	**PO1,PO2,PO3**
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**
CO3	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**
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	Demonstrate knowledge in Laplace transform of some special functions to develop analytical skills in solving problems involving initial value problems for constant coefficient linear ordinary differential equations using Laplace transform	**PO1,PO2,PO3**

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, Dr. B. S. Grewal, Khanna Publishers, Delhi,1999.

Reference Books:

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

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

I B.Tech I Semester

L	T	P	C
3	1	0	3

16CSE111 COMPUTER PROGRAMMING
(Common to all Branches)

Course Educational Objectives:

CEO1: To provide a complete study of the basics of C-programming language.

CEO2: To understand the impact of Selection, repetition statements and arrays in C Programming

CEO3: To know the functions and stringsin C-programming language

CEO4: To realize dynamic memory allocation and reallocation

CEO5: To explain the File handling functions in C-programming language

UNIT- 1 OVERVIEW OF COMPUTERS AND C PROGRAMMING BASICS

Overview of Computers: Computer Software - Algorithm –Flow Chart – Software Development Method.

C Programming Basics : Introduction to "C" programming – Characteristics of C – Structure of a "C" program – Tokens - Constants, Variables – Data Types – Operators and their types- Expressions – Operator precedence and associativity– Managing Input and Output operations.

UNIT-2 SELECTION, REPETITION STATEMENTS AND ARRAYS

Selection Statements: if statements - switch statement - Unconditional statements.

Iteration Statements: for statement – while statements – do-while statement -**Arrays:** Initialization – Declaration - One-dimensional arrays-Two-dimensional arrays – Multi-dimensional arrays.

UNIT- 3 FUNCTIONS AND STRINGS

Functions: Library Functions - User defined Functions –Function Prototype - Function Definition – Function call – Return statements - Category of functions – Nesting of Functions – Passing arrays to Functions- Recursion – Storage classes – Multi File Programs.

Strings: Declaring and initializing string variables –Reading string from terminal - Writing String to the screen - String operations – String handling functions.

UNIT -4 POINTERS, STRUCTURES AND UNIONS

Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays – Dynamic memory allocation and deallocation. **Structure**: Introduction – Need for structure data type – Structure definition – Structure declaration – Accessing Structure members - Structure within a structure – Copying and Comparing Structure Variables - Structures and arrays – Union - Programs using structures and Unions – Bit Fieds – Type Def - Enum.

UNIT- 5 FILE HANDLING

File accessing methods – sequential access and random access- Basic operations on Files –Command line arguments - File handling functions- Pre-processor directives.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Obtain the knowledge about the problem solving skills.	**PO1, PO2**
CO2	Develop programs using the basic elements like iteration statements, Arrays.	**PO1, PO2, PO3**
CO3	Understand about the code reusability with the help of user defined functions.	**PO1, PO2**
CO4	Solve the memory access problems by using pointers and design the programs on structures and unions.	**PO1, PO2, PO4**
CO5	Learn the basics of file handling mechanism that is essential for understanding the concepts of management systems.	**PO1, PO2**

Text Books:

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan & Richard F. Gilberg, Third Edition, Cengage Learning
2. Programming in C and Data Structures, 2/e, E.Balaguruswamy, Tata McGraw Hill, New Delhi, 2012.

Reference Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. Let Us C, Yashavant P. Kanetkar, BPB Publications, 2011.
3. Programming with C, Schaum's Outlines, Byron S Gottfried, Second Edition, Tata McGraw-Hill, 2006.
4. The C Programming language, Kernighan,B.W and Ritchie,D.M, 2nd Edition, Pearson Education,2006
5. Computer Fundamentals and Programming in C, Anita Goel and Ajay Mittal, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

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

I B.Tech I Semester

L	T	P	C
3	1	0	3

16EEE113 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Educational Objectives:

CEO1: To Understand electric circuits and its analysis

CEO2: To study construction and operation of D.C. machines and transformers

CEO3: To learn basic principles of all measuring instruments

CEO4: To provide an overview of the principles, operation and application of the diodes, Zener Diode, BJT for performing various functions

CEO5: To familiarize the students with different number systems, conversions, digital logic, simplification and minimization of Boolean functions

UNIT-1 INTRODUCTIONTO ELECTRICAL ENGINEERING:

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

UNIT-2 DC MACHINES AND TRANSFORMERS:

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, Swinburnes Test and Brake Test. Principles of Operation, Constructional Details, Losses and Efficiency of Transformer, O.C and S.C Tests.

UNIT-3 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 -4: ANALOG ELECTRONICS:

The P-N Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications,Applications of Diode,Diode as a Rectifier-Operation of Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge RectifierRectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN Transistor, Input-Output Characteristics of CE Configurations,BJT act as Amplifier.

UNIT -5: DIGITAL ELECTRONICS:

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

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Demonstrate and analyze fundamental laws and concepts of electrical circuits.	**PO1, PO2, PO3, PO4, PO12**
CO2	Analyze and apply AC fundamentals to real time problems.	**PO1, PO2, PO3, PO4, PO12**
CO3	Demonstrate and analyze the construction and performance of DC and AC machines.	**PO1, PO2, PO12**
CO4	Understand and evaluate the calibration of different electrical measuring instruments	**PO1, PO2**
CO5	Acquire sound knowledge on basic analog and digital electronic devices.	**PO1, PO2, PO12**

Text Books:

1. Basic Electrical Engineering-by M.S Naidu and S Kamakshaiah, 3rd edition, Tata McGraw Hill Pvt.Ltd, 2009.
2. Basic Electrical Engineering by T.K.Nagasarkar and M.S Sukhija, 2nd edition, Oxford Press New Delhi, 2007.
3. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, TMH, 3rd Edition, 2012.
4. Digital Design, 3rd edition, 2006, Morris Mano, Prentice Hall of India, New Delhi.

References Books:

1. Theory and Problems of Basic Electrical Engineering by DP Kothari and IJ Nagrath, 1st edition, Prentice Hall of India, New Delhi
2. Principle of Electrical Engineering by V.K Mehtha, 2nd edition, S Chand Publications, Delhi, 2009.
3. Introductory Circuit Analysis, R.L. Boylestad, 9th edition, 2006, Pearson Education Publication, 2013.

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

I B.Tech I Semester

L	T	P/D	C
1	-	5	3

16 MEC111 ENGINEERING DRAWING
(Common to all Branches)

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 and both the principal planes. **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 lines, planes and simple solids like prisms and pyramids by visual ray method.

Course Outcome:

On successful completion of the course, students will be able to		POs related to COs
CO1	Construct Engineering Curves and generate tangent and normal for those curves	**P01,P02,P03,PO10**
CO2	Draw Projection of Points, lines and Plane Surfaces	**P01,P02,P03,PO10**
CO3	Draw Projection of Solids and Sections of Solids like Prisms, Pyramids, Cylinder and Cone	**P01,P02,P03,PO10**
CO4	Construct Isometric Scale, Projections and develop the development of surfaces	**P01,P02,P03,PO10**
CO5	Draw Orthographic and perspective projections of Solids	**P01,P02,P03,PO10**

Text Books:

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

References Books:

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	1	-	-
CO.2	3	3	3	-	-	-	-	-	-	1	-	-
CO.3	3	3	3	-	-	-	-	-	-	1	-	-
CO.4	3	3	3	-	-	-	-	-	-	2	-	-
CO.5	3	3	3	-	-	-	-	-	-	2	-	-
CO*	**3**	**2.8**	**2.8**	**-**	**-**	-	**-**	**-**	**-**	**1.4**	**-**	**-**

I B.Tech I Semester

L	T	P	C
0	0	3	2

16SAH116 ENGLISH COMMUNICATION SKILLS LAB
(Common to all Branches)

Course Educational Objectives:

CEO1: To enhance communication skills especially in listening, speaking with confidence, read variety of materials and to improve their writing skills effectively.
CEO2: To learn better pronunciation by using proper phonetic sounds with accurate word accent.
CEO3: To provide PowerPoint presentations, participation in Group Discussion and facing Interviews with confidence.

UNIT-I

1. Phonetic Sounds

2. Just a Minute

UNIT-II

3. Rules regarding Stress

4. Listening Skills (TED Talks)

UNIT-III

5. Presentation Skills-oral

6. Role plays (organizing events in the college)

UNIT-IV

7. Book Review-oral

8. Resume writing

UNIT-V

9. Group Discussion Skills

10. Interview Skills

Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided language lab for 60 students with 60 systems, one master console, LAN facility and English Language Software for self study learners.

2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. System, projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component)

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

i) P-IV Processor-speed-2.8GHZ, RAM-512MB minimum, Hard Disk-80GB

ii) Headphones of High quality

Course Outcome:

On successful completion of the course, students will be able to		POs related to COs
CO1	Knowledge to communicate effectively using Phonetic sounds.	**PO1**
CO2	Knowledge in using Stress Rules of English while communicating	**PO5**
CO3	Get Self Confidence in one's life by performing presentation skills and Role Plays	**PO8**
CO4	Make good presentations through writing one's Resume.	**PO10**
CO5	Get knowledge to participate in Team discussion to get Individual confidence.	**PO12**

References Books:

1. Everyday Dialogues in English, Robert J. Dixson, Prentice-Hall of India Ltd., New Delhi,2006.

2. Body Language - Your Success Mantra, Dr Shalini Verma, S.Chand & Co, New Delhi,2009.

3. A Handbook for English language Laboratories, ,E.Sureshkumar, P.Sreehari, Foundation Books, Cambridge University Press, Chennai,2009.

Suggested Software:

- Globarena software, Hyderabad
- Walden Software, Hyderabad
- English Pronouncing Dictionary, Daniel Jones 17/e with CD, Cambridge University Press,New Delhi.
- DELTA's key to the Next Generation TOEFL Test, 6 audio CDS, 2007, New Age International Publishers, Critical Study, New Delhi.
- Oxford Advanced Learners' Dictionary with CD,8/e, 2010, Oxford.
- Cambridge Advanced Learners' English Dictionary with CD, 3/e, 2010.
- Murphy's English Grammar with CD, 2004, Cambridge.

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

I B.Tech I Semester

L	T	P	C
0	0	3	2

16CSE112 COMPUTER PROGRAMMING LAB

(Common to all Branches)

Course Educational Objectives:

CEO1: To exposed to problem solving techniques and flow charts.

CEO2: To familiar with programming in C.

CEO3: To Learn to use Arrays, strings, functions, structures and unions.

Exercise-1:

a. Write a c program to convert the temperature unit from Fahrenheit to Celsius using the formula C= (F-32)/1.8

b. Assume that any month is of 30 days. Now you are given total days. Write a C program to find out the exact number of Years, Months & Days

c. Write a c program to calculate the simple interest.

Exercise-2:

a. Write a program that prints the given 3 integers in ascending order using if - else.

b. Write a program to calculate commission for the input value of sales amount. Commission is calculated as per the following rules:

i) Commission is **NIL** for sales amount Rs. 5000.

ii) Commission is 2% for sales when sales amount is >Rs. 5000and <= Rs. 10000.

iii) Commission is 5% for sales amount >Rs. 10000.

c. A character is entered through keyboard. Write a program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol. The following table shows the range of ASCII values for various characters.

Characters	ASCII values
A - Z	65 - 90
a - z	97- 122
0 - 9	48 - 57

Special Symbols 0 - 47, 58 - 64, 91- 96, 123 – 127

Exercise-3:

a. Write a C program to find the roots of quadratic equation

b. Write a program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, %, use switch statement)

Exercise-4:

a. Write a C program to find the sum of individual digits of a positive integer.

b. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Exercise-5:

a. i) A perfect number is a number that is the sum of all its divisors except itself. Six is the perfect number. The only numbers that divide 6 evenly are 1, 2, 3 and 6 (i.e., 1+2+3=6).

ii) An abundant number is one that is less than the sum of its divisors (Ex: 12 <1+2+3+4+6).

iii) A deficient number is one that is greater than the sum of its divisors (Ex: 9 > 1+3).

Write a program to classify N integers (Read N from keyboard) each as perfect, abundant or deficient.

b. An amstrong number is a number that is the sum of the cubes of its individual digits.

Write a c program to print amstrong numbers below 1000.

Exercise-6:

a. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

b. Write a C program to calculate the following sum: sum = $1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$

Exercise-7:
a. Write a C program to find both the largest and smallest number in a list of integers.
b. Write a C program to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices

Exercise-8:
a. Write C programs that use both recursive and non-recursive functions to find the factorial of a given integer.
b. Write C programs that use both recursive and non-recursive functions to find the GCD (greatest common divisor) of two given integers.

Exercise-9:
a. Write a c program using pointers to read in an array of integers and print its elements in reverse order.
b. Swap/exchange values of two integer variables using call by reference.

Exercise-10:
a. Write a C program that uses functions to perform the following operations:
i) To insert a sub-string in to a given main string from a given position.
ii) To delete n Characters from a given position in a given string.
b**.** Write a C program to determine if the given string is a palindrome or not

Exercise-11:
a. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
b. Write a C program to count the lines, words and characters in a given text.

Exercise-12:
You are supposed to generate a result table which consists of student id, student name, marks of three subject and total marks. Write a program which takes input for ten students and displays result table. Also display student information separately who got the highest total. Use structures

Exercise-13:
Write a C program that uses functions to perform the following operations:
i) Reading a complex number ii) Writing a complex number
iii) Addition of two complex numbers iv) Multiplication of two complex numbers
(Note: represent complex number using a structure.)

Exercise-14:
a.Write a C program which copies one file to another.
b. Write a C program to reverse the first n characters in a file.
(Note: The file name and n are specified on the command line.)

Exercise-15:
a. Write a C program to display the contents of a file.
b.Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

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 C programming	**PO2**
CO3	Develop C programs step-wise by defining functions and calling them.	**PO3**
CO4	Implement lists, set, and dictionaries to develop C program.	**PO4**
CO5	Build C 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 and dictionaries implementing programs in future.	**PO12**

Reference Books:

1. Programming in C and Data Structures, E.Balaguruswamy, Tata McGraw Hill,2nd edition
2. Let us C, YashavantKanetkar, BPB, Thirteenth Revised and Updated edition,2013.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education
4. The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
5. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
6. Computer Basics and C Programming, V. Rajaraman, PHI Publications.

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	-	-	-	-	-	-	-	-	2	-	-	-
CO8	-	-	-	-	-	-	-	-	-	2	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	3	-	-	3	2	**2**	-	**3**

I B.Tech I Semester

L	T	P	C
0	0	3	2

16EEE114 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Course Educational Objectives:

CEO1: To provide practical experience with electrical circuits and apply circuit theorems and concepts in Engineering applications.
CEO2: To conduct and analyze the load test on DC shunt machines.
CEO3: To conduct various test on Transformer.
CEO4: To get an electrical model for various semiconductor devices.
CEO5: To find and plot V_I characteristics of PN and Zener diode

Part A ELECTRICAL EXPERIMENTS

(Any six of the following)

1. Verification of KCL and KYL
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 6.determination of critical field resistance.
7. Swinburne's test of D.C shunt machine.
8. Brake test on D.C shunt motor. Determination of performance characteristics.
9. OC & SC tests on single- phase transformer to find the efficiency.
10. Load test on three phase squirel cage induction motor

Part B ELECTRONICS EXPERIMENTS

(Any six 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. Bipolar junction transistor in CE configuration-input and output characteristics
6. Verification of basic logic gates- AND, OR, NOT,
7. 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 ACmachines	**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 , DC Machines, electronic devices , circuits, logic gates for various applications during their life time	**PO12**

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	-	-	-	-	-	-	-	-	2	-	-	-
CO8	-	-	-	-	-	-	-	-	-	2	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**2**	**2**	**-**	**3**

I B.Tech II Semester

L	T	P	C
3-	0	3	

16SAH121 FUNCTIONAL ENGLISH-II
(Common to All Branches)

Course Educational Objectives:

CEO1: To provide knowledge on Behavioral aspects, developing vocabulary by deriving various ways of **F**unctional Indian words used in English
CEO2: To acquire knowledge on Verbal and Non-Verbal communication skills
CEO3: To cultivate Self Confidence in one's life..
CEO4: To gain knowledge on the achievements made by the Scientists
CEO5: To develop knowledge in protecting Environment

UNIT-1: UNDER THE BANYAN TREE-a short story-by ***R.K.Narayan***

Exercises: 1.What do we learn from trees-Discuss (Speaking activity by students) 2. Synonyms and Antonyms 2.Tenses-Types 3.Transitive and Intransitive Verbs

UNIT-2: COMMUNICATION SKILLS FOR PORFESSIONALS

(a) Communication – Verbal-Areas of Communication-Suggestions to improve verbal Communication – Importance of Body Language.

(b) Non-verbal Communication- Category and Features – Cultural differences in Non-verbal communication – Suggestions to improve Non-verbal Communication.

Exercises: 1. Discuss a few interesting Cross cultural aspects of communication (Speaking activity by students) 2.Voice of Verbs 3. Direct and Indirect speech 4. Modal Verbs

UNIT-3: THE LAST RIDE TOGETHER – a poem- by ***Robert Browning***

Exercises: 1.Which is important in life-money or love?-Discuss (Speaking activity by students) 2.Expansion of Proverbs-(oral and written) 3.Conditional clauses 4. Note making 5.Question Tags.

UNIT-4:

(a) TECHNOLOGY WITH A HUMAN FACE-a lecture-by ***E.F.Schumacher***

(b) DR. APJ. ABDUL KALAM –A Missile Man –*web source*

Exercises: 1.Is technology a boon or bane?-Discuss (Speaking activity by students) 2. Synonyms and Antonyms 3. Idioms 4.Phrasal verbs 5.Subject Verb agreement 4.Analogy

UNIT-5: WANGARI MATHAAI-a Kenyan environmental and political activist -***from inspiring lives***

Exercises: 1.Have a discussion regarding current environmental issues (Speaking activity by students) 2.Synonyms and Antonyms 3.One word substitutes 4.Detecting errors.

Course Outcomes:

On successful completion of the course the will be able to,		POs related to COs
CO1	Get Knowledge on behavioral aspects and communicate effectively with others by using Indian words used in English.	**PO1, PO10**
CO2	Get knowledge on the proper usage of Grammar in one's career development as a lifelong learning through communicating effectively.	**PO1,PO10, PO12**
CO3	Cultivate knowledge to gain confidence in one's life skills.	**PO1,PO9**
CO4	Get knowledge on the achievements made by the scientists on the Earth by Lifelong learning scientific articles from various Journals present in the Library and through motion Pictures in Internet.	**PO1,PO12**
CO5	Develop knowledge independently and lifelong learning to protect environment and society from destruction.	**PO1,PO6**

Text Book:

1. The text book prepared by the Department of English of SITAMS will be issued to students

References Books:

1. Business Communication and Soft Skills, K.Srinivasa Krishna and B. Kuberudu, Excel Books, New Delhi, 2008.
2. English for Technical Communication. K. R. Lakshmi Narayana, Scitech.
3. Spoken English, R. K. Bansal and J. B. Harrison, Edn, Orient Longman, Mumbai, 2009.
4. Speaking English Effectively, Krishna Mohan & NP Singh, 2/e, Macmillan, New Delhi.
5. A Practical Course in English Pronunciation, J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice Hall of India Pvt. Ltd, New Delhi, 2004.
6. Murphy's English Grammar by Raymond Murphy.
7. Cambridge English Dictionary for Advanced Learners (with CD)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	2	-	2
CO3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	3	-	-	-	-	-	-
CO*	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**2.5**	**-**	**2.5**

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES.
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I B.Tech II Semester

L	T	P	C
3	1	0	3

16SAH122 MATHEMATICS – II
(Common to all Branches)

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 learn the concepts of double and triple integrals and compute double and triple integrals
CEO3: To develop skill to design Sine and Cosine waves with the help of Fourier Series & Fourier Transforms.
CEO4: To learn the concepts of z-transformation and inverse z- Transforms and to explore solving difference equations by using z- 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: MULTIPLE INTEGRALS
Multiple Integrals: Double and triple integrals - Change of variables - Change of order of integration.

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 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 diagnolisation using eigen values and eigen vectors	**PO1, PO2**
CO2	Demonstrate knowledge in evaluating double and triple integrals	**PO1, PO2**
CO3	Develop analytical skills in evaluating the properties of functions through Fourier series	**PO1, PO2,**
CO4	Develop analytical skills in evaluating the properties of functions through Fourier transform	**PO1, PO2,**
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**

Text books:

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

Reference books:

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

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

I B.Tech II Semester

L	T	P	C
3	1	0	3

16SAH112 ENGINEERING PHYSICS
(Common to all Branches)

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) - Newton's rings (Qualitative) – Diffraction –Fraunhofer Diffraction at single slit-Diffraction Grating. **Lasers:** Laser characteristics - Spontaneous and Stimulated emissions - Population inversion - Solid state laser (Ruby Laser) - Gas (He-Ne) Laser - Semiconductor (GaAs) Laser - Applications of Lasers. **Fiber Optics:** Structure of Optical Fiber - Types of Optical Fibers - Numerical Aperture - Fiber Optics in Communications - Applications.

UNIT - 2 CRYSTAL STRUCTURES AND ULTRASONICS

Crystal Structures: Introduction - Space lattice - Unit cell - Lattice parameters - Bravis lattices -Crystal Systems - Structures of Simple Cubic - Body Centered Cubic - Face Centered Cubic crystals - Miller Indices - Bragg's law - X-ray diffraction - Laue Methods. **Ultrasonic's:** Introduction - Production of Ultrasonic waves by Piezoelectric method - Properties of Ultrasonic waves - Applications of Ultrasonic's.

UNIT – 3 QUANTUM MECHANICS AND SEMI CONDUCTORS

Quantum Mechanics: Matter waves and properties - De Broglie's concept of matter waves - One dimensional time independent Schrodinger's wave equation - Particle in one Dimensional Potential box
Semiconductors: Intrinsic and Extrinsic Semiconductors (Qualitative) - Drift and Diffusion - Einstein's relation - Hall Effect - Direct and Indirect band gap Semiconductors - p-n junction

UNIT – 4 MAGNETIC MATERIALS AND SUPERCONDUCTIVITY

Magnetic Materials: Origin of magnetic moment of an atom - Classification of Dia - Para - Ferro Magnetic materials on the basis of Magnetic moment (Qualitative) - Hysteresis curve - Soft and Hard Magnetic materials with Applications. **Superconductivity:** General properties - Meissner effect - Types of superconductors - BCS Theory - Josephson's effect - Applications of superconductors.

UNIT – 5 PHYSICS OF NANOMATERIALS

Nano Materials: Introduction to Nanomaterials – Significance of Nanoscale- Surface to volume ratio - 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 Ultrasonic 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,PO3**
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**

Text Books:

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

Reference Books:

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-		-	-	-	-	-	-	-
CO2	2	3		-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**2.4**	**2.25**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

I B.Tech II Semester

L	T	P	C
3	1	0	3

16SAH113 ENGINEERING CHEMISTRY
(Common to all Branches)

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 phase rule, structural materials and refractories

CEO5: To apply the concept of Lubricants andElectrochemistry

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 - 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 corrosion - Control of corrosion - Cathodic protection - Sacrificial anode and impressed current.

UNIT - 3: POLYMERS

Polymerization reactions - Basic concepts - Types of polymerization - Addition and condensation polymerization - Plastics - Thermosetting and thermoplastics - Composition - Properties - Engineering uses 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). **Refractories:** Definition - Classification with examples - Criteria of a good refractory material - Causes for the failure of refractory materials.

UNIT - 5: LUBRICANTS AND ELECTRO CHEMISTRY

Lubricants: Principles and function of lubricants - Classification and properties of lubricants - Viscosity - Flash and fire points - Cloud and pour points - Aniline point - Neutralization number and mechanical strength.

Electro Chemistry: Conductance - Equivalent conductance - Molar conductance – Conduct metric titrations - Conductivity Measurements. Fuel cells: 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,PO3**
CO2	Demonstrate the knowledge in corrosion phenomenon and develop skills in different methods for control of corrosion	**PO1, PO2,PO3**
CO3	Demonstrate the knowledge on polymeric materials and to prepare polymeric material for environmental safety.	**PO1, PO2,PO3,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 Lubricants, Electrochemistry and analysis and different types of fuels cells.	**PO1, PO2**

Text Books:

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

Reference Books:

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

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

I B.Tech II Semester

L	T	P	C
3	1	-	3

16CIV121 ENGINEERING MECHANICS
(Common to Mechanical and Civil Engineering Branches)

Course Educational Objectives

CEO1: To apply the knowledge of principles of mechanics, system of forces
CEO2: To find the location of Centroid, center of gravity and moment of inertia for the given appropriate composite sections.
CEO3: To Analyze the bodies subjected to friction, simple frames and apply principle of virtual work to find reactions.
CEO4: To Analyze the kinematics of a body undergoing rectilinear, curvilinear motion.
CEO5: To Apply the Dynamic equilibrium principles and work energy equations to solve appropriate problems

UNIT - 1: BASICS, 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:** Classification of force system - Resultant of several, coplanar, collinear coplanar and concurrent coplanar forces. **Coplanar Parallel Forces:** Moment of force, Principle of moments (Varignon's theorem) - Types of parallel forces - Resultant of two parallel forces - Resolution of a force and couple system. **Conditions of Equilibrium:** Principles of equilibrium - Laws of equilibrium - Action and reaction - Free body diagram.

UNIT – 2: CENTROIDS, 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 – 3: FRICTION, VIRTUAL WORK AND FRAMES
Friction: Static and dynamic friction - Angle of friction - coefficient of friction - Laws of friction - Angle of repose - Equilibrium of a body on a rough horizontal plane and inclined plane - Analysis of ladder friction. **Virtual Work:** Principle of virtual work on beams carrying point load and uniformly distributed load. **Analysis of Perfect Frames:** Types of frames - Analysis of simple frames using method of joints and method of sections.

UNIT – 4: KINEMATICS
Projectiles: Terms used with projectiles - Equation for path of projectile - Motion of body thrown horizontally from a given height into the air - Projectile on an inclined plane. **Kinematics of Rectilinear Motion:** Introduction - Displacement - Velocity - Acceleration - Motion with uniform acceleration - Motion with variable acceleration. **Kinematics of Curvilinear Motion:** Introduction - Displacement - Velocity - Acceleration.

UNIT – 5: KINETICS
Kinetics of Rigid Bodies and Laws of Motion: Newton's laws of motion and rotation - Motion of two weights connected by a string on a horizontal plane, inclined plane and hanging free - Equations of dynamic equilibrium (D'Alembert's Principle). **Principles of Work and Energy:** Work, energy and power equations - Mechanical energy - Laws of conservation of energy - Impulse and Momentum.

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.	**PO1, PO2, PO12.**
CO2	Acquire knowledge to locate the centroid, center of gravity and moment of inertia for simple and composite sections.	**PO1, PO2, PO3**
CO3	Apply the laws of friction on simple bodies and ladder. Analyze the simple frames and apply principle of virtual work to find reactions.	**PO1, PO2, PO3**
CO4	Understand the basics concepts of rectilinear, curvilinear motion and projectile.	**PO1, PO2**
CO5	Analyze the connected bodies using D`Alembert's principle and work energy equations.	**PO1, PO2**

Text Books:

1. Engineering Mechanics, A K Tayal, Umesh publications, New Delhi, 2010.
2. A Textbook of Engineering Mechanics, Dr. R.K. Bansal, 6/e, Laxmi Publications, 2015.
3. Engineering Mechanics, S.Timoshenko, D.H.Young and J.V Rao, Tata McGraw Hill, New Delhi.

Reference Books:

1. Engineering Mechanics, 1/e, 2011, Prof.P.J. Shah, S.Chand and Company Pvt.Ltd., New Delhi.
2. A Text Book of Engineering Mechanics, Dr.R.K.Bansal, 5/e, Laxmi Publications (P) Ltd, New Delhi, 2008.
3. Engineering Mechanics (Dynamics and Statics), Dr. Sadhu Singh, Khanna Publishers, New Delhi.
4. Engineering Mechanics, N.H. Dubey, 1/e, Tata McGraw-Hill Education Pvt. Ltd, Noida, 2011.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2.4**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

I B.Tech II Semester

L	T	P	C
-	-	3	2

16MEC121 COMPUTER AIDED DRAFTING AND MODELING LAB
(Common to Mechanical and Civil Engineering Branches)

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-line figures.
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. and 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	Create knowledge on technical drawings and presentations of models from mechanical engineering disciplines.	**PO1**
CO2	Analyze the 2D diagrams for developing the models.	**PO2**
CO3	Generate 3D models for various machine components using Autodesk AutoCAD.	**PO3**
CO4	Select appropriate tools to complete the designing process in AUTOCAD	**PO5**
CO5	Follow ethical principles in designing laboratory and procedures used in software tools.	**PO8**
CO6	Develop the design model in AUTOCAD as an individual.	**PO9**
CO7	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO8	Continue updating their skill in designing software package and procedure for various innovation components.	**PO12**

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	-	-	-	-	-	-	-	-	2	-	-	-
CO7	-	-	-	-	-	-	-	-	-	2	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**-**	**3**	-	-	3	2	**2**	**-**	**3**

I B.Tech II Semester

L	T	P	C
-	-	3/2each	2

16SAH115 ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LAB
(Common to all Branches)

Part-A. ENGINEERING PHYSICS LAB

Course Educational Objectives:

CEO1: To make the students to recognize the important of optical phenomenon like Interference and diffraction.

CEO2: To make the students to understand the role of optical fiber parameters and signal losses in communication.

CEO3: To know the importance of energy gap in the study of conductivity and hall effect in semiconductors

CEO4: To understand the applications of B- H curve.

CEO5: To learn the applications of laser in the field of science, technology and in medicine

LIST OF EXPERIMENTS:

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 successful completion of the course, students will be able to		**POs related to COs**
CO1	Demonstrate knowledge on various Phenomena related to physical Optics	**PO1**
CO2	Analyze the results to determine the magnetic properties	**PO2**
CO3	Analyse and interpret conductivity properties of semiconductors	**PO4**
CO4	Follow ethical principles in conducting various experiments of Engineering Physics	**PO8**
CO5	Do experiments effectively as an individual and as a member in a group.	**PO9**
CO6	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO7	Continue updating their skill related to various Physics concepts	**PO12**

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**	**-**	**-**

Part –B. ENGINEERING CHEMISTRY LAB

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.

LIST OF EXPERIMENTS:

1. Preparation of Standard Potassium Dichromate and Estimation of Ferrous Iron.
2. Preparation of Standard Potassium Dichromate and Estimation of Copper by Iodometry.
3. Preparation of Standard EDTA solution and Estimation of Hardness of Water.
4. Preparation of Standard EDTA and Estimation of Copper.
5. Determination of Manganese in Steel and Iron in Cement.
6. Determination of strength of the given Hydrochloric acid against standard sodium hydroxide Solution by Conduct metric titration.
7. Determination of viscosity of the given oils through Redwood viscometer.
8. Estimation of dissolved oxygen in given water sample.
9. Determination of P^H of a given solution by P^H meter.
10. Estimation of alkalinity of water.

Course Outcomes:

On successful completion of the course the will be able to,		POs related to COs
CO1	**Demonstrate** Knowledge on measurement of various analysis of water treatment methods	**PO1**
CO2	**Identify** the different salt analysis of copper for engineering and technological applications.	**PO2**
CO3	**Provide** valid conclusions on phenomena of dissolved oxygen.	**PO4**
CO4	**Follow ethical** values during conducting of alkalinity of water samples.	**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**

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**	**-**	**-**

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

- - 3 2

16 MEC112 ENGINEERING WORKSHOPS AND IT WORKSHOP LAB
(Common to all Branches)

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.

ENGINEERINGWORKSHOP:

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.

- **TRADES FOR DEMONSTRATION:**

a. Drilling machine.
b. Lathe machine.
c. Grinding machine.

Course Outcomes:

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**

ITWORKSHOP:

Course Educational Objectives:

CEO1:The objective of this course includes training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel and Power Point.
CEO2:PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. The students should work on working PC to disassemble and assemble to working condition and install Windows and Linux operating systems on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.
CEO3:Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber-attacks would be introduced.
CEO4:Productivity tools module would enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools.
(Recommended to use Microsoft office 2007 in place of MS Office 2003)

PC Hardware
Week 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.

Week 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 would be given as part of the course content.

Week 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.

Week 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

MS-Word
Week 5 – Word Orientation: The mentor needs to give an overview of Microsoft (MS) office 2007: Importance of and MS office 2007 Word as word Processors, Details of the three tasks and features that would be covered in using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

Task 5.1: Using 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 Word.

Week 6: Creating project document: Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Week 7: Creating a Newsletter : Features to be covered:- Table of Content, newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.
Excel
Week 8 – Excel Orientation: The mentor needs to tell the importance of MS office 2007 Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 8.1: Calculating GPA – .Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text. Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, Sorting.

Power Point

Week 9: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows Hyperlinks, Inserting – Images, Clip Art, Audio, Video, Objects, Tables and Charts

Course Outcomes:

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. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. Introduction to Computers, Peter Norton, 6/e McGraw Hill
3. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
4. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
5. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson.

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	-	-	-	-	-	-	-	-	2	-	-	-
CO7	-	-	-	-	-	-	-	-	-	2	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	3	-	-	3	2	**2**	-	**3**

II B.Tech I Semester

L	T	P	C
3	1	0	3

16SAH211 MATHEMATICS – III
(Common to all Branches)

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 learn the method of evaluation of numerical derivative, numerical integration and to solve ordinary differential equations numerically using numerical methods

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, curland related concepts and carry out differentiation and integration of vector valued functions

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: NUMERICAL DIFFERENTIATION, NUMERICAL INTEGRATION AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical differentiation, 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 -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 the 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**
CO2	Demonstrate the knowledge in finding the numerical values to derivatives, 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**
CO3	Develop analytical skills for the problems involving partial differential equations and the methods to solve them.	**PO1,PO2**
CO4	Demonstrate the 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**
CO5	Demonstrate the 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**

Text Books:

1. Mathematical Methods, T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand and Company Publishers, New Delhi, 2012.
2. Higher Engineering Mathematics, Dr. B. S. Grewal, 34/e, Khanna Publishers, 1999.
3. Introductory Methods of Numerical Analysis, S S Sastry, 4/e, PHI Publishers, 2005.

Reference Books:

1. Engineering Mathematics–I, T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand and Company Ltd, New Delhi, PHI Publishers.
2. Engineering Mathematics for JNTU, B.V. Ramana, Tata McGraw Hill Publishers, New Delhi, 2012.
3. Advanced Engineering Mathematics, Erwin Kreyszig, 8/e, Wiley India, New Delhi, 2009.
4. Numerical Methods for Scientific and Engineering Computations, M K Jain, S R K Iyengar, R K Jain,4/e, 2004.
5. A Text Book of Engineering Mathematics, N.P.Bali, Laxmi publications(P)Ltd, New Delhi, 2011.

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

II B.Tech I Semester

L	T	P	C
3	1	-	3

16MEC211 MATERIAL SCIENCE AND ENGINEERING

Course Educational Objectives:

CEO1: To impart knowledge on the fundamentals of alloys and Phase diagram of various materials and the classification of micro structure in steel and cast iron.

CEO2: To know the heat treatment, testing and applications of metals and non-metallic materials.

CEO3: To learn the properties alloys and its effect of alloying elements on steel

CEO4: To understand the properties and applications of various thermosetting and thermoplastic polymers.

CEO5: To identify mechanical deformation of the materials and testing

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:** Introduction, definition, classification, properties and applications of ceramic materials. **Composites Materials:** Introduction, definition, classification, properties and applications of fibrous, laminated and particulate composites - Hybrid 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), 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	Understand the Crystal structure and its defects and Interpret the phase diagrams of materials	**PO1, PO2**
CO2	Identify suitable heat treatment Process to achieve desired Properties of metals and its alloys	**PO1, PO2**
CO3	Classify ferrous and non-ferrous materials and know their properties and applications	**PO1, PO2**
CO4	Illustrate properties and applications of Polymers, Ceramics and Composites	**PO1, PO2**
CO5	Conduct appropriate test in order to find mechanical properties of materials	**PO1, PO2, PO5**

Text Books:

1. Material Science and Engineering, R.K.Rajput, 4/e, S.K. Kataria and Sons Publications, 2013.

2. Material Science and Metallurgy for Engineers, Dr.V.D. Kodgire and S.V.Kodgire, 25/e, Everest Publishing House, Pune, 2009.

Reference Books:

1. Introduction to Physical Metallurgy, Sidney H Avner, 2/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2013.

2. Materials Science and Engineering-An Introduction, William D. Callister, 6/e, Wiley India Pvt. Ltd., 2010.

3. Introduction to Engineering Materials, B.K.Agrawal, 1/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2003.

4. Material Science and Engineering, V. Raghavan, 5/e, Prentice-Hall of India, Pvt. Ltd., 2009.

5. Elements of Material Science and Engineering, Lawrence H.Vanvlack, 6/e, Pearson Education, New Delhi, 2002.

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	-	-	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

II B.Tech I Semester

L	T	P	C
3	1	-	3

16MEC212 MECHANICS OF SOLIDS

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 AND TORSION

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. **Torsion of Circular Shafts:** Theory of pure torsion - Assumptions - Torsional moment of resistance - Polar section modulus - Torsion formulation stresses and deformation in solid and hollow shafts - Strength of a shaft of varying sections - Composite shafts.

UNIT – 5: COLUMNS, THIN AND THICK CYLINDERS

Columns: Modes of failure of columns - Euler's theory - Rankine's theory. **Thin Cylinders:**Thin seamless cylindrical shells - Derivation of formula for longitudinal and circumferential stresses - Hoop, longitudinal and volumetric strains - Changes in diameter and volume of thin cylinders - Riveted boiler shells - Thin spherical shells. **Thick Cylinders:**Lame's equation - Cylinders subjected to inside and outside pressures - Compound cylinders.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge on different types of fundamental stresses, strains and properties of materials Analyze the behavior of materials	**PO1, PO2**
CO2	Identify types of beams, loads analyze and how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations.	**PO1, PO2**
CO3	Demonstrate the applications of different sections of beams and understand how to calculate normal and shear stresses.	**PO1, PO2, PO3**
CO4	Explain about twisting loads and calculate the shear stresses, twisting moments and deflections for the transverse loads.	**PO1, PO2, PO3**
CO5	Understand and use the concept of internal fluid pressure in designing thin, thick cylinders and columns for axial buckling loads.	**PO1, PO2, PO3**

Text Books:

1. Mechanics of Materials, Dr.B.C.Punmia, Dr.Arun Kumar Jain, Er.Ashok Kumar Jain, 12/e, Laxmi Publications (P) Ltd., New Delhi, 2012.

2. Strength of Materials, S. Ramamrutham and R.Narayanan, 17/e, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2011.

Reference Books:

1. Strength of Materials, Dr.R.K.Bansal, 5/e, Laxmi publications (P) Ltd., New Delhi, 2012.

2. Strength of Materials, Bhavikatti, 3/e, Lakshmi Publications, New Delhi, 2012.

3. Mechanics of Materials, R.C.Hibbeler, 6/e, Pearson Education, New Delhi, 2007.

4. An Introduction to Mechanics of Solids, Thomas Lardner, Norman Dahl, 3/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2012.

5. Strength of Materials, R.K.Rajput, 5/e, S. Chand & Company Pvt. Ltd., New Delhi, 2006.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2.8**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

II B.Tech I Semester

L	T	P	C
3	1	-	3

16MEC213 FLUID MECHANICS AND MACHINERY
(Common to MECH and EEE Branches)

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 - Velocity and acceleration - Velocity potential function - Stream function - Equipotential lines.

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 - Application of momentum equation and pipe bend. **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 – Terminal velocity – Development of lift on an airfoil. **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 - Hydraulic gradient and energy gradient line (Theory only) - Siphon - 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 - Jet striking series of flat and radial curved vanes.

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 - Discharge - Slip - Indicator diagrams (Theory only) - Air vessels.

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**
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**
CO3	Analyze the model and the prototype using dimensional analysis and turbo machinery.	**PO1, PO2, PO3**
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, PO12**

Text Books:

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

Reference Books:

1. Fluid Mechanics and Hydraulic Machinery, R.K. Rajput, 4/e, S. Chand & Company, Pvt. Ltd., New Delhi, 2010.
2. Fundamentals of Fluid Mechanics, Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, 5/e, McGraw - Hill, New York, 2008.
3. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, 9/e, Laxmi Publications (P) Ltd, 2011.
4. Fluid Mechanics, Yunus A. Cengel, Tata McGraw Hill Education Private, 2010.
5. Introduction to Fluid Machines, S.K. Som and G. Biswas, 2/e, Tata McGraw-Hill Education, Pvt. Ltd., Noida, 2010.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	2	3	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	-	-	-	-	-	-	-	1
CO*	**2.8**	**2.6**	**1.67**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech I Semester

L	T	P	C
3	1	-	3

16MEC214 ENGINEERING THERMODYNAMICS

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 - Clausius Claperyon 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, PO4
CO2	Identify closed and open systems and/or apply the concept of second law to analyze simple systems	PO1, PO2, PO4
CO3	Evaluate properties of pure substances and gas mixtures and use steam tables and Mollier chart in solving complex problems.	PO1, PO2, PO4
CO4	Understand the various thermodynamic equations, functions and relations.	PO1
CO5	Understand the various psychrometric relations, properties, analyze air standard cycles applied in engines and identify methods to improve thermodynamic performance.	PO1, PO2, PO3

Text Books:

1. Engineering Thermodynamics, P.K.Nag, 5/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2013.

2. Thermodynamics-An Engineering Approach, Yunus Cengel 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 of India, 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.

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	2	-	1	-	-	-	-	-	-	-	-
CO.4	2	-	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.5**	**1**	**1.67**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

II B.Tech I Semester

L	T	P/D	C
-	-	6	3

16MEC215 MACHINE DRAWING

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 heads, eccentrics, connecting rod and piston.

UNIT – 5: ASSEMBLY DRAWINGS OF MACHINE PARTS

Assembly drawing of screw jack, plummer block and tailstock.

Course Outcomes:

On successful completion of the course, students will be able to:		POs related to COs
CO1	Analyze the machine drawing conventions which includes dimensioning, sections, conventional representation of materials and common machine elements.	**PO1, PO2, PO10**
CO2	Illustrate the machine elements including screw threads, bolts, nuts, keys, cotter joints, knuckle joint and riveted joints.	**PO1, PO2, PO3, PO10**
CO3	Illustrate the simple mechanical parts such as shaft coupling, spigot and socket joint - journal and foot step bearings	**PO1, PO2, PO3, PO10**
CO4	Construct an assembly drawing of engine parts such as stuffing box, cross heads, eccentrics, connecting rod and piston.	**PO1, PO2, PO10**
CO5	Construct an assembly drawing of machine parts such as screw jack, Plummer block and tailstock.	**PO1, PO2, PO10**

Text Books:

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

Reference Books:

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

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 or 2 out of 4 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.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	2	-	-
CO.2	3	2	1	-	-	-	-	-	-	2	-	-
CO.3	3	2	1	-	-	-	-	-	-	2	-	-
CO.4	2	3	-	-	-	-	-	-	-	2	-	-
CO.5	2	3	-	-	-	-	-	-	-	2	-	-
CO*	**2.6**	**2.4**	1	-	-	-	-	-	-	**2**		-

II B.Tech I Semester

L	T	P	C
-	-	3	2

16MEC216 MATERIAL SCIENCE AND TESTING LAB

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 working principle of metallurgical microscope, preparation of specimen and Fe-Fe_3C diagram	**PO1**
CO2	Identify the microstructure of different materials such as mild steel, copper, brass, aluminium, and cast iron.	**PO2**
CO3	Determine the various mechanical properties of materials by conducting appropriate experiments using suitable machines.	**PO5**
CO4	Follow ethical principles in conducting the experiments.	**PO8**
CO5	Do experiments effectively as an individual and as a member in a group.	**PO9**
CO6	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO7	Continue updating their knowledge related to materials and their properties for various applications during their life time.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-		-	-	-	-	-	-	-
CO2	-	2	-	-		-	-	-	-	-	-	-
CO3	-	-	-	-	1	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	-	-	2	-	-
CO7	-	-	-	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**2**	**3**	**2**	**-**	**2**

II B.Tech I Semester

L	T	P	C
-	-	3	2

16MEC217 FLUID MECHANICS AND MACHINERY LAB
(Common to MECH and EEE Branches)

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 variable head 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 venturimeter, orifice, mouth piece and notches also. Analyze the performance of the pumps and turbines.	**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	Measure the values of load 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 skills related to fluid mechanics and hydraulic machines in future.	**PO12**

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**

II B.Tech I Semester

L	T	P	C
2	-	-	-

16AUD211 PROFESSIONAL ETHICS

(Common to ALL Branches)

Course Educational Objectives:

CEO1: To develop the human values in work place, society and every where.

CEO2: To understand the importance of engineering ethics with the mentors' theory on ethics

CEO3: To inculcate codes of ethical values to the engineers in the society

CEO4: To understand the ethical issues on safety, responsibilities and human rights in society.

CEO5: To know the ethics issues on environmental, weapons, computers ethics & Moral leaderships.

UNIT - 1: Human Values

Morals, values and ethics – Integrity – Work Ethic –Honesty – courage – Empathy – Self-confidence – Character.

UNIT - 2: Engineering Ethics

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

UNIT - 3: Engineering as Social Experimentation

Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

UNIT - 4: Safety, Responsibility and Rights

Safety and risk – Assessment of safety and risk – Risk benefit analysis – The Three Mile Island and Chernobyl case studies.

UNIT - 5: Global Issues

Multinational corporations – Environmental ethics - Computer ethics – Weapons development – Engineers as managers – Engineers as expert witnesses and advisors – Moral leadership.

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., 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**

II B.Tech I Semester

L	T	P	C
2	-	-	-

16PAT219 ENGLISH COMMUNICATION SKILLS

Apart from the regular curriculum, to get intact with English Communication, weekly two periods are incorporated in the regular time table of each class to gain the improvement in English Communication Skills.

Category : Employability Enhancement Courses

Course Educational Objectives:

CEO1: To develop the English communication skills

CEO2: To develop self confidence to face the interviews

UNIT-1: Eminent Speakers' TED Talks (Which improves Listening Ability, Use of Body Language, Spoken Accent etc.) PPT (Students are asked to give Power Point Presentations to get rid of stage fear)

UNIT-2: GD (Group Discussion sessions are conducted to improve Analytical Skills) & L-S-R-W (Listening, Speaking, Reading and Writing)

UNIT-3: Mock Interviews are conducted as a Role Play with the peer students to gain knowledge how to face the Interview

UNIT-4: Reading Comprehension Passages are practiced from Hindu Daily News paper to know the newly developed vocabulary used.

UNIT-5: Report writings are taught to improve the writing skills where the students used to write mini projects and main projects.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Communicate fluently in English by verbal and oral	**PO9, PO10, PO12**
CO2	Face the interview confidently	**PO9, PO10, PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	--	2	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO*	**-**	**-**	**-**	**-**	**-**	**-**	72	**-**	**2.5**	**3**	**-**	**3**

II B.Tech I Semester

L	T	P	C
2	-	-	-

16PAT220 PERSONALITY DEVELOPMENT PROGRAM-I

Category : Employability Enhancement Courses

Course Educational Objectives:

CEO1: To develop the Self-confidence among the Students

CEO2: To enlarge the skill related to personnel for face the interviews

UNIT 1: SELF-CONFIDENCE:

- Factors affecting self-confidence
- Tips for improving self-confidence
- Symptoms of absence of self-confidence

UNIT 2: STRESS MANAGEMENT:

- Stress management for youngsters
- Symptoms of stress
- Way to reduce stress
- Overcoming stress at interviews, at work places

UNIT 3: PREPARING FOR WRITTEN TEST:

- Important areas in quantitative and verbal
- Sample aptitude and reasoning questions

UNIT 4: GROUP DISCUSSION:

- Different roles in G.D
- Types of G.D
- Preparing for G.D
- Contribution in G.D
- Do's and Don'ts in G.D
- Sample G.D topics

UNIT 5: FACING PERSONAL INTERVIEWS:

- Language and Body language preparation
- Common tips for success in interviews
- Do's and Don'ts while answering the questions

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Develop the Self-confidence among the Students	**PO9, PO10, PO12**
CO2	Expand the skill related to personnel for face the interviews	**PO9, PO10, PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	--	2	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO*	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.5**	**3**	**-**	**3**

II B.Tech II Semester

L	T	P	C
3	1	-	3

16SAH222 PROBABILITY AND STATISTICS
(Common to CSE, MEC & CE)

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, ANNOVA 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 AND ANNOVA

Curve fitting: The method of least squares – Linear, Parabola, Exponential and Power form. **ANNOVA:** ANNOVA 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 the knowledge on use the probability and Random Variables in the field of engineering	**PO1,PO2,PO3**
CO2	Demonstrate the knowledge in probability distributions and develop analytical skills for the problems involving means, probability distributions and standard deviations sampling techniques for decision making in uncertain environments	**PO1,PO2,PO3**
CO3	Construct confidence intervals on parameters for a single sample	**PO1,PO2,PO3,**
CO4	Demonstrate the knowledge in testing of hypotheses and Tests of significance for small and large samples and Develop skills for analyzing the data with suitable tests of significance for practical situations through probability distributions	**PO1,PO2,PO3,PO4,**
CO5	Demonstrate the knowledge on constructing a curve, or mathematical function, that has the best fit to a series of data points, possibly subject to constraints and develop skills for analyzing to test whether there are any statistically significant differences between the means of three or more independent (unrelated) groups using ANNOVA	**PO1,PO2,PO3,PO4**

Text Books:

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

Reference Books:

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

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

II B.Tech II Semester

L	T	P	C
3	1	-	3

16SAH212 ENVIRONMENTAL SCIENCE
(Common to All Branches)

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 andsurface.

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/ AgricultureStudy 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	Demonstrate knowledge on fundamentals of environment and Analyze the availability of non-conventional energy resources.	**PO1, PO2, PO6, PO7, PO8, PO9, PO12**
CO2	Identify appropriate types of habitats in the surrounding and analyze the influence of habitats on survival.	**PO1, PO2, PO7, PO8, PO12**
CO3	Identify appropriate method of controlling of pollution and design the eco friendly techniques	**PO1, PO2, PO6, PO7, PO8, PO12**
CO4	Analyze the effect of climatic changes	**PO1, PO2, PO6, PO7, PO8, PO12**
CO5	Understand the population growth and variation- environmental acts	**PO1, PO2, PO6, PO7, PO8, PO12**

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.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	2	3	3	1	-	-	3
CO2	3	3	-	-	-	-	2	1	-	-	-	3
CO3	3	3	-	-	-	3	1	3	-	-	-	3
CO4	3	3	-	-	-	3	3	3	-	-	-	3
CO5	3	3	-	-	-	3	3	3	-	-	-	3
CO	**3**	**3**	**-**	**-**	**-**	**2.7**	**2.4**	**2.6**	**1**	**-**	**-**	**3**

II B.Tech II Semester

L	T	P	C
3	1	-	3

16MEC221 THERMAL ENGINEERING - I

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 ICengines.
CEO3: To analyze the combustion of SI engines and CIengines.
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: FUELS AND COMBUSTION

S.I. Engine: Normal and abnormal combustion - Importance of flame speed and effect of engine variables - Type of abnormal combustion, pre ignition and knocking (concept only) - 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**
CO3	Demonstrate the basic knowledge and analyze the types and stages of combustion in SI and CI engines.	**PO1**
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, Laxmi Publications (P) Ltd, New Delhi, 2010.
2. Internal Combustion Engines, V. Ganesan, 4/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2012.

Reference Books:

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	1	-	-	-	-	-	-	-	-
CO.2	3	-	-	-	-	-	-	-	-	-	-	-
CO.3	3	-	-	-	-	-	-	-	-	-	-	-
CO.4	3	3	2	1	-	-	2	-	-	-	-	-
CO.5	3	3	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**1.67**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

II B.Tech II Semester

L	T	P	C
3	1	-	3

16MEC222 KINEMATICS OF MACHINERY

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 (basics only). **Gear trains:** Gear trains - Speed ratio - Train value - Parallel axis gear trains - Epicyclic gear trains.

Course Outcomes

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the principles of kinematic pairs, chains and their classifications, DOF, mechanisms, inversion, structure and machines. Draw inversions of different mechanisms. Understand the straight line motion of different mechanisms	**PO1, PO2, PO3, PO4, PO12**
CO2	Draw velocity and acceleration diagram for a given mechanism. Calculate velocity and acceleration from a given mechanism.	**PO1, PO2, PO3, PO12**
CO3	Explain steering geometry. Describe various steering mechanisms with its need and importance. To inculcate an ability to design *belt drives* and selection of belt, rope and chains.	**PO1, PO2, PO3, PO12**
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, PO12**
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, PO4, PO12**

Text Books:

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

Reference Books:

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	1	3	-	-	-	-	-	-	-	1
CO.2	2	1	3	-	-	-	-	-	-	-	-	1
CO.3	2	1	3	-	-	-	-	-	-	-	-	1
CO.4	1	2	1	-	-	-	-	-	-	-	-	1
CO.5	2	1	3	1	-	-	-	-	-	-	-	2
CO*	**2**	**1.6**	**2.2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.2**

II B.Tech II Semester

L	T	P	C
3	1	-	3

16MEC223 MANUFACTURING TECHNOLOGY

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 - 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 and flame characteristics - Metal arc welding - TIG and MIG welding - Submerged arc welding - Electro slag and gas welding - Plasma arc welding - Thermit welding - Electron beam welding - Friction and friction stir welding - Induction welding - Explosive welding - Laser welding - Gas cutting - Welding defects causes and remedies - 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, PO3**
CO3	Explain the concept of forging, rolling and drawing operations.	**PO1, PO2, PO3**
CO4	Illustrate the various sheet metal forming processes for a specific application.	**PO1, PO2**
CO5	To prepare small prototype components by using different operations.	**PO1, PO2, PO3, PO4, PO12**

Text Books:

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

Reference Books:

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

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	1	-	-	-	-	-	-	-	-	-
CO.4	2	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	1	-	-	-	-	-	-	-	1
CO*	**2.8**	**2**	**1.75**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech II Semester

L	T	P	C
3	1	-	3

16MEC224 AUTOMOBILE TECHNOLOGY

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 of 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 - Trouble shooting.

UNIT – 4: SUSPENSION AND BRAKING SYSTEM

Suspension System: Objects - Rigid axle suspension system - Torsion bar - Shock absorber - Independent suspension system. **Braking 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.

Course Outcomes:

On successful completion of the course the student will be able to,		POs related to COs
CO1	Acquired knowledge on structure and components.	**PO1, PO12**
CO2	Synthesized the principles of transmission system in automobile, and identified trouble shooting problems in transmission	**PO1, PO3, PO12**
CO3	Identified the steering system, wheel alignment and trouble shooting	**PO1, PO12**
CO4	Understand the functioning of suspension and braking system, identified the new technologies of braking system	**PO1, PO3, PO12**
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, Standard Book House, New Delhi, 2011.
2. Automotive Mechanics, William Crouse, 10/e, Tata McGraw-Hill Education Pvt. Ltd., Noida, 2006.

Reference Books:

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

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

II B.Tech II Semester

L	T	P	C
-	-	3	2

16MEC225 THERMAL ENGINEERING AND AUTOMOBILE TECHNOLOGY LAB

Course Educational Objectives:

CEO1: To develop the basic knowledge of timing diagram and to analyze the performance of ICengines.

CEO2: To introduce the methods to study the heat distribution and improve the performance of ICengines,

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 cylinder petrol 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, dismantling and assembling of multi cylinder petrol/diesel engine.

12. **a)** Study of petrol engine fuel system.
b) Study of diesel engine fuel system.

13. **a)** Study and measurement of heavy commercial vehicle frame.
b) Study, dismantling and assembling of front and rear axles.

14. **a)** Study, dismantling and assembling of clutch.
b) Study, dismantling and assembling of gear box.
c) Study, dismantling and assembling of differential.

15. **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 IC engines, air compressor and automobile components.	**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. 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	Measure the values of speed, air- fuel consumption, load and temperatures 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 evolve in future for the identification of performance parameters of engines and compressors.	**PO12**

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

II B.Tech II Semester

L	T	P	C
-	-	3	2

16MEC226 MANUFACTURIENG TECHNOLOGY LAB

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.

a) Sand rammer

b) Universal strength

c) Permeability

3. Melting and casting.

4. Arc welding.

a) Lap joint

b) Single ‘V’ butt joint

c) Double ‘V’ butt joint

d) T-corner joint

5. Spot welding.

6. TIG welding.

7. Study of simple, compound and progressive press tool.

8. Blanking and piercing operation.

9. Bending operations.

10. Injection moulding.

Course Outcomes

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge on sand moulding, casting, welding, Blanking, Piercing and injection moulding operation.	**PO1**
CO2	Analyze the results from the fabrication of casting, Welding, Sheet metal operation, Injection moulding operation.	**PO2.**
CO3	Design and develop the wooden patterns for casting process and also design the different welded joints by using the different methods of welding operation.	**PO3**
CO4	Identification of casting defects, Welding defects and Burr formation in Shearing operation in sheet metal.	**PO4**
CO5	Follow ethical principles and safety procedure inside the laboratory.	**PO8**
CO6	Do experiments effectively as a team for the experiments.	**PO9**
CO7	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO8	Utilize the knowledge of the theory and principles for their future research and projects.	**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	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-
CO4	-	-	-	1	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	2	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	2
CO	**3**	**2**	**1**	**1**				**2**	**3**	**2**		**2**

II B.Tech II Semester

L	T	P	C
-	-	-	**1**

16MEC227 ONLINE COMPREHENSIVE TEST-I

As per the Regulation 2016, There shall be two comprehensive online examinations will be conducted. One at the end of II year II Semester and the other at the end of III year, II semester, It has 100 objective questions for 100 marks on the subjects studied in the respective semesters.

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

II B.Tech II Semester

L	T	P	C
2	-	-	-

16PAT228 PERSONALITY DEVELOPMENT PROGRAM-II

Category : Employability Enhancement Courses

Course Educational Objectives:

CEO1: To develop the Personality Development Activities among the Students

CEO2: To build up the Positive Attitude to all the students

UNIT 1: PERSONALITY DEVELOPMENT ACTIVITIES (FDA)

- Develop Self-confidence
- Stress management
- Group discussion

UNIT 2: PREPARING FOR WRITTEN TEST:

- Pre-Interview Preparation
- Resume Writing Tips
- Preparing Self-Information
- Gathering Company Details
- Learning Tips

UNIT 3: SWOT ANALYSIS:

- Functions
- SWOT Analysis in Business World
- Analyzing Career With SWOT Analysis

UNIT 4: ATTITUDE:

- Attitude and Personality
- Developing Positive Attitude
- Tips for Attitude Developing

UNIT 5: FACING PERSONAL INTERVIEWS:

- Psychological approach
- Real Time References

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Expand Personality Development Activities among the Students	**PO9, PO10, PO12**
CO2	Build up the Positive Attitude to all the students	**PO9, PO10, PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	--	2	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO*	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.5**	**3**	**-**	**3**

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

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)

Amendments in Regulation B.Tech – 2016

4.9# Core Electives

Students have to choose core electives CE-1 in III year, II semester, CE-II and CE-III in IV year I semester and core electives (CE-IV and V) 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.

4.10# Open Electives (OEs)

The CBCS, also called as Open Electives (OEs) has been implemented during III Year, II semester and IV year first semester. 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.

4.11#Value Added Courses (VAC)

Every student to undergo one Value Added Course (VAC) per semester from third year first semester 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.

4.12[#] Industrial Visit

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

4.13 [#]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 program. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES.
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

III B.Tech- I Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC311	Thermal Engineering-II	PC	3	1	-	3	30	70	100
2	16MEC312	Dynamics of Machinery	PC	3	1	-	3	30	70	100
3	16MEC313	Design of Machine Elements	PC	3	1	-	3	30	70	100
4	16MEC314	Machine Tools Technology	PC	3	1	-	3	30	70	100
5	16MEC315	Engineering Metrology and Measurements	PC	3	1	-	3	30	70	100
6	16MEC316	Operations Research	ES	3	1	-	3	30	70	100
7	16MEC317	Machine Tools Technology Lab	PC	-	-	3	2	30	70	100
8	16MEC318	Engineering Metrology and Measurements Lab	PC	-	-	3	2	30	70	100
9	16PAT319	Reasoning and Aptitude - I	EEC	2	-	-	-	-	-	-
Contact periods per week				18	6	6	-	-	-	-
Total periods per week				30			-	-	-	-
Total credits (6 Theory + 2 Labs)							22	-	-	-
Total Marks								240	560	800

III B.Tech- II Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC321	Heat and Mass Transfer	PC	3	1	-	3	30	70	100
2	16MEC322	Finite Element Analysis	PC	3	1	-	3	30	70	100
3	16MEC323	Design of Transmission System	PC	3	1	-	3	30	70	100
4	16MEC324	CAD/CAM/CIM	PC	3	1	-	3	30	70	100
5	16MEC325	**Core Elective-I**	CE	3	1	-	3	30	70	100
6	OE-I	**Open Elective-I**	OE	3	1	-	3	30	70	100
7	16MEC326	Heat Transfer Lab	PC	-	-	3	2	30	70	100
8	16MEC327	Computer Aided Machine Drawing Lab	PC	-	-	3	2	30	70	100
9	16MEC328	On-line Comprehensive Test-II	EEC	2	-	-	1	-	100	100
10	16PAT329	Reasoning and Aptitude - II	EEC	2	-	-	-	-	-	-
Contact periods per week				20	6	6	-	-	-	-
Total periods per week				32			-	-	-	-
Total credits (6 Theory + 2 Labs)							23	-	-	-
Total Marks								240	660	900

IV B.Tech- I Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC411	Refrigeration and Air-Conditioning	PC	3	1	-	3	30	70	100
2	16MEC412	Fundamentals of Vibrations	PC	3	1	-	3	30	70	100
3	16MEC413	Mechatronic Systems	ES	3	1	-	3	30	70	100
4	16MEC414	**Core Elective-II**	CE	3	1	-	3	30	70	100
5	16MEC415	**Core Elective-III**	CE	3	1	-	3	30	70	100
6	OE-II	**Open Elective-II**	OE	3	1	-	3	30	70	100
7	16MEC416	Mechatronics Lab and Dynamics Lab	PC	-	-	3	2	30	70	100
8	16MEC417	Computer Aided Analysis Lab and CNC Technology Lab	PC	-	-	3	2	30	70	100
Contact periods per week				18	6	6	-	-	-	-
Total periods per week				30			-	-	-	-
Total credits (6 Theory + 2 Labs)							22	-	-	-
Total Marks								240	560	800

IV B.Tech- II Semester

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC421	Power Plant Engineering	ES	3	1	-	3	30	70	100
2	16MEC422	Industrial Engineering and Management	PC	3	1	-	3	30	70	100
3	16MEC423	**Core Elective-IV**	CE	3	1	-	3	30	70	100
4	16MEC424	**Core Elective-V**	CE	3	1	-	3	30	70	100
5	16MEC425	Project Work	EEC	18	-	-	10	30	70	100
Contact periods per week				30	4	-	-	-	-	-
Total periods per week				34			-	-	-	-
Total credits (4 Theory + 1 Project Work)							22	-	-	-
Total Marks								150	350	500

CORE ELECTIVES

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

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC325A	Automation and Robotics	CE	3	1	-	3	30	70	100
2	16MEC325B	Gas Dynamics and Jet Propulsion	CE	3	1	-	3	30	70	100
3	16MEC325C	Composite Materials	CE	3	1	-	3	30	70	100
4	16MEC325D	Fuel Cell Technology	CE	3	1	-	3	30	70	100

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

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC414A	Renewable Energy Sources	CE	3	1	-	3	30	70	100
2	16MEC414B	Advanced I.C. Engines	CE	3	1	-	3	30	70	100
3	16MEC414C	Design of Heat Exchangers	CE	3	1	-	3	30	70	100
4	16MEC414D	Computational Fluid Dynamics	CE	3	1	-	3	30	70	100

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

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC415A	Product Design and Development	CE	3	1	-	3	30	70	100
2	16MEC415B	Design Concepts in Engineering	CE	3	1	-	3	30	70	100
3	16MEC415C	Industrial Tribology	CE	3	1	-	3	30	70	100
4	16MEC415D	Design of Pressure Vessels and Piping	CE	3	1	-	3	30	70	100

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

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC423A	Total Quality Management	CE	3	1	-	3	30	70	100
2	16MEC423B	Principles of Management	CE	3	1	-	3	30	70	100
3	16MEC423C	Production and Operations Management	CE	3	1	-	3	30	70	100
4	16MEC423D	Process Planning and Cost Estimation	CE	3	1	-	3	30	70	100

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

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MEC424A	Modern Manufacturing Process	CE	3	1	-	3	30	70	100
2	16MEC424B	Additive Manufacturing Technology	CE	3	1	-	3	30	70	100
3	16MEC424C	Sustainable and Green Manufacturing	CE	3	1	-	3	30	70	100
4	16MEC424D	Non-Destructive Evaluation and Testing	CE	3	1	-	3	30	70	100

OPEN ELECTIVE-I

III B.Tech- II Semester

Offered Department	Course Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
S&H	16OSAH321	LASER and Fiber Optics	OE	3	1	-	3	30	70	100
	16OSAH322	Advanced Mathematics	OE	3	1	-	3	30	70	100
	16OSAH323	Mathematical Modelling	OE	3	1	-	3	30	70	100
CSE	16OCSE321	Object Oriented Programming	OE	3	1	-	3	30	70	100
	16OCSE322	Python Programming	OE	3	1	-	3	30	70	100
	16OCSE323	Web Programming	OE	3	1	-	3	30	70	100
CIV	16OCIV321	Construction Equipment, Planning and Management	OE	3	1	-	3	30	70	100
	16OCIV322	Remote sensing and GIS	OE	3	1	-	3	30	70	100
	16OCIV323	Green Buildings and Energy Conservation	OE	3	1	-	3	30	70	100
EEE	16OEEE321	Power Plant Instrumentation	OE	3	1	-	3	30	70	100
	16OEEE322	Neural Networks and Fuzzy Logic	OE	3	1	-	3	30	70	100
	16OEEE323	Sensors and Instrumentation	OE	3	1	-	3	30	70	100
ECE	16OECE321	Machine Vision System	OE	3	1	-	3	30	70	100
	16OECE322	MEMS and Micro Systems	OE	3	1	-	3	30	70	100
	16OECE323	Foundation of Nano –Electronics	OE	3	1	-	3	30	70	100

OPEN ELECTIVE-II

IV B.Tech- I Semester

Offered Department	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
S&H	16OSAH411	Applications of Graph Theory	OE	3	1	-	3	30	70	100
	16OSAH412	Introduction to Nano Science and Technology	OE	3	1	-	3	30	70	100
	16OSAH413	Entrepreneurship Development	OE	3	1	-	3	30	70	100
CSE	16OCSE411	Database Management Systems	OE	3	1	-	3	30	70	100
	16OCSE412	Internet of Things	OE	3	1	-	3	30	70	100
	16OCSE413	Information Security	OE	3	1	-	3	30	70	100
CIV	16OCIV411	Transport and Environment	OE	3	1	-	3	30	70	100
	16OCIV412	Disaster Management	OE	3	1	-	3	30	70	100
	16OCIV413	Air Pollution and Control Engineering	OE	3	1	-	3	30	70	100
EEE	16OEEE411	Energy Auditing and Demand Side Management	OE	3	1	-	3	30	70	100
	16OEEE412	Fundamentals of Electrical Estimation and Costing	OE	3	1	-	3	30	70	100
	16OEEE413	Fundamentals of Electrical Power Utilization	OE	3	1	-	3	30	70	100
ECE	16OECE411	Medical Electronics	OE	3	1	-	3	30	70	100
	16OECE412	Fundamentals of Embedded Systems	OE	3	1	-	3	30	70	100
	16OECE413	Data Communication and Networks	OE	3	1	-	3	30	70	100

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	Subject Code	Subject	Offered Semester	Category	Scheme of Instructions Periods per Week			
					L	T	P/D	C
1	P&T	English Communication Skills	II-I	EEC	2	-	-	-
2	P&T	Personality Development Program-I	II-I	EEC	2	-	-	-
3	P&T	Personality Development Program-II	II-II	EEC	2	-	-	-
4	16MEC227	On-line Comprehensive Exam-I	II-II	EEC	2	-	-	1
5	P&T	Reasoning and Aptitude-I	III-I	EEC	2	-	-	-
6	16MEC328	On-line Comprehensive Exam-II	III-II	EEC	2	-	-	1
7	P&T	Reasoning and Aptitude-II	III-II	EEC	2	-	-	-
8	16MEC425	Project Work	IV-II	EEC	18	-	-	10
				Total	32	-	-	12

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.	SH	8	14	3	6	-	-	-	-	31	17.61
2.	ES	13	7	5	-	3	-	3	3	34	44.31
3.	PC	-	-	14	16	19	16	10	3	78	19.31
4.	CE	-	-	-	-	-	3	6	6	15	08.52
5.	OE	-	-	-	-	-	3	3	-	6	03.40
6.	EEC	-	-	-	1	-	1	-	10	12	06.81
7.	AC	-	-	Y	-	-	-	-	-	0	0
Total		**21**	**21**	**22**	**23**	**22**	**23**	**22**	**22**	**176**	**100**

Note: SH- Science and Humanities; PC – Professional Core; ES – Engineering Science; CE- Core Elective; OE- Open Elective; EEC- Employability Enhancement Courses; AC – Audit Course

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC311 THERMAL ENGINEERING – II

Course Educational Objectives:

CEO1: To apply the concepts and laws of thermodynamics for cycle analysis and improve cycle performance.
CEO2: To classify and analyze the Boiler and draught to increase its efficiency
CEO3: To realize the concepts of steam flow through nozzle and the condenser
CEO4: To understand the thermodynamic concepts for steam turbines.
CEO5: To gain basic knowledge about Gas turbine and jet propulsion.

UNIT – 1: STEAM POWER CYCLE

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

Boilers: Classification of steam boilers – Modern high pressure boilers – Boiler 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 STEAM CONDENSERS

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

UNIT – 4: STEAM TURBINES

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

Gas Turbines: Constant pressure gas turbine – Methods improvement of thermal efficiency – Effects of operating variables – Constant volume gas turbines. **Jet Propulsion:** Classification – Working principles of turbo jet, turbo prop, ram jet, pulse jet engine and rocket engine.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand all the steam power cycles and methods to improve cycle performance	**PO1,PO2,PO3**
CO2	Classify and analyze the steam boilers with its accessories and draught	**PO1,PO2,PO3, PO4**
CO3	Realize the steam flow through Steam Nozzles, Steam Condensers	**PO1,PO3,PO4,PO5**
CO4	Demonstrate and classify the impulse and reaction stream turbine also examine the condition for maximum efficiency obtained in turbine	**PO1, PO3,PO4, PO5**
CO5	Build the knowledge on Gas turbine and understand the working all types of jet propulsion systems.	**PO1,PO2,PO3**

Text books:

1. Thermal Engineering, R.K Rajput, 8/e, 2010, Laxmi Publications (P) Ltd, New Delhi.
2. Basic and Applied Thermodynamics, P.K. Nag, 2/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Thermal Engineering, Rudramoorthy, 15/e, 2012, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Thermal Engineering, R.S.Khurmi and J.K.Gupta, 5/e, 2008, S Chand & Company Pvt. Ltd., New Delhi.
3. Thermal Engineering, Ballaney. P.L .24/e, 2012, Khanna publishers.
4. Thermal Engineering, Mahesh. M. Rathore, 1/e, 2010, Tata McGraw Hill, New Delhi.
5. A course in Thermal Engineering, Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V., 7/e, 2010. Dhanpat Rai & Sons.

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	1	1	-	-	-	-	-	-	-
CO.4	3	-	2	1	1	-	-	-	-	-	-	-
CO.5	3	1	1	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2**	**1.8**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC312 DYNAMICS OF MACHINERY

Course Educational Objectives:

CEO1: To understand the gyroscopic effect on automobile vehicles and friction
CEO2: To examine the dynamic concepts of the clutches, Brakes and dynamometer
CEO3: To realize the concepts of Inertia forces and turning moment diagrams of IC engines
CEO4: To understand the method of dynamic force analysis and effects of balancing of rotating mass in rotors and engines
CEO5: To gain basic knowledge on the concepts of governors and its types.

UNIT – 1: GYROSCOPIC EFFECTS AND FRICTION

Precession: Gyroscopes – Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships. **Friction: -** Introduction - Principles - Inclined plane – Friction of screw and nuts, pivot and collar – Uniform pressure, uniform wear, friction circle and friction axis – Lubricated surfaces – Boundary friction – Film lubrication.

UNIT – 2: CLUTCHES, BRAKES AND DYNAMOMETER

Clutches: Friction clutches – Single disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch. **Brakes:** Simple block brakes – Internal expanding brake and band brake of vehicle. **Dynamometers:** Absorption and transmission types – General description and methods of operation.

UNIT – 3: INERTIA FORCES AND TURNING MOMENT DIAGRAMS

Inertia Forces: Introduction – D-Alembert's principle – Velocity and acceleration of the reciprocating parts in engines – Velocity and acceleration of the piston – Analytical method for inertia torque. **Turning Moment Diagrams:** Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine – Crank effort – Coefficient of fluctuation of energy – Coefficient of fluctuation of speed – Fly wheels and their design.

UNIT – 4: BALANCING OF ROTATING AND RECIPROCATING MASSES

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

UNIT – 5: GOVERNORS

Governors: Watt, Porter and Pronell governors **–** Spring loaded governors – Hartnell, Hartung, Wilson-Hartnell and Pickering governors with auxiliary springs **–** Sensitiveness, isochronism and hunting – Effort and power of a governor.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Students can explain the theory behind gyroscopic couple and to predict the effect of gyroscopic couple in aircraft, ships and automobiles. Explain laws of friction. Calculate power loss due to friction in bearings.	**PO1, PO2 ,PO3, PO5, PO12**
CO2	List different types of clutches, brakes and dynamometers. Explain construction and operation of various braking mechanisms.	**PO1, PO2, PO3, PO5, PO12**
CO3	Analyze inertia forces acting on different links of simple planar mechanisms. Design suitable flywheel for simple mechanical systems.	**PO1, PO2, PO3, PO4, PO5, PO12**
CO4	Students are capable of explaining how balancing of rotating and reciprocating masses are done and can calculate the unbalanced forces and couples in a system.	**PO1, PO2, PO3, PO4, PO5, PO12**
CO5	List different types of governors. Explain working principle of governors.	**PO1, PO2, PO3, PO4, PO5, PO12**

Text books:

1. Theory of Machines and Mechanisms, S.S.Rattan, 3/e, 2009, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Theory of Machines, R.K Bansal, 5/e, 2010, Lakshmi Publications, New Delhi.

Reference books:

1. Theory of Machines, Thomas Bevan, 3/e, 2009, Pearson Education, New Delhi.
2. Theory of Machines, R.S Khurmi and J.K Gupta, 14/e, 2013, S.Chand & Company Pvt. Ltd. New Delhi.
3. Theory of Machines, Sadhu Singh, 3/e, 2011, Pearson Education, New Delhi.
4. The Theory of Machines, Shiegley, 3/e, 2009, Oxford University Press, New Delhi.
5. Theory of Machines, PL. Ballaney, 25/e, 2011, Khanna Publishers, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	-	1	-	-	-	-	-	-	2
CO.2	2	3	2	-	1	-	-	-	-	-	-	2
CO.3	3	2	1	2	1	-	-	-	-	-	-	2
CO.4	3	3	2	3	3	-	-	-	-	-	-	2
CO.5	3	3	3	3	2	-	-	-	-	-	-	2
CO*	**2.8**	**2.8**	**2.2**	**2.6**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC313 DESIGN OF MACHINE ELEMENTS

Course Educational Objectives:

CEO1: To understand the design concepts and stress developed in machine members
CEO2: To examine the factors considered for design when applying variable loads
CEO3: To gain the knowledge for designing of permanent joints like riveted joints and Welding joints
CEO4: To gain the knowledge for designing of temporary joints like Cotter and Knuckle Joints Screwed Joints
CEO5: To gain basic knowledge on the concepts of design of shafts, keys and coupling

UNIT – 1: DESIGN CONCEPTS AND STRESSES IN MACHINE MEMBER

General considerations of design, design process – Selection of engineering materials – Material properties – Manufacturing considerations in the design – BIS codes of materials – Preferred numbers. **Stresses in Machine Members:** Simple and combined stresses – Torsional and bending stresses – Impact stresses – Stress-Strain relation – Factor of safety – Selection of factor of safety – Various theories of failure – Design for strength and rigidity – Concept of stiffness in tension, bending, torsion and combined cases.

UNIT – 2: DESIGN FOR VARIABLE LOADS

Cyclic stresses – Fatigue and endurance limit – Effect of loading, surface finish and size on endurance limit – Factor for fatigue loading – Stress concentration factor various machine members – Stress concentration due to holes and notches – Methods of reducing stress concentration – Factors to be considered for avoid fatigue failure – Fatigue stress concentration factor – Notch sensitivity – Goodman method – Soderberg method – Combined variable normal stress and variable shear stress.

UNIT – 3: DESIGN OF PERMANENT JOINTS

Riveted Joints: Types, Methods and material of riveting – Caulking and fullering – Failures of a riveted joint – Strength and efficiency of a riveted joint – Design of boiler through riveted joints – Riveted joints for structural use – Joints of uniform strength – Eccentric loaded riveted joint. **Welded Joints:** Types of welded joints – Weld symbols – Strength of transverse and parallel fillet welded joints – Special cases of fillet welded joints – Strength of butt joints – Stresses for welded joints – Stress concentration factor for welded joints – Axially loaded unsymmetrical welded sections – Eccentrically loaded welded joints.

UNIT – 4: DESIGN OF TEMPORARY JOINTS

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 – Bolted joints under eccentric loading. **Cotter and Knuckle Joints:** Design of socket and spigot cotter joint, sleeve and cotter, gib and cotter joint for strap end of a connecting rod, gib and cotter joint for square rods, cotter joint to connect piston rod 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

Design of Shafts: Standard sizes and stresses in shafts – Design of shafts subjected to twisting and bending moment, combined twisting moment and bending moment, fluctuating and axial moment – 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 – Design of rigid and flexible couplings.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire knowledge on design process and identified the bis codes of materials and preferred numbers, analyze the different stresses in machine members	**PO1,PO2, PO3**
CO2	Analyze the cyclic stresses and factors effecting endurance limit, recognize stress concentration due to holes and notches, determine variable normal and shear stresses due to variable loads	**PO1,PO2,PO3**
CO3	Examine the strength and efficiency of permanent joints and design the permanent joints for eccentric loads	**PO1,PO2,PO3, PO4**
CO4	Analyze the stresses produced in temporary joints (screwed, cotter, and knuckle joints)	**PO1,PO2,PO3,PO4**
CO5	Determine the combined twisting, bending and axial moments for better shaft design develop design for keys and couplings according to the requirement and prescribed standards	**PO1,PO2,PO3**

Text Books:

1. Introduction to Machine Design, V.B.Bhandari, 2/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Machine Design, R.S.Khurmi and J.K.Gupta, 11/e, 1996, S.Chand & Company Pvt. Ltd., New Delhi.

Reference Books:

1. Machine Design, Pandya and Shah, 18/e, Charotar Publishing House Pvt. Ltd. Anand.
2. Machine Design, J.E. Shigley, 9/e, 2011, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Machine Design, Alfred Hall, A.Holowenko, H.Lanphlin, 2/e, 1968, Schaum Series, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Design of Machine Elements-I, T. Krishna Rao, 2/e, 2010, I.K. International Publishing House Pvt. Ltd., New Delhi.
5. Machine Design, P.Kannaiah, 12/e, 2009, Scitech Publishers, Chennai.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	3	2	-	-	-	-	-	-	-	-	-
CO.3	3	1	3	3	-	-	-	-	-	-	-	-
CO.4	3	3	3	3	-	-	-	-	-	-	-	-
CO.5	3	3	3	-	-	-	-	-	-	-	-	-
CO*	**3**	**2.4**	**2.6**	**3**	-	-	-	-	-	-	-	-

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC314 MACHINE TOOLS TECHNOLOGY

Course Educational Objectives:

CEO1: To understand the basic concepts of metal cutting manufacturing process

CEO2: To know the functions of engine lathe, it's members and it types

CEO3: To gain the knowledge on the functions & applications of Shaper, Slotter and milling machines

CEO4: To understand the working principles and applications of drilling, boring machines, Jigs and Fixtures

CEO5: To expand basic knowledge on the functions of Grinding, Broaching machines

UNIT – 1: THEORY OF METAL CUTTING

Elementary Treatment of Metal Cutting Theory: Elements of cutting process – Geometry of single point tool and angles chip formation and types of chips – Built up edge and its effects, chip breakers – Mechanics of orthogonal cutting – Merchant's force diagram – Cutting forces – Cutting speeds, feed, depth of cut, tool life, coolants, machinability – Economics – Tool materials.

UNIT – 2: LATHES

Engine Lathe: Principle of working, specification of lathe – Types of lathes – Work holders, tool holders – Box Tools, taper turning, thread turning and attachments for lathes – Turret and capstan lathes – Collet chucks – Other work holders – Tool holding devices – Box and tool layout – Principal features of automatic lathes – Classification – Single spindle and multi-spindle automatic lathes – Tool layout and cam design.

UNIT – 3: SHAPER, SLOTTER, PLANNER AND MILLING MACHINE

Milling Machine: Principles of working – Specifications – Classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Machining operations – Types and geometry of milling cutters – Methods of indexing – Accessories to milling machines. **Shaping, Slotting and Planning 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 AND JIGS AND FIXTURES

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: CONVENTIONAL ABRASIVE MACHINING PROCESSES

Grinding machine – Theory of grinding – Classification of grinding machine – Cylindrical and surface grinding machine – Tool and cutter grinding machine – Special types of grinding machines – Grinding wheel: Different types of abrasives, bonds, specification and selection of a grinding wheel – Lapping – Honing – Comparison of grinding, lapping and honing. **Broaching Machines:** Constructional features, speed and feed units – Machining time calculations.

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,PO12**
CO3	Select suitable reciprocating machines for typical component.	**PO1,PO2,PO3,PO12**
CO4	Design jigs for drilling and fixtures for turning, milling.	**PO1,PO3,PO12**
CO5	Identify various grinding machines used for different operations.	**PO1,PO2,PO12**

Text Books:

1. Workshop Technology-Vol II, B.S. Raghuvamshi, 2/e, 2006, S.Chand & Company Pvt. Ltd., New Delhi.
2. Production Technology, R.K. Jain and S.C. Gupta, 5/e, 2005, Khanna Publishers, New Delhi.

Reference Books:

1. Production Technology, H.M.T. (Hindustan Machine Tools), 11/e, 2004, Khanna Publications, New Delhi.
2. Manufacturing Technology, Kalpakzian, 5/e, 2006, Pearson Education, New Delhi.
3. Elements of Workshop Technology-Vol.II, Hajra Choudhury, Media Promoters.
4. Fundamentals of Metal Machining and Machine Tools, Geofrey Boothroyd, 1984, McGraw Hill, New Delhi.
5. Manufacturing Technology, Metal Cutting and Machine Tools, Rao. P.N, 2003, Tata McGraw Hill, New Delhi.

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	-	-	-	-	-	-	-	-	2
CO.4	3	-	2	-	-	-	-	-	-	-	-	2
CO.5	3	2	-	-	-	-	-	-	-	-	-	2
CO*	**3**	**2**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC315 ENGINEERING METROLOGY AND MEASUREMENTS

Course Educational Objectives:

CEO1: To understand the basic need for metrology and standards of measurements

CEO2: To know the functions & measurement of linear, angular measuring Instruments and Comparator

CEO3: To understand the Methods of measuring in surface finish of the materials

CEO4: To expand basic knowledge on metrology of assembly and transmission elements

CEO5: To develop the advanced measurements in metrology in industry.

UNIT – 1: NEED FOR METROLOGY AND STANDARDS OF MEASUREMENTS

Introduction: Need for metrology – Role in quality control – Factors affecting measurement – Need of inspection – Methods of measurements – Measuring instruments characteristics – Errors in measurements – Precision, accuracy, calibration and uncertainty. **Standards:** Line, end and wave length standards – Calibration of measuring instruments – Limits, fits and tolerances – Unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability and selective assembly – Indian Standard Institution (ISI) system – International Standard (IS) system.

UNIT – 2: LINEAR AND ANGULAR MEASUREMENTS

Linear Measuring Instruments: Vernier caliper – Vernier height gauge – Micrometer – Types of micrometer: inside, stick, thread, outside, V-anvil, blade, dial, screw, bench and depth micrometers and digital – Slip gauges. **Comparator:** Mechanical, pneumatic, optical and electrical comparators and applications. **Angular measurements:** Bevel protector, sine bar, sine centre, angle dekkor.

UNIT – 3: METROLOGY OF SURFACES

Measurement of straightness and flatness – Autocollimator – Spirit level. **Measurement of Surface Finish:** Surface texture – Surface roughness – Codes as per Indian Standards – Analysis of surface analysis (R.M.S, C.L.A, R_a, R_z, R_{max}, and R_t) – **Methods of measuring surface finish:** Tomilson surface meter and Taylor-Hobson Talysurf. **Gauges**: Plug, ring, snap, taper and position gauges – Taylors's principle for gauge design.

UNIT – 4: METROLOGY OF ASSEMBLY AND TRANSMISSION ELEMENTS

Measurements of Roundness: Diametral, circumferential, rotating on centres and accurate spindle. **Measurements of Screw Threads:** Screw threads terminology – Errors in screw threads – Measurement of major, minor, effective diameters (two and three wire method), pitch, angle and form of thread. **Measurements of Gears:** Terminology of gears – Gear errors – Gear measuring instruments: Gear tooth vernier caliper, constant chord method and base pitch measuring Instrument.

UNIT – 5: ADVANCES IN METROLOGY

Role of Light Wave and Laser in Metrology: Michelson interferometer, single frequency DC interferometer and NPL flatness interferometer – Laser interferometer – Optical flats – Toolmaker's microscope – Profile projector. **CMM:** Principle of working – Features – Performance – Applications. **Machine Vision System:** Principle of working – Functions – Field of machine vision system – Applications. **Gauging:** Advanced automatic gauge system and measurements.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate knowledge on fundamentals of measurement and Analyze the concept of different types of fits and able to design tolerance and fits for selected product quality.	**PO1, PO2**
CO2	Identify appropriate devices for linear and angular measurement and identify the uses of comparator.	**PO1, PO5, PO12**
CO3	Analyse the methods of surface finish and devices to measure surface roughness parameters.	**PO1, PO5,PO12**
CO4	Identify appropriate method and instruments for inspection of various gear elements and its errors.	**PO1, PO2**
CO5	Acquire knowledge on interferometer, toolmaker's microscope, profile projector, CMM and automated gauging.	**PO1,PO2,PO5**

Text Books:

1. Engineering Metrology, R.K. Jain, 3/e, 2012, Khanna Publishers, New Delhi.
2. Engineering Metrology, Mahajan, 6/e, 2012, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Reference Books:

1. Engineering Metrology and Measurements, N.V. Raghavendra and L. Krishnamurthy, 2013, Oxford University Press.
2. A Text Book of Dimensional Metrology, Dotson Connie, 1/e, 2012, Cengage Learning.
3. Handbook of Dimensional Measurement, Mark Curtis and Francis T. Farago, 5/e, 2013, Industrial Press.
4. Mechanical Measurements, John H. Lienhard V, Thomas G.Beckwith, Roy D. Marangoni, 6/e, 2009, Pearson Educations, New Delhi.
5. A Textbook of Engineering Metrology, I.C.Gupta, 4/e, 2009, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	-	-	-	1	-	-	-	-	-	-	1
CO.3	2	-	-	-	2	-	-	-	-	-	-	1
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	2	-	-	-	-	-	-	-
CO*	**2.6**	**2**	**-**	**-**	**1.66**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

III B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC316 OPERATIONS RESEARCH

Course Educational Objectives:

CEO1: To Identify & solve the Linear Programming Problems under constrained conditions

CEO2: To formulate and solve the transportation and assignment problems for optimum solution

CEO3: To understand the network and sequencing models for optimization

CEO4: To expand the basic knowledge on game theory for optimization

CEO5: To develop the modern tools in service of a product by Queuing theory

UNIT – 1: LINEAR PROGRAMMING MODELS

Development – Definition – Characteristics and phases – Types of models and applications – Linear programming problem formulation – Graphical solution – Simplex method – Artificial variables techniques – Two-phase method – Big-M method – Duality principle – Economic interpretation of duality.

UNIT – 2: TRANSPORTATION AND ASSIGNMENT PROBLEMS

Transportation Problem: Formulation – Finding basic feasible solutions – North west corner rule, least cost method and Vogel`s approximation method – Optimal solution by MODI method – Unbalanced transportation problem – Degeneracy. **Assignment Problem:** Formulation – Optimal solution – Variants of assignment problem – Traveling salesman problem.

UNIT – 3: NETWORK AND SEQUENCING MODELS

Shortest route – Minimal spanning tree – Maximum flow models – Project network – CPM and PERT – Critical path-critical activities – Determining minimum time required to complete the project. **Sequencing:** Introduction – Flow – Shop sequencing – 'n' jobs through two machines – 'n' jobs through three machines – Job shop sequencing – Two jobs through 'm' machines.

UNIT – 4: GAME THEORY

Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2×2 games – Dominance principle – m×2 and 2×n games – Graphical method.

UNIT – 5: QUEUING THEORY

Introduction – Structures of queuing systems – Characteristics – Balking, Reneging, Jockeying –Kendall notation – Parameter – Single server models – Poisson input – Exponential service – Constant rate service – Infinite and finite population – Multi-server model – Poisson input – Exponential service – Constant rate service – Infinite population.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Know the development, Characteristics, phases and concepts of OR modelling approaches and formulate, solve engineering and managerial situations as LPP	**PO1,PO2,PO3,PO7**
CO2	Solve transportation and assignment Problems	**PO1,PO2,PO3,PO7**
CO3	Construct network diagram, to estimate the minimum time required to complete the Project and determine optimum processing job order	**PO1,PO2,PO3,PO7, PO11**
CO4	Solve game theory problems	**PO1,PO2,PO3,**
CO5	Identify queuing model and apply appropriate queuing theory to obtain its operating characteristics	**PO1,PO2,PO3**

Text Books:

1. Operations Research, P. Sankara Iyer, 1/e, McGraw Hill Education (India) Private Ltd.
2. Operations Research, R. Panneerselvam, 2/e, PHI, Learning (P) Ltd.

Reference Books:

1. Operations Research an Introduction, Hamdy A. Taha, 8/e, Prentice Hall of India Pvt. Ltd.
2. Operations Research, Frederick S. Hiller and Gerald J. Liberman, 8/e, Tata McGraw HillEducation Pvt. Ltd.
3. Quantitative Techniques in Management, N D Vohra, 4/e, McGraw Hill Education (India) Private Ltd.
4. Operations Research - Theory and Applications, J.K. Sharma, 3/e, MacMillion India Ltd.
5. Principles of Operations Research, Harvy M. Wagner, 2/e, Prentice Hall of India Pvt. Ltd.

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	-	-	-	2	-
CO.4	3	3	2	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**-**	-	**-**	**2**	**-**	**-**	**-**	**2**	**-**

III B.Tech I Semester

L	T	P	C
0	0	3	2

16MEC317 MACHINE TOOLS TECHNOLOGY LAB

Course Educational Objectives:

CEO1: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 other allined machine tools	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		3	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech I Semester

L	T	P	C
0	0	3	2

16MEC318 ENGINEERING METROLOGY AND MEASUREMENTS LAB

Course Educational Objectives:

CEO1: To demonstrate the theoretical concepts taught in mechanical measurements and metrology.
CEO2: To understand and use various measuring instruments.

List of Experiments:

1. Calibration of vernier caliper and micrometer using slip gauges.
2. Comparison and measurements of linear dimensions using digital vernier caliper, 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 vernier height gauge &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. Checking & comparison of the dimensions of standard component using comparator.
12. Quality checking of the components using mechanical comparator.
13. Measurement of alignment using autocollimator.
14. Checking the flatness of surface plate using sprit level.
15. Measurement of bore diameter using dial bore gauge.
16. Alignment test on lathe drilling and milling machines.
17. Measurement of temperature using thermocouple.
18. Measurement of angle, flow, force/weight and torque using transducers.

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: 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
2	0	0	0

16PAT319 REASONING AND APTITUDE - I

Course Educational Objectives:

CEO1: To apply quantitative reasoning techniques to the real time problems.
CEO2: To understand the mathematical analysis for solve the life time 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	Solve the quantitative reasoning techniques to the real time problems	PO1,PO3,PO5,PO12
CO2	Understand the mathematical analysis for solve the life time problems	PO1,PO3,PO5,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 II Semester

L	T	P	C
3	1	0	3

16MEC321 HEAT AND MASS TRANSFER

Course Educational Objectives:

CEO1: To understand the basics of heat transfer and steady state conduction
CEO2: To develop knowledge in extended surface and unsteady state heat transfer system
CEO3: To understand the convective heat transfer systems with types
CEO4: To expand the basic knowledge on radiation and heat exchangers
CEO5: To demonstrate the condensation, boiling and mass transfer in a system

UNIT – 1: INTRODUCTION TO HEAT TRANSFER, STEADY STATE CONDUCTION

Introduction: Mechanisms of conduction, convection and radiation heat transfer – Fourier's heat conduction equation – General heat conduction equation in Cartesian, cylindrical and spherical coordinates – Boundary conditions. **Steady State Heat Conduction:** Introduction – Systems without internal heat conduction – Systems with variable thermal conductivity – Composite slabs, cylinders and spheres – Critical radius of insulation – Slabs and cylinders with heat generation.

UNIT – 2: EXTENDED SURFACE AND UNSTEADY STATE HEAT TRANSFER

Extended Surfaces Heat Transfer: Heat transfer in rectangular, triangular and pin fins – Pin efficiency and effectiveness. **Transient Heat Conduction:** Systems with negligible internal resistance – Response time of a temperature measuring instrument – Systems with negligible surface resistance – Semi-infinite body – Systems with finite surface and internal resistance – Heislers chart for transient conduction.

UNIT – 3: CONVECTIVE HEAT TRANSFER

Introduction – Convective heat transfer coefficient – Basic equations – Boundary layer concepts – Differential boundary layer equations – Boundary layer similarity parameters – Turbulence and time averaging equations – Flow through pipes – Dimensional analysis. **Forced Convection:** Parallel flow over a flat plate – Flow over cylinders and spheres – Flow across tube banks – Fully developed laminar tube flow in circular tubes – Entry region in laminar tube flow – Convection correlations for turbulent flow in tubes. **Natural Convection:** Laminar boundary layer equations of free convection on a vertical flat plate – Integral method for free convection on a vertical flat plate – Transition and turbulence in free convection – Empirical correlations for natural convection

UNIT – 4: RADIATION AND HEAT EXCHANGERS

Nature of thermal radiation, emissive power – Absorption, reflection, transmission – Concept of black body – Intensity of radiation (Lambert's Cosine law) – Laws (Planck's, Wien's, Rayleigh Jeans, Stefan Boltzmann law) – Kirchhoff's law – Radiation between two black isothermal surfaces – Shape factor - Heat exchange between gray bodies – Electrical network analogy for thermal radiation – Radiation shields. **Heat Exchangers:** Introduction – Types of heat exchangers – Overall heat transfer coefficient - Fouling factors – LMTD and NTU methods – Problems.

UNIT – 5: CONDENSATION, BOILING AND MASS TRANSFER

Boiling and Condensation: Boiling heat transfer phenomena – Boiling correlations – Flow boiling – Condensation heat transfer – Laminar and turbulent film wise condensation – Filmwise condensation on horizontal tubes, inside and outside. **Mass Transfer:** Fick's law of diffusion – General mass diffusion equation – Steady state equimolar counter diffusion – Mass transfer co-efficient – Convective mass transfer

Course Outcomes:

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

Text books:

1. Heat and Mass Transfer, R. K. Rajput, S.Chand & Company Limited, New Delhi.
2. Fundamentals of Engineering: Heat and Mass Transfer, R.C. Sachdeva, 3/e, 2008, New Age International (P) Ltd, Publishers, New Delhi.

Reference books:

1. Heat and Mass Transfer: Fundamentals and Applications, Yunus A Cengel and Afshin J. Ghajar, 2017, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Heat Transfer, J.P. Holman, 9/e, 2010, Tata McGraw-Hill Education Pvt.Ltd., Noida.
3. Heat Transfer, P.K.Nag, 2/e, 2010, Tata McGraw-Hill Education Pvt.Ltd., Noida.
4. Process Heat transfer, D.Q.Kern, Tata McGraw-Hill Education Pvt.Ltd., Noida
5. Fundamentals of Heat and Mass Transfer, C.P.Kothandaraman, 3/e, 2012, New Age International (P) Ltd, Publishers, 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	2	-	-	-	-	-	-	-	-
CO.2	3	-	2	1	-	-	-	-	-	-	-	-
CO.3	2	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	1	-	-		-	-	-	-	-
CO.5	2	2	-	1	-	-		-	-	-	-	-
CO*	**2.6**	**2.3**	**2.2**	**1.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC322 FINITE ELEMENT ANALYSIS

Course Educational Objectives:

CEO1: To understand the fundamental concepts of finite element analysis
CEO2: To analyze one dimensional element and truss element problems
CEO3: To evaluate the Constant Strain Triangle Element in two dimensional scalar problems
CEO4: To develop the modern of vector variable problems and isoparametric elements
CEO5: To demonstrate the numerical integration and applications in heat transfer

UNIT – 1: FUNDAMENTAL CONCEPT

Methods of engineering analysis – Historical background – General steps of finite element analysis – Galerkin method – Potential energy approach: Rayleigh Ritz method – Boundary, initial and eigen value problems – Gaussian elimination problems – Application of FEA.

UNIT – 2: ONE DIMENSIONAL PROBLEM

One Dimensional Elements: Finite element modeling – Co-ordinates and shape function – Analysis of stiffness matrix, 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 calculation, element stiffness matrix, assembly of element equation, load vector, treatment of boundary condition and element stresses calculation in one dimensional truss element.

UNIT – 3: TWO DIMENSIONAL SCALAR PROBLEMS

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: VECTOR VARIABLE PROBLEMS AND ISOPARAMETRIC ELEMENTS

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. **Isoparametric Element:** Co-ordinates – Shape function for four noded rectangular elements – Shape function for four noded isoparametric quadrilateral element – Evaluation of Jacobian matrix, Strain-displacement matrix and element stresses.

UNIT – 5: NUMERICAL INTEGRATION AND APPLICATIONS IN HEAT TRANSFER

Numerical Integration: Gaussian quadrature and application to plane stress problems – Introduction to analysis software. **Heat Transfer Applications:** Temperature and shape function for one dimensional heat conduction element – Stiffness matrix finite element equations for one dimensional heat conduction element – One dimensional in heat transfer – Heat conduction in fin element.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the concepts behind variation methods and weighted residual methods in FEM	**PO1,PO2,PO5,PO10,PO12**
CO2	Formulate and solve problems in one dimensional structures including trusses, beams and frames.	**PO1,PO2,PO3,PO4,PO5**
CO3	Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.	**PO1,PO2,PO3,PO4,PO5**
CO4	Formulate FE characteristic equations for one dimensional elements and analyze plain stress, plain	**PO1,PO2,PO5**
CO5	Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow	**PO1,PO2,PO5**

Text Books:

1. Introduction to Finite Elements in Engineering, R.Chandraputla and Ashok D.Belegundu, 4/e, 2011, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Text Book of Finite Element Analysis, Seshu,P, 2007, Prentice-Hall of India Pvt. Ltd., New Delhi.

Reference Books:

1. Finite Element Method in Engineering, Singiresu S Rao, 5/e, 2012, Elsevier India Pvt.ltd Publishers. New Delhi.
2. An Introduction to Finite Element Method, JN Reddy, 3/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. A First Course in Finite Element Method, Daryl L Logan, 4/e, 2007, Cengage Learning, UK.
4. Fundamentals of Finite Element Analysis, David V Hutton, 1/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Finite Element Analysis, Dhanaraj. R and Prabhakaran Nair. K, 2015, Oxford Publications.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	3	-	-	-	-	1	-	1
CO.2	3	2	1	1	3	-	-	-	-	-	-	-
CO.3	3	3	1	1	3	-	-	-	-	-	-	-
CO.4	3	3	-	-	3	-	-	-	-	-	-	-
CO.5	1	2	-	-	3	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC323 DESIGN OF TRANSMISSION SYSTEM

Course Educational Objectives:

CEO1: To understand the design the parts in the internal combustion engine

CEO2: To demonstrate the design of mechanical components such as springs and power screws

CEO3: To know the procedure of designing the Sliding Contact Bearings and Rolling Contact Bearings

CEO4: To develop the design of spur and helical gears

CEO5: To gain the knowledge in the design of bevel gear and power transmission system such as belt and chain drives

UNIT – 1: DESIGN OF INTERNAL COMBUSTION ENGINE PARTS

Principal parts of an I.C. engine – Design of a cylinder – Design considerations for piston – Forces acting on the connecting rod – Design of connecting rod – Design procedure for crankshaft – Valve gear mechanism – Valves – Rocker arm.

UNIT – 2: DESIGN OF SPRINGS AND POWER SCREWS

Springs: Types of springs – 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. **Power Screws:** Types of screw threads – Torque required raising and lowering load – Efficiency – Overhauling and self-locking – Efficiency of self locking – Coefficient of friction – ACME – Stresses in power screws – Design of screw jack.

UNIT – 3: DESIGN OF BEARINGS

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 – Selection.

UNIT – 4: DESIGN OF SPUR AND HELICAL GEARS

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.

UNIT – 5: DESIGN BEVEL GEAR AND OF POWER TRANSMISSION SYSTEM

Bevel Gear: Types – Pitch angle – Formative number – Strength and forces – Design procedure for bevel gear. **Belt and Chain Drives:** Types of belt and rope drives – Materials used for belt and rope drives – Design of flat belt drives, V-belt drives and rope drives – Classification of chains – Design procedure for chain drives.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Design and Analyze the forces, stresses and strength of different Engine parts for advanced technologies.	**PO1, PO2, PO3, PO4**
CO2	Experiment the energy stored capacity, stresses, deflections of springs and Design the springs for fatigue loading and analyze the possible failures in power screws	**PO1, PO2, PO3, PO4**
CO3	Identify the bearing and lubricating materials, bearing life for different types of bearings.	**PO1, PO2, PO3, PO4**
CO4	Design and analyze the spur and helical gears for wear considerations.	**PO1, PO2, PO3, PO4**
CO5	Identify the slip of different belt drives theoretically for better transmission and design a chain and rope drives for different applications	**PO1, PO2, PO3, PO4**

Text Books:

1. Machine Design, J.E. Shigley, 9/e, 2011, Tata McGraw-Hill Education Pvt.Ltd., Noida
2. Introduction to Machine Design, V.B.Bhandari, 2/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference Books:

1. Machine Design an Integrated Approach, Robert L.Norton, 2/e, 2002, Pearson Education, New Delhi.
2. Machine Design, R.S. Khurmi and J.K.Gupta, 11/e, 1996, S.Chand & Company Pvt. Ltd., New Delhi.
3. Design of Machine Elements-II, T. Krishna Rao, 2/e, 2011, I.K. International Publishing House Pvt. Ltd., New Delhi.
4. Machine Design, P.Kanniah, 12/e, 2009, Scitech Publishers, Chennai.
5. Machine Design, Pandya and Shah, 18/e, Charotar Publishing House Pvt. Ltd. Anand.

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	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	1	0	3

16MEC324 CAD/CAM/CIM

Course Educational Objectives:

CEO1: To gain knowledge about the basic fundamental of CAD.
CEO2: To understand the requirements of Geometric modeling
CEO3: To gain knowledge about the basic fundamental of NC/CNC system and programming.
CEO4: To obtain the concepts, applications and components of Computer integrated manufacturing
CEO5: To gain knowledge on advance manufacturing and flexible manufacturing system.

UNIT – 1: COMPUTER GRAPHICS AND DRAFTING

Computers in industrial manufacturing – Design process – Product cycle. **CAD / CAM hardware:** Basic structure – CPU – Memory types – Input devices – Display devices – Hard copy devices – Storage devices – System software – System configuration. **Computer Graphics:** Raster scan graphics – Coordinate system – Database structure for graphics modeling – Engineering data management system – Transformation of geometry – 3D transformations – Clipping – Surface removal – Colour and shading – Geometric commands, layers, display control commands, editing and dimensioning – Standardization in graphics – Graphical kernel system – Exchange of modeling data.

UNIT – 2: GEOMETRIC MODELING

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

UNIT – 3: NC/CNC SYSTEMS

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 – CNC 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: COMPONENTS OF CIM

CIM as a concept and a technology – CASA/SME model of CIM, CIM II – Benefits of CIM – Communication matrix in CIM – Computer communication in CIM – CIM data transmission methods – Series, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex – Types of communication in CIM – Point to point (PTP), star and multiplexing – Computer networking in CIM – Seven layer OSI model, LAN model, MAP model, network topologies – Star, ring and bus, advantages of networks in CIM.

UNIT – 5: GROUP TECHNOLOGY, PROCESS PLANNING AND FMS

Group Technology: Role of G.T in CAD/CAM integration – Part families classification and coding – DCLASS, MCLASS and OPTIZ coding systems – Facility design using G.T – Benefits of G.T – Cellular manufacturing. **Process Planning**: Process planning in CAD/CAM integration – Approaches to computer aided process planning – Variant approach and generative approaches. **FMS**: Components of FMS – Types – FMS workstation – Material handling and storage system – FMS layout.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain about computer basic components, necessity in design and manufacturing. Know advanced tools in computer aided design and analyze their transformations effects.	**PO1, PO2, PO3, PO5, PO12.**
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, PO12.**
CO4	Obtain the knowledge on elements of an automated manufacturing environment, compare effective type's communication.	**PO1, PO2, PO10**
CO5	Knowledge of Automated planning to manufacture custom specific components and Evaluate basics of variability and its role in the performance of a production system.	**PO1, PO2, PO3, PO4, PO5, PO10**

Text Books:

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

Reference Books:

1. CAD/CAM/CIM, V.Raju, S.Subramanyam, P.Radhakrishnan, 3/e, 2007, New Age International (P) Ltd, Publishers, New Delhi.
2. Computer Integrated Manufacturing, James A. Regh and Henry W. Kreabber, 2/e, 2005, Prentice Hall of India Pvt. Ltd., New Delhi.
3. CAD CAM Principles, Practice and Manufacturing Management, Chris McMahon and Jimmie Browne, 2/e, 2005, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Automation, Production Systems and Computer Integrated Manufacturing, Groover, 3/e, 2008, Pearson Education, New Delhi.
5. Computer Aided Design and Manufacturing, Lalit Narayan, 1/e, 2008, Pearson Education, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	2	-	-	-	-	-	-	2
CO.2	3	1	2	-	2	-	-	-	-	-	-	-
CO.3	3	2	1	-	3	-	-	-	-	-	-	3
CO.4	3	1	-	-	-	-	-	-	-	2	-	-
CO.5	3	2	2	2	2	-	-	-	-	2	-	-
CO*	**3**	**1.6**	**1.75**	**2**	**2.25**	-	-	-	-	**2**	-	**2.5**

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC325A AUTOMATION AND ROBOTICS

Course Educational Objectives:

CEO1: To study the various fundamental and advanced concepts of automation in Industry
CEO2: To understand the Line balancing and flow lines in automated industry
CEO3: To understand the basic concepts associated with the design and functioning and applications of robots.
CEO4: To study about the kinematics and dynamics of robots.
CEO5: To learn about drives, sensors used in robots, robot programming and application.

UNIT – 1: BASICS OF AUTOMATION

Basic elements of an automated system – Need – Types – Advanced automation function – Levels of automation – Hardware components for automation and process control – Automated storage and retrieval system – Material transport system and equipments – Over view of automated identification technique – Bar code technology.

UNIT – 2: AUTOMATED FLOW LINES AND LINE BALANCING

Automated flow lines: Part transfer methods and mechanisms – Types of flow lines – Flow line with/without buffer storage – Qualitative analysis. **Assembly line balancing:** Assembly process and systems assembly line – Line balancing methods – Ways of improving line balance and flexible assembly lines.

UNIT – 3: INDUSTRIAL ROBOTICS AND DRIVE SYSTEM

Definition – Robot anatomy – Co-ordinate systems, Work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion, pay load – Robot parts and functions – Need for robots – Different applications. **Robot Drive System:** Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Servo motors and stepper motor – Grippers – Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum Grippers; two fingered and three fingered grippers; internal grippers and external grippers.

UNIT – 4: KINEMATICS AND DYNAMICS OF ROBOTS

Robot Kinematics: Homogeneous transformations as applicable to rotation and translation – D-H notation – Forward and inverse kinematics. **Robot Dynamics:** Differential transformation – Jacobians, Lagrange-Euler and Newton-Euler formations. **Trajectory Planning:** Trajectory planning and avoidance of obstacles – Path planning – Skew motion – Joint integrated motion – Straight line motion.

UNIT – 5: ROBOT PROGRAMMING AND APPLICATION

Robot Sensors: Range sensor – Proximity sensor – Touch sensor – Force and torque sensor. **Robot Programming**: Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion commands, sensor commands, end effecter commands and simple programs. **Robot Applications:** Robot application in manufacturing industry – Applications in assembly and inspection.

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
CO2	Understand the Line balancing and flow lines of robotics in automated industry	PO1, PO2
CO3	Demonstrate the basic concepts associated with industrial robots and driving systems used in robots	PO1
CO4	Compare the kinematics and dynamics of robots.	PO1,PO2
CO5	Explain about sensors used in robots, robot programming and applications	PO1

Text books:

1. Automation, Production Systems and CIM, 3/e, 2008, M.P.Groover, Prentice- Hall of India, Pvt. Ltd., New Delhi.
2. Introduction to Robotics-Analysis, Control, Applications, 2/e, 2011, Saeed B.Niku, Wiley India Pvt, Ltd., New Delhi.

Reference books:

1. Industrial Robotics, 2/e, 2012, M.P. Groover, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Robotics Technology and Flexible Automation, 2/e, 2009, S.R.Deb, Shankar Deb, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Fundamentals of Robotics: Analysis and Control, 1/e, 2009, Robert J.Schilling, Prentice- Hall of India, Pvt. Ltd., New Delhi.
4. Robotics, Fundamental Concepts and Analysis, 1/e, 2006, Ashitave Ghosal, Oxford University Press, New Delhi.
5. Introduction to Robotics, 3/e, 2008, John J. Craig, Pearson Education, New Delhi.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC325B GAS DYNAMICS AND JET PROPULSION

Course Educational Objectives:

CEO1: To understand the Basic concepts of compressible flows and Isentropic flows

CEO2: To know the variation of flow properties in constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow)

CEO3: To derive the conditions for change in pressure, density and temperature for flows through normal and oblique shocks.

CEO4: To understand the types, functions of jet propulsion

CEO5: To develop the modern space propulsion system

UNIT – 1: BASIC CONCEPTS AND ISENTROPIC FLOWS

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: FLOW THROUGH DUCTS

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Choking concept, isothermal flow with friction –Use of gas tables.

UNIT – 3: NORMAL AND OBLIQUE SHOCKS

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

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

Types of rocket engines and propellants – Characteristic velocity – Thrust equation – Theory of single and multistage rocket propulsion – Liquid fuel feeding systems – Solid propellant geometries – Orbital and escape velocity – Rocket engine performance parameters and problems.

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	Develop the modern space propulsion system	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, 2003, McGraw Hill.

Reference Books:

1. Fundamentals of Gas Dynamics, Zucker, R.D., and Biblarz, O, 2/e, 2011, Wiley.
2. Rocket Propulsion Elements, Sutton, G.P. John, 8/e, 2010, Wiley, New York.
3. Gas Dynamics, Rathakrishnan, E., 2003, Prentice Hall of India.
4. Fundamentals of Compressible Fluid Dynamics, Balachandran, P., 2007, Prentice Hall of India.
5. Compressible Fluid Flow, P.H.Oosthaizen, W.E. Carscallen, 1999, McGraw-Hill ISE.

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	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC325C COMPOSITE MATERIALS

Course Educational Objectives:

CEO1: To know the fundamentals of composite material strength and its mechanical behavior
CEO2: To understand the Manufacturing process of polymer matrix composites
CEO3: To understand fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
CEO4: To understand lamina strength analysis and analysis of laminated flat plates
CEO5: To understand thermo-mechanical behavior and study of residual stresses

UNIT – 1: INTRODUCTION TO COMPOSITE MATERIALS

Definition – Matrix materials-polymers-metals-ceramics – Reinforcements: Particles, whiskers, inorganic fibers, metal filaments – Ceramic fibers – Fiber fabrication – Natural composite wood, jute – Advantages and drawbacks of composites over monolithic materials – Mechanical properties and applications of composites, particulate-reinforced composite materials, dispersion-strengthened composite – Fiber-reinforced composites – Rule of mixtures – Characteristics of fiber-reinforced composites – Manufacturing fiber and composites.

UNIT – 2: MANUFACTURING OF COMPOSITES

Manufacturing of polymer matrix composites (PMCs) – Handlay-up, spray technique, filament winding, pultrusion, resin transfer moulding (RTM) – Bag moulding, injection moulding, sandwich mould composites (SMC) – Manufacturing of metal matrix composites (MMCs) – Solid state, liquid state, vapour state processing, manufacturing of ceramic matrix composites (CMCs) – Hot pressing-reaction bonding process – Infiltration technique, direct oxidation – Interfaces.

UNIT – 3: INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS

Lamina constitutive equations: Lamina assumptions – Macroscopic viewpoint – Generalized Hooke's law – Reduction to homogeneous orthotropic lamina – Isotropic limit case, orthotropic stiffness matrix (QIJ) – 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 module – Evaluation of lamina properties from laminate tests – Quasi-isotropic laminates – Determination of lamina stresses within laminates.

UNIT – 4: LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES

Introduction – Maximum stress and strain criteria – Von-Mises 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 equilibrium equations of motion – Energy formulations – Static bending analysis – Buckling analysis – Free vibrations – Natural frequencies.

UNIT – 5: THERMAL ANALYSIS

Assumption of constant co-efficient of thermal expansion (C.T.E.) – 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.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamentals of composite material strength and its mechanical behavior	PO1,PO2
CO2	Demonstrate the manufacturing process of polymer matrix composites	PO1,PO2,PO3
CO3	Understand fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.	PO1,PO2,PO4,
CO4	Summarize the lamina strength analysis and analysis of laminated flat plates	PO1, PO2, PO3,
CO5	Illustrate thermo-mechanical behavior and study of residual stresses	PO1, PO2, PO3,

Text Books:

1. Principles of Composite Material Mechanics, Gibson, R.F., 2/e, 1994, McGraw-Hill, CRC press in progress.
2. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, Reprint 2008, University Press (India) Pvt. Ltd., Hyderabad.

Reference Books:

1. Composite Materials: Science and Applications, Chung, Deborah D.L., 1st Indian Reprint, 2009, Ane Books Pvt. Ltd. /Springer, New Delhi.
2. Engineering Mechanics of Composite Materials, Issac M. Daniel and Ori Ishai, 1st Indian Edition, 2007, Oxford University Press.
3. Fiber-Reinforced Composites: Materials, Manufacturing and Design, Mallick, P.K., Maneel Dekker Inc, 1993.
4. Stress Analysis of Fiber-Reinforced Composite Materials, Hyer, M.W., 1998, McGraw-Hill.
5. Analysis and Performance of Fiber Composites, Agarwal, B.D., and Broutman L.J., 1990, John Wiley and Sons, New York.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	3	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	2	-	-	-	-	-	-	-	-
CO.4	3	3	3	-	-	-	-	-	-	-	-	-
CO.5	3	1	3	-	-	-	-	-	-	-	-	-
CO*	**3**	**2.1**	**3**	**2**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC325D FUEL CELL TECHNOLOGY

Course Educational Objectives:

CEO1: To understand the basics of electro chemicals and performance characteristics of fuel cell
CEO2: To know the working of Alkaline Fuel Cells and Phosphoric Acid Fuel Cells
CEO3: To understand the working principles of solid oxide and molten carbonate fuel cells
CEO4: To demonstrate the working of direct methanol & proton exchange membrane fuel cells
CEO5: To understand the fuel processing and hydrogen storage

UNIT – 1: INTRODUCTION AND BASIS OF ELECTRO CHEMISTRY

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

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

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

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

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.

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, J. Larminie and A. Dicks, 2003, Wiley.
2. Fuel Cells Principles and Applications, B.Viswanathan and Aulice Scibioh, 2006, Universities Press, Hyderabad.

Reference Books:

1. Fuel Cells: From Fundamentals and Applications, S. Srinivasan, 2006, Springer.
2. Fuel Cell Engines, M. M. Mench, 2008, Wiley.
3. Fuel Cell Technology Handbook (FCTH), Gregor Hoogers, Current Edition, 2003, CRC Press.
4. Principles of Fuel Cells, X. Li, 2005, Taylor and Francis.
5. Fuel Cell Technology, N. Sammes, 2006, Springer.

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**	-	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
0	0	3	2

16MEC326 HEAT TRANSFER LAB

Course Educational Objectives:

CEO1: To determination of thermal conductivity of materials
CEO2: To know the overall heat transfer co-efficient through composite slab apparatus
CEO3: To learn emissivity of a gray body through emissivity apparatus

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	3	2

16MEC327 COMPUTER AIDED MACHINE DRAWING LAB

Course Educational Objectives:

CEO1: To make the students understand and interpret drawings of machine components.
CEO2: To prepare assembly drawings using standard CAD packages.
CEO3: To familiarize the students with Indian Standards on drawing practices and standard components.
CEO4: To gain practical experience in handling 2D drafting and 3D modeling software systems.

List of Exercises:

1. Study of drawing standards and CAD tools.
2. Drawing of welding joints and riveted joints.
3. Drawing of screw threads and fasteners.
4. Assembly drawing of sleeve and cotter joint.
5. Assembly drawing of socket and spigot joint.
6. Assembly drawing of knuckle joint.
7. Assembly drawing of universal joint.
8. Assembly drawing of shaft coupling.
9. Assembly drawing of screw jack.
10. Assembly drawing of plummer block.
11. Assembly drawing of stuffing box.
12. 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 analys using CATIA V6 and ABACUS software packages.	**PO5**
CO6	Follow ethical principles in designing, simulating and implementing various procedures used in software tools.	**PO8**
CO7	Do experiments effectively as an individual.	**PO9**
CO8	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO9	Utilise the knowledge of the theory and principles of the new technologies and information systems in the design of products and processes.	**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	-	-	-	2		-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	2	-	-	-
CO8	-	-	-	-	-	-	-	-	-	2	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**2**	**3**	-	-	3	2	**2**	-	**3**

III B.Tech II Semester

L	T	P	C
2	0	0	1

16MEC328 ON-LINE COMPREHENSIVE TEST – II

As per the Regulation 2016, There shall be two comprehensive online examinations will be conducted. One at the end of II year II Semester and the other at the end of III year, II semester, It has 100 objective questions for 100 marks on the subjects studied in the respective semesters.

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

III B.Tech II Semester

L	T	P	C
2	0	0	0

16PAT329 REASONING AND APTITUDE - II

Course Educational Objectives:

CEO1: To apply quantitative reasoning techniques to the real time problems.

CEO2: To understand the mathematical analysis for solve the life time 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	Solve the quantitative reasoning techniques to the real time problems	PO1,PO3,PO5,PO12
CO2	Understand the mathematical analysis for solve the life time problems	PO1,PO3,PO5,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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	-	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	-	-	3
CO*	**3**	**-**	**3**	**-**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC411 REFRIGERATION AND AIR-CONDITIONING

Course Educational Objectives:

CEO1: To understand the basics functions of Air Refrigeration system
CEO2: To know the working of Vapour Compression and Vapour Absorption Refrigeration systems
CEO3: To understand the behavior of Refrigerants, functions of System Components
CEO4: To know the Psychometric properties, processes & Air Conditioning Equipments
CEO5: To understand the air conditioning systems and cooling load estimation

UNIT – 1: AIR REFRIGERATION SYSTEMS

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

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

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

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

Requirements of human comfort and concept of effective temperature – Comfort chart – Comfort air conditioning – Summer, winter, year round, unitary and central air conditioning systems. **Cooling Load Calculations:** Heat load concepts – RSHF, GSHF and ERSHF – Estimation of total load.

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, PO4**
CO2	Know the working of vapour compression refrigeration system and identify methods for performance improvement.	**PO1,PO2,PO3, PO4**
CO3	Know the working of vapour absorption refrigeration system and identify methods for performance improvement.	**PO1,PO2,PO3, PO4**
CO4	Acquire knowledge of refrigerants and consider health and safety issues of societal and environmental contexts and knowledge on other refrigeration systems.	**PO1,PO2,PO3, PO4**
CO5	Apply psychrometric charts, analyze the problems on psychrometry and acquire knowledge on air conditioning equipment's.	**PO1,PO2,PO3, PO4**

Text books:

1. Refrigeration and Air Conditioning, C.P. Arora, 3/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Refrigeration and Air Conditioning, P.L.Ballaney, 7/e, 2012, Khanna Publishers, New Delhi.

Reference books:

1. Refrigeration and Air Conditioning, Manohar Prasad, 2/e, 2003, New Age International (P) Ltd, Publishers, New Delhi.
2. Principles of Refrigeration, Dossat, 4/e, 2007, Pearson Education, New Delhi.
3. Refrigeration and Air Conditioning, R.C.Arora, 2/e, 2010, Prentice-Hall of India, Pvt. Ltd., New Delhi.
4. Basic Refrigeration and Air-Conditioning, Ananthanarayanan, 4/e, 2013, Tata McGraw-Hill Education Pvt. Ltd., Noida.

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	2	-	-	-	-	-	-	-	-
CO.2	3	3	3	2	-	-	-	-	-	-	-	-
CO.3	3	1	3	-	-	-	-	-	-	-	-	-
CO.4	3	2	3	-	-	3	3	-	-	-	-	-
CO.5	3	3	3	-	-	-	-	-	-	-	-	3
CO*	**3**	**2.4**	**3**	**2**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**3**

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC412 FUNDAMENTALS OF VIBRATIONS

Course Educational Objectives:

CEO1: To understand the sources of vibration, application of vibration and its types

CEO2: To investigate free vibration of single-degree of freedom systems in all kind of vibration systems

CEO3: To determination of natural frequencies of Torsional systems, spring-mass systems

CEO4: To understand natural frequency of Transverse Vibration of a String, Longitudinal Vibration of a rod and Lateral Vibration of Beams

CEO5: To recognize the control of vibration unit and it's measurement.

UNIT – 1: ELEMENTS OF VIBRATION

Introduction: Brief history of vibration – Importance and Classification of vibration – Basic Concepts – 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, definitions and terminology.

UNIT – 2: FREE VIBRATION OF SINGLE-DEGREE OF FREEDOM SYSTEMS

Undamped Translational System: Equation of motion using Newton's second law of motion, equation of motion using other methods, equation of motion of a spring-mass system in vertical position, solution, harmonic motion. **Undamped Torsional System:** Equation of motion and solutions – Rayleigh's energy method – Stability of systems. **Free Vibration with Viscous Damping:** Equation of motion, solution, logarithmic decrement, energy dissipated in viscous damping, torsional systems with viscous damping.

UNIT – 3: DETERMINATION OF NATURAL FREQUENCIES AND MODE SHAPES

Introduction – Dunkerley's formula. **Rayleigh's Method:** Properties of Rayleigh's quotient, computation of the fundamental natural frequency, fundamental frequency of beams and shafts. **Holzer's Method:** Torsional systems, spring-mass systems. **Matrix Iteration Method**: Convergence to the highest natural frequency, computation of intermediate natural frequencies.

UNIT – 4: CONTINUOUS SYSTEMS

Transverse Vibration of a String or Cable: Equation of motion, initial and boundary conditions, free vibration of a uniform string, free vibration of a string with both ends fixed, traveling-wave solution. **Longitudinal Vibration of a Bar or Rod:** Equation of motion and solution, orthogonality of normal functions – Torsional vibration of a shaft or rod. **Lateral Vibration of Beams**: Equation of motion, initial conditions, free vibration, and boundary conditions.

UNIT – 5: VIBRATION CONTROL AND MEASUREMENT

Vibration Control: Vibration nomograph and vibration criteria – Reduction of vibration at the source. **Balancing of rotating machines**: Single-plane balancing and two-plane balancing. **Whirling of Rotating Shafts**: Equations of motion, critical speeds, response of the system, and stability analysis – Control of vibration, control of natural frequencies, damping of vibration isolation and vibration absorbers (theoretical approach). **Vibration Measurement:** Variable resistance transducers – Piezoelectric transducers – Electro-dynamic transducers – LVDT.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the varies sources of vibrations, characteristics and its types	PO1,PO2, PO3
CO2	Investigate free vibration of single-degree of freedom systems in all kind of vibration systems	PO1,PO2,PO3
CO3	Determination of natural frequencies of torsional systems, spring-mass systems	PO1,PO2,PO4
CO4	Illustrate the natural frequency of transverse vibration of a string, longitudinal vibration of a rod and lateral vibration of beams	PO1, PO2, PO4
CO5	Recognize the control of vibration unit and it's measurement	PO1, PO2, PO3

Text Books:

1. Mechanical Vibrations, Singiresu S.Rao, 5/e, 2010, Pearson Education.
2. Mechanical Vibrations, Raveesh Pratap, V.P. Singh, 2014, Dhanpat Rai & Co.

Reference Books:

1. Principles of Vibrations, Benson H. Tongue, 2/e, 2007, Oxford University.
2. Theory of Vibration with Application, William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, 5/e, 2011, Pearson Education.
3. Introductory course on Theory and Practice of Mechanical Vibration, Rao, J.S and Gupta.K, Reprint, 2014, New Age International Publications.
4. Theory of vibrations-An introduction, A.A. Shabana, 3/e, 2010, Springer.
5. Fundamentals of Vibrations, Balakumar Balachandran and Edward B. Magrab, 1/e, 2009, Cengage Learning.

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

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC413 MECHATRONIC SYSTEMS

Course Educational Objectives:

CEO1: To understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors

CEO2: To know the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in mechatronics systems

CEO3: To demonstrate the Basic system models and Controller used in Mechatronic systems

CEO4: To understand the applications of microprocessors and programmable logic controller in mechatronic system

CEO5: To recognize the Elements of CNC Machines in mechatronics system

UNIT – 1: MECHATRONICS, SENSORS AND TRANSDUCERS

Introduction to mechatronics systems – Measurement systems – **Control Systems:** Open loop, closed loop, automatic control, block diagram, pneumatic control and hydraulic control systems. **Transducers:** Terminology and mechanism – Classifications – Resistance, variable inductance, capacitive, piezoelectric, Hall effect and photoelectric transducers – Strain gauge (theory only). **Sensors:** Proximity, light and pneumatic sensors – Load cells – Digital optical encoders – Selection of sensors.

UNIT – 2: ACTUATION SYSTEMS

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

UNIT – 3: SYSTEM MODELS AND CONTROLLERS

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 modes – Two step mode – Proportional mode – Derivative mode – Integral mode – PID controllers – Digital controllers – Adaptive control systems.

UNIT – 4: MICROPROCESSORS AND PROGRAMMABLE LOGIC CONTROLLER

Microprocessors: Introduction – Pin configuration – Architecture of 8085 – Addressing Modes – Instruction set, timing diagram of 8085. **Data Acquisition:** Data acquisition systems – Analog-to-Digital conversion (ADC) – Digital-to-Analog conversion (DAC). **Programmable Logic Controller:** Introduction – Architecture, input/output processing – Programming with timers, counters and internal relays – Data handling – Selection of PLC.

UNIT– 5: MECHATRONIC SYSTEMS

Elements of CNC Machines: NC/CNC Introduction, functions and applications – Machine structure – Guide ways – Drives – Spindle and bearings – Measuring systems – Controls – Gauging – Tool monitoring system – Swarf removal – Safety. **Mechatronic Systems:** Design process – Embedded 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.

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	Illustrate the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in mechatronics systems	PO1,PO2,PO3
CO3	demonstrate the Basic system models and Controller used in Mechatronic systems	PO1,PO2
CO4	Understand the applications of microprocessors and programmable logic controller in mechatronic system	PO1, PO2
CO5	Recognize the elements of CNC Machines in mechatronics system	PO1, PO2, PO3

Text Books:

1. Mechatronics, Bolton,W, 2/e, Fifth Indian Reprint, 2003, Pearson Education.
2. A Textbook of Mechatronics, R.K.Rajput, 2007, S. Chand & Co.

Reference Books:

1. Mechatronics Systems Design, Devadas Shetty and Richard A. Kolk, 2010, Cengage Learning.
2. Mechatronics Integrated Technologies for Intelligent Machines, Smaili.A and Mrad.F, 2007, Oxford University Press.
3. Mechatronics Principles, Concepts and Applications, Nitaigour Premchand Mahalik, 2015, McGraw Hill Education.
4. Introduction to Mechatronics and Measurement Systems, Michael B. Histand and David G. Alciatore, 2000, McGraw-Hill International Editions.
5. Understanding Electro-Mechanical Engineering: An Introduction to Mechatronics, 2000, Lawrence J. Kamm, Prentice – Hall of India Pvt., Ltd.

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	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC414A RENEWABLE ENERGY SOURCES

Course Educational Objectives:

CEO1: To describe the types solar thermal collectors and solar energy sources for electricity generation
CEO2: To understand the functions of wind turbine and describe the environmental issues
CEO3: To describe the types Biomass gasifier and Biodiesel production sources for electricity generation
CEO4: To develop the advancement in Geothermal Energy and Ocean Thermal Energy conversion process
CEO5: To educate the various new and alternative sources such as Magneto Hydro Dynamic Power and fuel cells

UNIT – 1: SOLAR ENERGY

Present renewable energy status in India – 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 – 2: WIND ENERGY

Wind data and energy estimation – Betz limit - Site selection for wind farms – Horizontal axis wind turbine – Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues – Applications.

UNIT – 3: BIOMASS ENERGY

Bio resources – Biomass direct combustion – Biomass gasifier – Types of biomass gasifiers – Cogeneration – Carbonisation – Pyrolysis – Biogas plants – Digesters – Biodiesel production – Ethanol production – Applications.

UNIT – 4: GEO THERMAL, TIDE AND OCEAN THERMAL ENERGY

Geothermal Energy: Geothermal energy sources – Types of geothermal power plants – Applications – Environmental impact – Small hydro. **Ocean Thermal Energy:** Tidal energy – Wave energy – Open and closed OTEC cycles.

UNIT – 5: NEW AND ALTERNATIVE ENERGY SOURCES

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.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the types solar thermal collectors and solar energy sources for electricity generation	PO1,PO2, PO6
CO2	Understand the functions of wind turbine and describe the environmental issues	PO1,PO2,PO6, PO7
CO3	Illustrate the types Biomass gasifier and Biodiesel production sources for electricity generation	PO1,PO6,PO7
CO4	Develop the advancement in Geothermal Energy and Ocean Thermal Energy conversion process	PO1, PO6, PO7
CO5	Demonstrate the various new and alternative sources such as Magneto Hydro Dynamic Power and fuel cells	PO1, PO7

Text books:

1. Non-Conventional Energy Sources, G.D. Rai, 1/e, 2010, Khanna Publishers, New Delhi.
2. Non-Conventional Sources, Khan, B.H., 2/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Renewable Energy Resources, G.N.Tiwari, M.K.Ghosal, 1/e, 2004, Alpha Science International Ltd., UK.
2. Renewable Energy Sources, Twidell ands Tony Weir, 2/e, 2005, Taylor and Francis Group Publishers, UK.
3. Solar Power Engineering, B.S.Magal Frank Kreith and J.F.Kreith, 1/e, 1990, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Non-Conventional Energy, Ashok V Desai, 1/e, 2008, ABP (P) Ltd., New Delhi.
5. Non-Conventional Energy Systems, K Mittal, 2/e, 1999, Wheeler Publications, 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	2	-	-	-	-	-
CO.3	3	-	-	-	-	2	2	-	-	-	-	-
CO.4	3	-	-	-	-	2	2	-	-	-	-	-
CO.5	3	-	-	-	-	-	2	-	-	-	-	-
CO*	**3**	**2**	-	-	-	2	2	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC414B ADVANCED I.C. ENGINES

Course Educational Objectives:

CEO1: To understand the fuel injection systems and knock effect of Spark Ignition engine

CEO2: To understand the fuel-injection system & turbocharging of Compression Ignition engine

CEO3: To provide knowledge on pollutant formation, measurements, Emission norms & control

CEO4: To provide knowledge in suitability of alternate fuels and engine modification.

CEO5: To summarize the latest advancement in automobile and hybrid vehicles

UNIT – 1: SPARK IGNITION ENGINES

Mixture requirements – Fuel injection systems – Monopoint, multipoint and direct injection – Stages of combustion – Normal and abnormal combustion – Knock – Factors affecting knock – Combustion chambers.

UNIT – 2: COMPRESSION IGNITION ENGINES

Diesel fuel 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.

UNIT – 3: POLLUTANT FORMATIONS AND CONTROL

Pollutant – Sources – Formation of carbon monoxide, unburnt hydrocarbon, oxides of nitrogen, smoke and particulate matter – Methods of controlling emissions – Catalytic converters, selective catalytic reduction and particulate traps – Methods of measurement – Emission norms and driving cycles.

UNIT – 4: ALTERNATIVE FUELS

Alcohol, hydrogen, compressed natural gas, liquefied petroleum gas and bio diesel – Properties, suitability, merits and demerits – Engine modifications.

UNIT – 5: RECENT TRENDS

Air assisted combustion, homogeneous charge compression ignition engines – Variable geometry turbochargers – Common rail direct injection systems – Hybrid electric vehicles – NOx adsorbers – Onboard diagnostics.

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, 2/e, 2002, TMH.
2. Internal Combustion Engine Fundamentals, Ramalingam. K.K., 2002, Scitech Publications.

Reference books:

1. Internal Combustion Engine Fundamentals, 1/e, 2011, John B Heywood, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Fundamentals of Internal Combustion Engines, 2/e, 2013, Gupta H.N, Prentice- Hall of India, Pvt. Ltd., New Delhi.
3. IC Engines: Combustion and Emissions, 1/e, 2010, B.P.Pundir, Narosa Publishing House, New Delhi.
4. Internal Combution Engines, 2/e, 2011, Colin R.Ferguson, Allan T.Kirkpatrick, Wiley India Pvt, Ltd., New Delhi.
5. A Text Book of Internal Combustion Engines, 2/e, 2007, R.K.Rajput, Laxmi Publications (P) 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	-	-	-	-	-	-
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	1	0	3

16MEC414C DESIGN OF HEAT EXCHANGERS

Course Educational Objectives:

CEO1: To understand the fundamental principles of heat exchanger and it's types.

CEO2: To analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger

CEO3: To learn thermal and stress analysis on various parts of the heat exchangers.

CEO4: To provide knowledge in design of compactable plate heat exchanger.

CEO5: To develop a design of evaporative condensers and Cooling towers.

UNIT – 1: INTRODUCTION

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

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

Stress in tubes – Header sheets and pressure vessels – Thermal stresses, shear stresses – Types of failures, buckling of tubes, flow induced vibration.

UNIT – 4: 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 – 5: DESIGN OF CONDENSERS AND COOLING TOWERS

Design of surface and evaporative condensers – Cooling tower – Performance characteristics.

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 it's types	PO1,PO2
CO2	Analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger	PO1,PO2,PO3
CO3	Illustrate the thermal and stress analysis on various parts of the heat exchangers	PO1,PO2,PO3
CO4	Understand the design of compactable plate heat exchanger	PO1, PO2, PO3
CO5	Develop a design of evaporative condensers and Cooling towers.	PO1, PO2, PO3

Text Books:

1. Heat Exchangers Selection, Rating and Thermal Design, Sadik Kakac, Hongtan Liu, Anchasa Pramuanjaroenkij, 3/e, 2012, CRC Press.
2. Fundamentals of Heat Exchanger Design, Shah, R. K., Dusan P. Sekulic, 2003, John Wiley and Sons.

Reference Books:

1. Process Heat Transfer Principles and Applications, Robert W. Serth, 2010, Academic press, Elesevier.
2. Process Heat Transfer, Sarit Kumar Das, 2005, Alpha Science International.
3. Compact Heat Exchangers: Selection, Design and Operation, John E. Hesselgreaves, 2001, Elsevier science Ltd.
4. Heat Exchanger Design Hand Book, T. Kuppan, Marcel Dekker, 2009, New York.
5. Advances In Thermal Design of Heat Exchangers: A Numerical Approach: Directsizing, Step-Wise Rating and Transients, Eric M. Smith, 1999, John Wiley & Sons.

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	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1.5**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC414D COMPUTATIONAL FLUID DYNAMICS

Course Educational Objectives:

CEO1: To formulate the Governing equation and boundary conditions of fluid dynamics

CEO2: To derive and solve the finite difference equations of fluid dynamics

CEO3: To formulate the Finite volume formulation for steady state one, two and three dimensional diffusion problems

CEO4: To derive Steady one dimensional convection and diffusion of computational fluid dynamics

CEO5: To create confidence in solving complex problems in the field of fluid flow and heat transfer

UNIT – 1: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

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 METHOD

Derivation of finite difference equations – Simple methods – General methods for first and second order accuracy – Solution methods for finite difference equations – Elliptic equations – Iterative solution methods – Parabolic equations – Explicit and implicit schemes – Example problems on elliptic and parabolic equations.

UNIT – 3: FINITE VOLUME METHOD (FVM) FOR DIFFUSION

Finite volume formulation for steady state one, two and three dimensional diffusion problems – One dimensional unsteady heat conduction through explicit, crank – Nicolson and fully implicit schemes.

UNIT – 4: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION

Steady one dimensional convection and diffusion – Central, upwind differencing schemes- properties of discretization schemes – Conservativeness, boundedness, trasnportiveness, hybrid, power-law, quick schemes.

UNIT – 5: CALCULATION FLOW FIELD BY FVM

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure correction equation – Simple algorithm and its variants – Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models.

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
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
CO4	Summarize Steady one dimensional convection and diffusion of computational fluid dynamics	PO1, PO2, PO3
CO5	Solve complex problems in the field of fluid flow and heat transfer	PO1, PO2

Text books:

1. Computational Fluid Dynamics, Basics with Applications, John. D. Anderson, 1/e, 2012, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Computational Fluid Flow and Heat Transfer, Muralidhar.K, Sundararajan,T, 2/e, 2012, Narosa Publishing House, New Delhi,

Reference books:

1. Introduction to Computational Fluid Dynamics, Prodip Niyogi, S.K.Chakkrabarty, M.K.Laha, 1/e, 2005, Pearson Educations, New Delhi.
2. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, 1/e, 2004, University Press (India) Private Ltd., Hyderabad.
3. Introduction to Computational Fluid Dynamics, Date, 1/e, Cambridge University Press India, New Delhi.
4. Introduction to Computational Fluid Dynamics, Anil W. Date 1/e, 2005, Cambridge University Press, UK.
5. An Introduction to Computational Fluid Dynamics The Finite Volume Method, Versteeg and Mallalasekara, 2/e, 2016, Pearson Education, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1.5**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC415A PRODUCT DESIGN AND DEVELOPMENT

Course Educational Objectives:

CEO1: To develop the Characteristics of successful product development in an organization

CEO2: To evaluate the product planning and product specification of a product

CEO3: To understand the generation, selection and testing of a concept

CEO4: To develop product architecture and design for manufacturing new product

CEO5: To appreciate the importance, various stages, concepts, management and prototyping of products.

UNIT – 1: INTRODUCTION

Introduction – Characteristics of successful product development – Duration and cost of product development – Challenges – Generic development process – Concept development: The front end process – Adaptation of the Generic product development process – Product development process flow – Product development organization.

UNIT – 2: PRODUCT PLANNING AND PRODUCT SPECIFICATION

Product planning process – Identification of opportunities – Evaluation and prioritization of projects – Allocation of resources and plan timing – Completion of pre-project planning – Identification of customer needs – Collection of raw data from customers – Interpretation of raw data of customer needs – Organization of the needs into a hierarchy – Establishment of relative importance of needs – Product specifications – Establishment of target specifications, setting-up of final specifications.

UNIT – 3: CONCEPT GENERATION, SELECTION, TESTING

Concept generation – Clarification of the problem – Searching externally – Searching internally, systematic exploration – Concept selection – Concept screening steps – Concept scoring steps – Concept testing – Defining the purpose of concept test – Choosing a survey population – Format – Communicating the concept – Measuring the customer response – Interpretation of results.

UNIT – 4: PRODUCT ARCHITECTURE AND DESIGN FOR MANUFACTURE

Product Architecture – Types of modularity – Implications – Establishing the Architecture – Platform Planning – Industrial Design – Assessing the need – Impact – Design Process – Design for Manufacturing – estimation of manufacturing costs – reduction of costs of components, assembly, supporting production – other factors.

UNIT – 5: PROTOTYPING AND MANAGING PRODUCTS

Prototype basics – Principles of prototyping – Prototyping technologies – Planning for prototypes – Management of projects – Understanding and representing tasks – Baseline project planning – Accelerating projects – Project execution – Postmortem project evaluation – Robust design.

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
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,PO5
CO5	Describe the importance, various stages, concepts, management and prototyping of products	PO1,PO2,PO3

Text Books:

1. Product Design and Development, Ulrich K.T. and Eppinger S.D., 5/e, 2011, McGraw-Hill Education.
2. Effective Product Design and Development, Rosenthal S., 1992, Business One Orwin, Homewood, ISBN 1-55623-603-4.

Reference Books:

1. Total Design-Integrated Methods for Successful Product Engineering, Pugh S., 1991, Addison Wesley Publishing, ISBN 0-202-41639-5.
2. Concurrent Engineering in Product Design and Development, Moustapha, I. 2011, New Age International.
3. Product Design and Manufacturing, Regalla, Srinivasa Prakash , Sangwan, Kuldip Singh 2014, New Age International.
4. Product Design-Techniques in Reverse Engineering and New Product Development, Kevin N. Otto, 2011, Pearson, New Delhi.
5. Product Design and Manufacturing, Chitale.A.K and Gupta.R.C, 2007, Prentice Hall of India, New Delhi.

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	-	-	1	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	1	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC415B DESIGN CONCEPTS IN ENGINEERING

Course Educational Objectives:

CEO1: To impart the importance of design in today's context of global competition

CEO2: To evaluate Basic modules in design process by Scientific method and design method

CEO3: To develop the creativity and innovation in design to solve problems by vertical and lateral thinking.

CEO4: To develop design in human machine interface by considering ergonomic factors.

CEO5: To understand the selection of Material for performance characteristics for new design

UNIT – 1: DESIGN TERMINOLOGY

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

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

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

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

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 (DFA).

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the importance of design in today's context of global competition	PO1,PO2
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 by considering ergonomic factors	PO1,PO2
CO5	Understand the selection of material for performance characteristics for new design	PO1,PO2,PO3

Text Books:

1. Engineering Design: A Materials and Processing Approach, George E.Dieter, 4/e, 2008, Tata McGraw Hill.
2. Mechanical Engineering Design, Joseph E.Shigley, Charles R.Mische, 6/e, 2009, McGraw Hill International.

Reference Books:

1. Design and Technology, James Garratt, 2/e, 1996, Cambridge University Press.
2. Integrated Product and Process Design and Development, Edward B.Magrab,Satyandra K. Gupta, F. Patrick McCluskey and Peter Sandborn, 2/e, 2009, CRC Press.
3. Concepts in Engineering Design, Aziz, Atif, 2017, New Age International.
4. Concepts in Engineering Design, Sumesh Krishnan and Dr.Mukul Shukla, 1/e, 2016, Notion Press.
5. Concepts in Engineering Design, Mohit S. Maheshwarkar,Pallavi Maheshwarkar,1/e, 2016, S.K.Kataria & Sons Publisher of Engineering & Computer Books, New Delhi.

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	-	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC415C INDUSTRIAL TRIBOLOGY

Course Educational Objectives:

CEO1: To describe the importance of friction between different surfaces and should know to calculate the friction.

CEO2: To explain the phenomenon of wear between surfaces in contact and its implications.

CEO3: To understand the principles, methods, purpose and selection of lubricants for the reduction of friction.

CEO4: To know the lubrication theory and the flow of lubricants with different applications.

CEO5: To brief the surface treatment methods to improve the wear resistance and friction properties.

UNIT – 1: SURFACES AND FRICTION

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

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

Types and properties of lubricants – Testing methods – Hydrodynamic lubrication – Elasto hydrodynamic lubrication – Boundary lubrication – Solid lubrication – Hydrostatic lubrication.

UNIT – 4: FILM LUBRICATION THEORY

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

Surface modifications – Transformation Hardening, surface fusion – Thermo chemical processes – Surface coatings – Plating and anodizing – Fusion processes – Vapour phase processes – Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings.

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
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
CO4	Summarize the lubrication theory and the flow of lubricants with different applications	PO1,PO2
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, M.M.Khonsari and E.R.Booser, 2/e, 2001, Wiley India Pvt, Ltd., New Delhi.

Reference Books:

1. Bearing Design in Machinery, Harnoy, Avraham Harnoy, 1/e, 2002, Marcel Dekker Publishers, NewYork.
2. Basic Lubrication Theory, C.M.Mc Ettles, A.Cameron, 3/e, 1981, Ellis Horwood Publishers Ltd., U.K.
3. Tribology, Principles and Design Applications, J. Halling, P.B. Davies, R.D. Arnell HallingJ, 1/e, 1993, McMillan Press Ltd., Springer (India) Pvt. Ltd., Bangalore.
4. Friction and Wear of Engineering Materials, I.M. Hutchings, 1/e, 1992, CRC Press, UK.
5. Engineering Tribology, Sahoo Prasantha, 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	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16MEC415D DESIGN OF PRESSURE VESSELS AND PIPING

Course Educational Objectives:

CEO1: To know the importance of cylindrical shell and various closures in the design of pressure vessels and piping

CEO2: To explain the stress concentration in plate having circular hole due to bi-axial loading

CEO3: To understand the design of base plate and support lugs for vertical and horizontal pressure vessels

CEO4: To know the design for stiffening rings, buckling under combined external pressure and axial loading.

.**CEO5**: To brief the piping layout and piping stress analysis in pressure vessels and piping

UNIT – 1: CYLINDRICAL SHELL AND VARIOUS CLOSURES

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

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

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

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

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.

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
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
CO4	Describe the design for stiffening rings, buckling under combined external pressure and axial loading	PO1,PO2,PO4
CO5	Explain the piping layout and piping stress analysis in pressure vessels and piping	PO1,PO2,PO3

Text Books:

1. Theory and Design of Pressure Vessels, John F. Harvey, 1987, CBS Publishers and Distributors.
2. Process Equipment Design, Brownell. L. E and Young. E. D, Wiley Eastern Ltd., India.

Reference Books:

1. Chemical Process Equipment, Selection and Design, Stanley M Wales, 1988, Butterworths series in Chemical Engineering,
2. ASME Pressure Vessel and Boiler code, Section VIII Div.1&2, 2003, American standard code for pressure piping, B31.1.
3. Approximate Methods in the Design and Analysis of Pressure Vessels and Piping, William.J.,Bees, 1997, ASME Pressure vessels and piping conference.
4. Pressure Vessels: Design and Practice, Somnath Chattopadhyay, 2004, CRC Press.
5. Fundamentals of Piping Design, Smith P, 2007, Elsevier Gulf Publishing Company.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**1.5**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
0	0	3	2

16MEC416 MECHATRONICS LAB AND DYNAMICS LAB

Course Educational Objectives:

CEO1: To impart practical knowledge about the elements and techniques involved in mechatronics systems

CEO2: To understand the concept of automation by hydraulic and pneumatic actuators.

CEO3: To study the parameter of gears, Mechanism, Joints and gear trains

CEO4: To study of gyroscopic effect and determination of range sensitivity, effort of Governors

CEO5: To determination of natural frequency of single degree and two degree of freedom.

MECHATRONICS LAB:

1. Actuation of hydraulic, pneumatic circuits.
2. Experimental study of piezo electric transducers/ trainer.
3. Calibration of P/I and I/P converter.
4. Measurement of displacement, speed, force, level, relative humidity and pH.
5. Experimental study of multi process trainer.
6. Experimental study of control valve characteristics.
7. Experimental study of servo and regulator operations.
8. Experimental study of distributed control system.
9. Experimental study of 8-bit 8085 microprocessor setup.
10. Conversion of ADC / DAC through PC.
11. Data acquisition system studies using of LabVIEW.
12. Experimental study of gas chromatography.

DYNAMICS LAB:

1. Study of gear parameters.
2. Experimental study of velocity ratios of simple, compound, epicyclic and differential gear trains.
3. Experimental study of kinematics of four bar, slider crank, crank rocker, double crank, double rocker, oscillating cylinder mechanisms.
4. Experimental study kinematics of single and double universal joints.
5. Determination of mass moment of inertia of fly wheel and axle system / Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus / Determination of mass moment of inertia using bifilar suspension and compound pendulum.
6. Study of gyroscopic effect and couple.
7. Governor – Determination of range sensitivity, effort.
8. Cams – Cam profile drawing, motion curves and study of jump phenomenon.
9. Single degree of freedom spring mass system – Determination of natural frequency and verification of laws of springs – Damping coefficient determination.
10. Vibration of equivalent spring mass system – Undamped and damped vibration.
11. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
12. Transverse vibration of free-free beam – With and without concentrated masses / forced vibration of cantilever beam – Mode shapes and natural frequencies.

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	-	-	-	-	-	-	-	-	2	-	-	-
CO.8	-	-	-	-	-	-	-	-	-	2	-	-
CO.9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	**3**	-	-	3	2	**2**	-	**3**

IV B.Tech I Semester **L T P C**
0 0 3 2

16MEC417 COMPUTER AIDED ANALYSIS LAB AND CNC TECHNOLOGY LAB

Course Educational Objectives:

CEO1: To gain practical experience in FEA software systems.
CEO2: To estimate the natural frequencies and mode shapes, harmonic response of 2D beam
CEO3: To learn the G Code and M codes for CNC Machining process
CEO4: To write Part programming exercise on turning, milling, drilling.

COMPUTER AIDED ANALYSIS LAB:

1. Study of simulation software tools.
2. Determination of deflection and stresses in 2D and 3D trusses and beams.
3. Determination of deflections component and principle and Von-mises stresses in plane stress, plane strain and axisymmetric components.
4. Determination of stresses in 3D and shell structures (IC engine parts)
5. Estimation of natural frequencies and mode shapes, harmonic response of 2D beam.
6. Steady state heat transfer analysis of plane and axisymmetric components.
7. Determination of thermo-mechanical stresses of a 3D component
8. Determination of thermo-mechanical- electrical stresses of a spot welding.
9. Exercise based on fluid dynamics.

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,PO4
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	-	-	2	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	3		-	-	-	-	-	-	-
CO.5	-	-	-	-	3	-	-	-	-	-	-	-
CO.6	-	-	-	-	-	-	-	3	-	-	-	-
CO.7	-	-	-	-	-	-	-	-	2	-	-	-
CO.8	-	-	-	-	-	-	-	-	-	2	-	-
CO.9	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**2**	**3**	**3**	-	-	3	2	**2**	-	**3**

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC421 POWER PLANT ENGINEERING

Course Educational Objectives:

CEO1: To understand the working principles of power plants and analyze performance.
CEO2: To explain the working of nuclear power plant and safety measures
CEO3: To understand the working principles of diesel and hydroelectric power plant
CEO4: To know the working of gas turbine power plant and other renewable energy sources
CEO5: To learn the economics, Energy management environmental issues of power generation.

UNIT – 1: STEAM POWER PLANT

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: NUCLEAR POWER PLANT

Layout and subsystems – Fuels and nuclear reactions – Pressurized water reactor (PWR) – Boiling water reactor (BWR) – Gas cooled and liquid metal fast breeder reactor – Heavy water reactor – Working and comparison – Safety measures.

UNIT – 3: DIESEL AND HYDROELECTRIC POWER PLANT

Diesel Power Plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – Fuel supply system, air starting equipment, lubrication and cooling system – Super charging. **Hydroelectric Power Plant**: Water power – Hydrological cycle – Hydrographs – Storage and pondage – Classification of dams and spill ways – Classification of hydroelectric plant – Pumped storage power plants – Typical layout and associated components – Selection of turbines.

UNIT – 4: GAS TURBINE POWER PLANT AND RENEWABLE ENERGY SOURCES

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. **Renewable Energy Sources:** Principle, construction and working of solar energy, utilization of solar energy and solar energy collectors – Wind energy – horizontal and vertical axis wind turbine (HAWT & VAWT) – Geo thermal – Tidal energy – Ocean thermal – Biogas – Fuel cell, thermoelectric and thermionic generation.

UNIT – 5: ENERGY MANAGEMENT, ECONOMICS AND ENVIRONMENTAL ISSUES

Power tariff types – Load distribution parameters – Load curve – Comparison of site selection criteria – Capital and operating cost of different power plants – Pollution control technologies including waste disposal options for coal and nuclear power plants.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the working principles of power plants and analyze performance	PO1,PO2,PO3
CO2	Explain the working of nuclear power plant and safety measures	PO1,PO3,
CO3	Understand the working principles of diesel and hydroelectric power plant	PO1,PO2,PO3
CO4	Explain the working of gas turbine power plant and other renewable energy sources	PO1,PO2,PO3
CO5	Describe the economics, Energy management environmental issues of power generation	PO1,PO2,PO3,PO6

Text books:

1. Power Plant Engineering, P.K.Nag, 4/e, 2015, McGraw-Hill Education Pvt. Ltd., New Delhi.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar, 6/e, 2012, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Reference books:

1. Powerplant Technology, Mohamed Mohamed El-Wakil, 2010, Tata McGraw-Hill, New Delhi.
2. A Text Book of Power Plant Engineering, R.K.Rajput, 4/e, 2012, Laxmi Publications (P) Ltd., New Delhi.
3. Power Plant Engineering, K.K.Ramalingam, 1/e, 2010, Scitech Publishers, Chennai.
4. Power Plant Engineering, Nagpal G. R, n/e, 2004, Khanna Publisher, New Delhi.
5. Introduction to Power Plant Technology, G.D.Rai, 3/e, 2012, Khanna Publishers, 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	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	2	-	-	-	-	-	-
CO*	**3**	**2**	**1.4**	-	-	**2**	-	-	-	-	-	-

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC422 INDUSTRIAL ENGINEERING AND MANAGEMENT

Course Educational Objectives:

CEO1:To learn the concepts of management and characteristics of Administration and organization

CEO2:To understand the organizational structures and plant layout for productivity improvements

CEO3:To know the basic need of work study, method study, time study and industrial ergonomics

CEO4:To learn the Forecasting, Process planning and control of manufacturing a product

CEO5:To study the inventory control and personnel management in an industry

UNIT – 1: CONCEPTS OF MANAGEMENT

Management: Administration and organization – Importance and characteristics – Managerial skills – Differences between polices, goal and objectives – Scientific management – Management contribution of FW Taylor, Henry Foyal and Gilberth – Motivation theories – Principles of management – Process and functions of management – Levels management – Management chart and development – Project management – Management information system – Industrial ownership – Responsibilities of supervisor/foreman – Leadership concepts and qualities.

UNIT – 2: ORGANIZATIONAL STRUCTURES AND PLANT LAYOUT

Organization: Concept, importance, characteristics, elements, types and process of organization – organization theory – Principle of organization – Organization structure – Committees – Project and matrix organization – Departmentation – Authority and delegation – Group dynamics – Organizational change, conflict and development – Managerial leadership and Communication system. **Plant Layout:** Types of layout – Flow pattern – Storage space – Plant layout procedure – Consideration in building design – Production and productivity.

UNIT – 3: WORK STUDY

Definition and need – Advantages and objectives – Method study – Process chart symbols – Flow process chart – Flow diagram – String diagram – Multiple activity chart – Operation analysis – Principles of motion economy – Design of work place – Therbligs – SIMO chart – Time study – Standard data – Analytical estimating – PMTS – Ergonomics.

UNIT – 4: PRODUCTION PLANNING AND CONTROL

Introduction – Continuous and intermittent production – Job, open and closed job shop – One time large projects – Forecasting – Process planning – Economical batch quantity – Tool control – Loading – Scheduling – Control of production – Dispatching – Routing – Progress control – Flow control – Line of balance.

UNIT – 5: INVENTORY CONTROL AND PERSONNEL MANAGEMENT

Inventory Control: Classification – Objectives – Economic order quantity (EOQ) – Inventory models – ABC analysis – Material requirements planning (MRP) – Manufacturing resource planning (MRP-II). **Personnel Management:** Definition and concept – Objectives – Recruitment and selection – Training – Job evaluation – Merit rating – Wage incentives – Wage incentive plans – Safety and welfare measures – Housekeeping – Communication – Promotion, lay-off, transfer and discharge.

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,PO12
CO2	Explain the organizational structures and plant layout for productivity improvements	PO1, PO2
CO3	Describe the basic need of work study, method study, time study and industrial ergonomics	PO1, PO2
CO4	Explain the Forecasting, Process planning and control of manufacturing a product	PO1, PO2
CO5	Demonstrate the inventory control and personnel management in an industry	PO1, PO2

Text books:

1. Industrial Engineering and Management, 17/e, 2010, O.P. Khanna, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Manufacturing Organization and Management, 2/e, 2004, Amrine, Pearson Education, New Delhi.

Reference books:

1. Industrial Engineering and Organization Management, 1/e, 2011, S.K.Sharma, Savita Sharma, S.K.Kataria and Sons Publications, New Delhi.
2. Industrial Engineering and Management, 2/e, 2009, RaviShankar, Galgotia Publications, New Delhi.
3. Production and Operations Management, 3/e, 2012, Panneer Selvam, Pearson Education, New Delhi.
4. Motion and Time Study: Design and Measurement of work, 7/e, 2009, Ralph M Barnes, Wiley India Pvt, Ltd., New Delhi.
5. Operations Management, 10/e, 2003, Chase, Jacobs, Aquilano, Tata McGraw-Hill Education Pvt. Ltd., Noida.

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

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC423A TOTAL QUALITY MANAGEMENT

Course Educational Objectives:

CEO1: To understand the concepts of total quality management, and Contributions of TQM Gurus

CEO2: To learn TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.

CEO3: To study the basic need of quality control and process control in an organization

CEO4: To learn the traditional and modern TQM tools and techniques

CEO5: To study the quality standard, requirements and elements in Quality management system

UNIT – 1: INTRODUCTION

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

Leadership – Strategic quality planning – Quality statements – Customer focus, customer orientation, customer satisfaction, customer complaints and customer retention – Employee involvement – Motivation – Empowerment – Team 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

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

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector – Bench marking – Reason to bench mark – Bench marking process – FMEA – Stages – Types – Quality circles – Quality function development (QFD) – Taguchi quality loss function – TPM – Concepts – Improvement needs – Cost of quality – Performance measures.

UNIT – 5: QUALITY SYSTEMS

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, documentation, quality auditing – QS 9000 – ISO 14000 – Concepts, requirements and benefits – TQM implementation in manufacturing and service sectors.

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 Gurus	**PO1,PO8, PO12**
CO2	Understand the TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.	**PO1,PO8, PO9,PO12**
CO3	Illustrate the basic need of quality control and process control in an organization	**PO1,PO5,PO9,PO12**
CO4	Summarize the traditional and modern TQM tools and techniques	**PO1,PO2,PO12**
CO5	Realize the quality standard, requirements and elements in Quality management system	**PO1,PO8,PO12**

Text Books:

1. Total Quality Management, Dale.H.Besterfiled, 3/e, 2010, Pearson Education, New Delhi.
2. The Management and Control of Quality, James R.Evans and William M.Lindsay, 6/e, 2005, South-Western (Thomson Learning) Publications, New Delhi.

Reference Books:

1. Total Quality Management, Suganthi.L and Anand Samuel, 2006, Prentice Hall (India) Pvt. Ltd.
2. Total Quality Management-Text and Cases, Janakiraman. B and Gopal .R.K., 2006, Prentice Hall (India) Pvt. Ltd.
3. Introduction to Statistical Quality Control, Douglas.C. Montgomery, 7/e, 2012, John Wiley.
4. Quality Management, Kaniskha Bedi, 1/e, 2006, Oxford University Press, New Delhi.
5. TQM-Text with Cases, Oakland, J.S. Butterworth, 3/e, 2003, Oxford University Press, New Delhi.

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	-	-	-	-	-	-	2	-	-	-	2
CO.2	3	-	-	-	-	-	-	2	2	-	-	2
CO.3	3	-	-	-	2	-	-	-	3	-	-	2
CO.4	3	2	-	-	-	-	-	-	-	-	-	2
CO.5	3	-	-	-	-	-	-	2	-	-	-	2
CO*	3	2	-	-	2	-	-	2	2.5	-	-	2

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC423B PRINCIPLES OF MANAGEMENT

Course Educational Objectives:

CEO1: To identify 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

CEO2: To interpret 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

.**CEO3**: To Justify 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.

CEO4: To Apply 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

CEO5: To 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

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, Students will be able to		POs related to COs
CO1	Identify 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,PO7,PO8
CO2	Interpret 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
CO3	Justify 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.	PO9
CO4	Apply 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.	PO9,PO10
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,PO7,PO8

Text Books:

1. Principles of Management, M. Govindarajan and S. Natarajan, Prentice Hall of India Pvt. Ltd.
2. Essentials of Management, Andrew J. Dubrin, 7/e, 2007, Thomson South western.

Reference Books:

1. Principles of Management, Harold Koontz, Cyril O'Donnell, 2010, Tata Mcgraw Hill, New Delhi.
2. Management, Stephen P. Robbins and Mary Coulter, 8/e, Prentice Hall of India.
3. Principles of Management, Charles W.L Hill, Steven L McShane, 2007, Mcgraw Hill Education, Special Indian Edition.
4. Management-A Competency Based Approach, Hellriegel, Slocum and Jackson, 10/e, 2007, Thomson South Western.
5. Management – A global and Entrepreneurial Perspective, Harold Koontz, Heinz Weihrich and mark V Cannice, 12/e, 2007, Tata Mcgraw Hill, New Delhi.

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

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC423C PRODUCTION AND OPERATIONS MANAGEMENT

Course Educational Objectives:

CEO1: To Understand the scope of operations management and it's functional areas
CEO2: To study the requirement and selection of good forecasting methods and techniques
CEO3: To understand the concept of aggregate planning and material requirement planning
CEO4: To study the systematic approach to capacity planning and capacity management techniques
CEO5: To understand the production activity control and lean manufacturing in an operational management

UNIT – 1: INTRODUCTION
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
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
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 rules – Master production schedule (MPS) – Procedure for developing MPS – MRP – Lot sizing methods of MRP – MRP implementation issues.

UNIT – 4: CAPACITY MANAGEMENT
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 – MRP-II – Introduction to ERP – Introduction TOC.

UNIT – 5: PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING
Objectives and activities of production activity control – Introduction to scheduling in different types of production systems – Lean manufacturing – Principles – Activities – Tools and techniques – Case studies.

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, PO6
CO2	Understand the requirement and selection of good forecasting methods and techniques.	PO5, PO6
CO3	Illustrate the concept of aggregate planning and material requirement planning	PO1,PO6
CO4	Summarize the systematic approach to capacity planning and capacity management techniques	PO1, PO5
CO5	Understand the production activity control and lean manufacturing in an operational management	PO2, PO5

Text Books:

1. Production and Operations Management, K.Aswathappa, K.Shridhara Bhat, 2/e, 2010, Himalaya Publishing House, New Delhi.
2. Theory and Problems in Production and Operations Management, S.N.Chary, 3/e, 2004, Tata Mcgraw Hill, New Delhi.

Reference Books:

1. Production and Operations Management, J.P.Saxena, 2/e, 2011, Tata Mcgraw Hill, New Delhi.
2. Production and Operations Management, Panneerselvam. R, 2012, PHI.
3. Operations Management, Norman Gaither, Greg Frazier, 2002, Thomson Learning.
4. Operations Management Strategy and Analysis, Lee J.Krajewski, Larry P.Ritzman, 2003, PHI.
5. Production Planning and Inventory Control, Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington, 2009, PHI.

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

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC423D PROCESS PLANNING AND COST ESTIMATION

Course Educational Objectives:

CEO1: To know the basics and objectives of work study, method study, time study and industrial ergonomics
CEO2: To explain the various principles, tools & techniques of Process planning.
CEO3: To evaluate the costing and estimation, the concepts of allocation of over head charges and Calculation of depreciation cost
CEO4: To estimation of production cost for all manufacturing Process
CEO5: To estimate the Machining Time in different Lathe Operations ,in machine shop

UNIT – 1: WORK STUDY AND ERGONOMICS
Work study: Method study, objectives procedure, recording techniques, work measurements, work sampling, analytical estimating, synthesis and PMTS. **Ergonomics:** Concepts, ergonomics principles applied in design and control, machines and controls and layout of workplace.

UNIT – 2: PROCESS PLANNING
Process Planning: Aims and objectives, place of process planning in manufacturing cycle, drawing interpretation, dimensional tolerance Vs production processes **–** Design of a process plan – Selection of production processes, tools and process parameters positioning and work holding devices, selection of inspection devices and tools, documenting the process plan, simple case studies **–** Computer-aided process planning (CAPP) – Benefits, architecture and approaches.

UNIT – 3: INTRODUCTION TO COST ESTIMATION
Cost estimating – Cost accounting – Component of cost estimation – Cost estimation procedure – Costing – Elements of cost **–** Importance, purpose of cost estimation **–** Classification of costs **–** Overhead expenses **–** Break-even analysis – Types of estimates – Methods of estimates – Allowances in estimation – Estimation of material cost, labour cost and over head cost.

UNIT – 4: PRODUCTION COST ESTIMATION
Estimation of production cost for **–** Casting processes **–** Welding processes and Forging processes.
UNIT – 5: COST ESTIMATION AND MACHINING TIME FOR MACHINE SHOP
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.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the basics and objectives of work study, method study, time study and industrial ergonomics	PO1, PO2, PO3
CO2	Explain the various principles, tools & techniques of Process planning	PO1, PO2, PO3
CO3	Evaluate the costing and estimation, the concepts of allocation of over head charges and Calculation of depreciation cost	PO1, PO6, PO11
CO4	Estimate the production cost for all the manufacturing Process	PO1, PO11
CO5	Estimate the Machining Time in different Lathe Operations, in machine shop	PO1, PO2, PO3

Text Books:

1. Mechanical Estimating and Costing, Sinha.B.P, 1995, Tata McGraw-Hill, Publishing Co.
2. Process Planning and Cost Estimation, M. Adithan, 2007, New Age International Publishers.

Reference Books:

1. Estimating and Costing for the Metal Manufacturing Industries, Robert Creese, M. Adithan, B.S Pabla, Marcel Dekker, 1992.
2. Manufacturing Processes and Systems, Phillip F. Ostwald, Jairo Munoz, 9/e, 2002, Wiley student edition.
3. Production and Costing, G.B.S. Narang, V. Kumar, 2000, Khanna Publishers.
4. Product Design and manufacturing, Chitale, A, K., and Gupta, R. C, 1997, Prentice Hall of India, New Delhi.
5. Operations Management, Russell.R.S and Tailor.B.W, 4/e, 2003, PHI.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	2	-	-	-	-	2	-	-	-	-	2	-
CO.4	2	-	-	-	-		-	-	-	-	2	-
CO.5	3	2	2	-	-		-	-	-	-	-	-
CO*	**2.2**	**2**	**2**	-	-	2	-	-	-	-	**2**	-

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC424A MODERN MACHINING PROCESSES

Course Educational Objectives:

CEO1: To understand the working principles of mechanical energy based machining process.
CEO2: To learn electric discharge machining and wire cut EDM process for machining
CEO3: To understand the working principles of thermal energy based machining process.
CEO4: To know the chemical based and electro chemical based machining process.
CEO5: To learn advanced surface finishing processes and recent developments in the non-traditional machining processes.

UNIT – 1: MECHANICAL ADVANCED MACHINING PROCESS

Introduction: Need for non-traditional machining methods – Classification of modern machining processes – Considerations in process selection materials and applications. **Abrasive Jet, Water Jet and Abrasive Water Jet Machining:** 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

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.

UNIT – 3: ELECTRON BEAM AND LASER BEAM MACHINING PROCESS

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

UNIT – 4: ELECTRO CHEMICAL AND CHEMICAL ADVANCED MACHINING PROCESS

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.

UNIT – 5: OTHER ADVANCED MACHINING PROCESS

Electro Stream Drilling: Principle and working – Process performance. **Magnetic Abrasive Finishing:** Principle and working, material removal and surface finish and applications. **Shaped Tube Electrolytic Machining:** Principle and working, applications. **Rapid Prototyping:** Classification – Stereo lithography - Selective laser sintering and applications.

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,PO3,PO7**
CO2	Explain electric discharge machining and wire cut EDM process for machining	**PO1,PO2,PO7**
CO3	Understand the working principles of thermal energy based machining process	**PO1,PO2,PO3,PO7**
CO4	Explain the chemical based and electro chemical based machining process.	**PO1,PO2,PO3,PO7**
CO5	Summarize the advanced surface finishing processes and recent developments in the non-traditional machining processes.	**PO1**

Text Books:

1. Advanced Machining Processes, V. K. Jain, 2002, Allied Publishers Pvt. Ltd., New Delhi.
2. Modern Machining Processes, Pandey P.C. and Shan H.S., 1980,Tata McGraw Hill, New Delhi.

Reference Books:

1. Unconventional Machining Process, M Adithan, 2014, Atlantic Publications, New Delhi
2. Non-Traditional Manufacturing Processes, G.F., Marcel Dekker Inc., New York 1987.
3. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmid, 2013, Prentice Hall.
4. Introduction to Micromachining, V. K. Jain, 2014, Narosa publishing House, New Delhi.
5. Advanced Machining, Brahem T. Smith, 1989, I.F.S., U.K.

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	-	-	-	-	-
CO.3	3	2	2	-	-	-	2	-	-	-	-	-
CO.4	3	2	2	-	-	-	2	-	-	-	-	-
CO.5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	2	-	-	-	-	-

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC424B ADDITIVE MANUFACTURING TECHNOLOGY

Course Educational Objectives:

CEO1: To understand the need and development of additive manufacturing technology.

CEO2: To learn the design for additive manufacturing and tool design

CEO3: To know the parameters of photo polymerization and powder bed fusion processes

CEO4: To explain extrusion based and sheet lamination processes

CEO5: To demonstrate the printing processes and beam deposition processes

UNIT – 1: BASIC CONCEPT

Overview: Need **–** Development of additive manufacturing technology **–** Principle – AM process chain **–** Classification – Rapid prototyping **–** Rapid tooling – Rapid manufacturing – Applications **–** Benefits – Case studies

UNIT – 2: DESIGN FOR ADDITIVE MANUFACTURING

Design Tools: Data processing **–** CAD model preparation – Part orientation and support structure generation – Model slicing – Tool path generation. **Design for Additive Manufacturing:** Concepts and objectives **–** AM unique capabilities – DFAM for part quality improvement **–** Customized design and fabrication for medical applications.

UNIT – 3: PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES

Photo Polymerization: SLA **–** Photo curable materials – Process **–** Advantages and applications. **Powder Bed Fusion:** SLS **–** Process description – Powder fusion mechanism – Process Parameters – Typical materials and application **–** Electron beam melting.

UNIT – 4: EXTRUSION BASED AND SHEET LAMINATION PROCESSES

Extrusion Based System: FDM **–** Introduction – Basic principle – Materials – Applications and limitations – Bioextrusion. **Sheet Lamination Process:** LOM **–** Gluing or adhesive bonding – Thermal bonding.

UNIT – 5: PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES

Printing Processes: Droplet formation technologies – Continuous mode – Drop on demand mode – Three dimensional printing – Advantages – Bioplotter. **Beam Deposition Process:** LENS **–** Process description – Material delivery – Process parameters – Materials – Benefits – Applications.

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, PO3
CO2	Explain the design for additive manufacturing and tool design	PO1, PO2, PO3
CO3	Illustrate the parameters of photo polymerization and powder bed fusion processes	PO1, PO2
CO4	Explain extrusion based and sheet lamination processes	PO1, PO2, PO3
CO5	Summarize the printing processes and beam deposition processes	PO1, PO2

Text Books:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W.Rosen, Brent Stucker, 2010, Springer.
2. Rapid Prototyping: Principles and Applications, Chua C.K., Leong K.F., and Lim C.S., 3/e, 2010, World Scientific Publishers.

Reference Books:

1. Rapid Prototyping: Theory and Practice, Kamrani A.K. and Nasr E.A., 2006, Springer.
2. Design for Additive Manufacturing, Tom Page, 2012, Lambert Academic Publishing.
3. Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing, Gebhardt, 2011, Hanser Gardner Publication.
4. Rapid Manufacturing: The Technologies and Application of RPT and Rapid Tooling, Pham D.T. and Dimov S.S., 2001, Springer, London.
5. Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, Liou L.W. and Liou F.W., 2007, CRC Press.

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

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC424C SUSTAINABLE AND GREEN MANUFACTURING

Course Educational Objectives:

CEO1: To learn concept of triple bottom line, environmental, economic and social dimensions of sustainability.

CEO2: To evaluate the performance and Strategic environmental impact assessments of Sustainability

CEO3: To know the concepts of competitive strategy and manufacturing strategies

CEO4: To learn the basics involved in Green manufacturing,

CEO5: To study the importance of recycling and life cycle assessment

UNIT – 1: INTRODUCTION TO SUSTAINABLE MANUFACTURING

Sustainable manufacturing – Concept of triple bottom line, environmental, economic and social dimensions of sustainability, sustainable product development – Various phases.

UNIT – 2: EVALUATING SUSTAINABILITY

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

Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme – 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

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

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.

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, PO2, PO3
CO2	Evaluate the performance and Strategic environmental impact assessments of sustainability	PO1, PO2, PO7
CO3	Understand the concepts of competitive strategy and manufacturing strategies	PO1, PO2
CO4	Explain the basics involved in Green manufacturing	PO1, PO2, PO6
CO5	Summarize the importance of recycling and life cycle assessment	PO1, PO2,PO6

Text Books:

1. Sustainable Manufacturing, Davim, J.P., 2010, John Wiley & Sons.
2. Green Manufacturing, Dornfield David, 2012, Springer.

Reference Books:

1. Sustainable Manufacturing: Shaping Global Value Creation, Seliger, G, 2012, Springer.
2. Greener Manufacturing and Operations: From Design to Delivery and Back, Joseph Sarkis, 2001, Greenleaf Pub.
3. Green Manufacturing Processes and Systems, Davim.J.Pauls, 2013, Springer.
4. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar.
5. 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	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	2	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	2	-	-	-	-	-	-
CO.5	3	2	-	-	-	2	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**

IV B.Tech II Semester

L	T	P	C
3	1	0	3

16MEC424D NON-DESTRUCTIVE EVALUATION AND TESTING

Course Educational Objectives:

CEO1: To learn the basics of non-destructive testing and selection of visual inspection methods.
CEO2: To know the liquid penetrate testing and magnetic particle testing in NDT
CEO3: To describe the contact and non-contact inspection methods in thermographs and eddy current testing
CEO4: To develop the knowledge in ultrasonic testing and acoustic emission testing
CEO5: To impart knowledge on various sources of radiography in non-destructive evaluation and testing methods.

UNIT – 1: INTRODUCTION AND VISUAL INSPECTION METHODS

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

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 need, methods, advantages and limitations, applications, magnetic rubber inspection, magnetic printing, magnetic painting.

UNIT – 3: THERMOGRAPHY AND EDDY CURRENT TESTING

Thermography: Introduction, principle, contact and non-contact inspection methods, active and passive methods, liquid crystal – Concept, example, 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

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

Introduction, principle, X-ray production, gamma ray sources, tubing materials, X-ray tubing 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, digital radiography – Film digitization, direct radiography and computed radiography, computed tomography, gamma ray radiography, safety in X-ray and gamma ray radiography.

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. Introduction to Nondestructive Testing: A Training Guide, Paul E Mix, 2/e, 2005, Wiley, New Jersey.
2. Practical Non-Destructive Testing, Baldev Raj, T.Jayakumar, M.Thavasimuthu, 2009, Narosa Publishing House.

Reference Books:

1. Non-Destructive Testing Techniques, Ravi Prakash, 1/e, 2010, New Age International Publishers.
2. Handbook of Nondestructive Evaluation, Charles, J. Hellier, 2001, McGraw Hill, New York.
3. Non-Destructive Evaluation and Quality Control, ASM Metals Handbook Vol-17, American Society of Metals, Metals Park, 2000, Ohio, USA.
4. Infrared Thermography, G. Gaussorgues, Chapman and Hall, 1994, University Press, Cambridge.
5. Non-Destructive Testing and Evaluation of Materials, J Prasad, C G K Nair, 2008, Tata McGraw Hill Education Private Ltd.

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
18	0	0	10

16MEC425 PROJECT WORK

Course Educational Objectives:

CEO1: To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
CEO2: The main objective of the project work is for the students to learn and experience all the major phases and processes involved in solving "real life engineering problems".

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.

Manual: Refer project work manual for evaluation

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
CO.4	-	-	-	3	-	-	-	-	-	-	-	-	3	3
CO.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
CO.6	-	-	-	-	-	3	-	-	-	-	-	-	3	3
CO.7	-	-	-	-	-	-	3	-	-	-	-	-	3	3
CO.8	-	-	-	-	-	-	-	3	-	-	-	-	3	3
CO.9	-	-	-	-	-	-	-	-	3	-	-	-	3	3
CO.10	-	-	-	-	-	-	-	-	-	3	-	-	3	3
CO.11	-	-	-	-	-	-	-	-	-	-	3	-	3	3
CO.12	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3

OPEN ELECTIVE-I

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OSAH321 LASERS AND FIBER OPTICS

Course Educational Objectives:

CEO1: To acquire knowledge on fundamentals of LASERS

CEO2: To study the working of different types of LASERS

CEO3: To develop knowledge on applications of LASERS in various fields

CEO4: To gain knowledge in fundamentals of Optical fiber, construction, types and attenuations

CEO5: To develop knowledge on applications of Optical fibers in various fields

UNIT – 1: LASERS INTRODUCTION

Introduction, properties of lasers, spontaneous emission, stimulated absorption and stimulated emission, population inversion, conditions to achieve population inversion, different pumping mechanisms, einstein coefficients.

UNIT – 2: TYPES OF LASERS

Laser types, ruby laser, helium-neon laser, CO_2 laser, semi conductor junction laser, dye laser.

UNIT – 3: APPLICATIONS OF LASERS

Holography, laser fusion reaction, light wave communication using lasers, stimulated Raman effect, lasers in industry (laser welding, hole drilling, laser cutting), lasers in medicine.

UNIT – 4: OPTICAL FIBERS

Introduction, principle of optical fiber, construction of fiber, propagation of laser through the fibers, fiber types.

UNIT – 5: APPLICATION OF FIBERS

Fiber optic communication system, pressure sensor, liquid level sensor, fiber optic endoscope, optical fibers in computer networks.

Course Outcomes:

On successful completion of the course the student will be able to,		**POs related to COs**
CO1	**Acquire** the basic knowledge on LASERS	**PO1, PO12**
CO2	**Identify** different types of LASERS	**PO1, PO12**
CO3	**Develops** knowledge on different applications of LASERS	**PO1, PO12**
CO4	**Acquire** the basic knowledge on Optical Fibers	**PO1,PO12**
CO5	**Develops** knowledge on different applications of Optical Fibers	**PO1,PO12**

Reference Books:

1. Lasers Theory and Applications, K.Thyagarajan and A.K.Ghatak: Macmillan India Limited, New Delhi.
2. Lasers and Non-Linear Opitics, BBLaud, 2/e, NewAge International (P) limited, Publishers, New Delhi.
3. An Introduction to Fiber Optic Systems, John Powers, Richard D Irwin, 2/e, A Times Mirror Higher Education, Inc Company, USA.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OSAH322 ADVANCED MATHEMATICS

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.

CEO2: To provide knowledge on

- Numerical methods to find a root of an equation
- Analyzing the consistency, stability and convergence of a numerical scheme.
- Number of numerical methods for solving integral equations.
- The relations ship between differential and integral equations, and how to change from one to another.

CEO3: To learn different iterative methods which can be used to solve algebraic and transcendental equations. .

CEO4: To understand, Integral Equations ,Integral Equations come from real life physical problems

CEO5: To explore the practical Knowledge, for each type of PDEs (hyperbolic, parabolic and elliptic), what kind of numerical methods are best suited for and the reasons behind these choices

CEO6: To Learn the principles for designing numerical schemes for PDEs, in particular, finite difference schemes.

CEO7: To learn Differential Equations and Partial Differential Equations that can be transformed into Integral and integro- differential equations

UNIT – 1: SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Introduction – Secant Method or chord method – Newton Raphson extended formula: Chebyshev method – Horner's method – Muller's method.

UNIT – 2: PARTIAL DIFFERENTIAL EQUATIONS

Introduction – Formation of partial differential equations – Solution of a partial differential –Equations solvable by direct integration – Linear equation of first order – Non linear equation of first order – Charpit's method – Homogenous linear equations with constant coefficient – Rules of finding complementary function – Rules of finding particular integral – Working procedure to solve homogeneous linear equations of any order.

UNIT – 3: NUMRICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Introduction – Solution of Laplace equation, solution of poisons equation, solution of heat equation (Crank-Nicolson method) – Solution of wave equation.

UNIT – 4: NUMERICAL SOLUTION OF MATRIX COMPUTATION

Algebraic equations – Numerical solution - Matrix computation: Iterative methods – Jacobi method – Gauss-Seidel method – Successive over relaxation method.

UNIT – 5: INTEGRAL EQUATIONS

Introduction – Definition – Conversion of a linear differential equation to an integral equation and vice versa – Conversion of boundary value problem into integral equation using Green's function – Solution of an integral equation – Abel's integral equation.

Course Outcomes:

On completion of this course, the students will be able to:		**POs related to COs**
CO1	Acquire knowledge in necessity and techniques of advanced mathematical methods, to develop analytical and designing skills in mathematical models through numerial techniques.	PO1,PO2
CO2	Demonstrate knowledge in Partial differential equations of higher order, mathematical modelling through partial differential equations,	PO1,PO2,
CO3	Demonstrate knowledge in Numrical solution of partial differential equations.Develop analytical and numerical skillsin solving Partial Differential Equations	PO1,PO2,P03
CO4	Acquire knowledge in Numerical Solution of Matrix Computation. Develop designingand analytical skills in applications of Advanced Numerical Techniques for solving system of equations by matrix computations.	PO1,PO2
CO5	Acquire knowledge in solving Integral equation and developdesigningand analyticalskill in conversion of boundary value problem into integral equation	PO1,PO2,PO3 PO4

Text Books:

1. Numerical Methods for Scientific and Engineering. Computation , M.K. Jain, S.R.K. Iyengar R.K. Jain, New Age international Publishers.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publishers.

Reference Books:

1. Mathematical Methods, Pal, Oxford.
2. Introduction to Numerical Analysis, S.S. Sastry, PHI.
3. Mathematical Methods, S.K.V.S. Sri Ramachary, M. Bhujanga Rao, P.B. Bhaskar Rao & P.S. Subramanyam, BS Publications.
4. Linear Integral Equations, Theory and Technique, 1/e, 1971, Ram P .Kanwal, Academic Press, New York.
5. Numerical Methods of Engineers, D V Griffiths and I M Smith.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OSAH323 MATHEMATICAL MODELLING

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques thatare essential for an engineering course.

CEO2: To provide knowledge on

- Mathematical modelling through trigonometry
- Designing mathematical models through Ordinary differential equations
- Mathematical modelling through Linear Programming
- Designing mathematical models through Difference equations
- Partial differential equations based mathematical models

CEO3: To learn the need and techniques of mathematical modelling, to design mathematical models through trigonometry.

CEO4: To understand, familiarize the knowledge of the significance of ordinary differential equations based mathematical models through linear growth and decay models, compartment models and geometrical problems.

CEO5: To explore the practical utility of mathematical models through linear programming including transportation and assignment models.

CEO6: To learn the concepts of linear difference equations with constant coefficients and understand some simple models through difference equations

CEO7: 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: MATHEMATICAL MODELLING: NEED, TECHNIQUES, CLASSIFICATIONS AND SIMPLE ILLUSTRATIONS

The technique of mathematical modelling – Classification of mathematical models – Some characteristics of mathematical models – Mathematical modelling through trigonometry, calculus – Limitations of mathematical modelling.

UNIT – 2: MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Mathematical modelling through differential equations – Linear growth and decay models – Compartment models – Mathematical modelling in dynamics through ordinary differential equations of first order – Mathematical modelling of geometrical problems through ordinary differential equations of first order.

UNIT – 3: MATHEMATICAL MODELLING THROUGH LINEAR PROGRAMMING

Mathematical modelling through linear programming – Graphical method – Simplex method – Transportation and assignment models.

UNIT – 4: MATHEMATICAL MODELLING THROUGH DIFFERENCE EQUATIONS

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 MODELLING THROUGH PARTIAL DIFFERENTIAL EQUATIONS

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.

Course Outcomes:

After the completion of this course, a successful student is able to		**POs related to COs**
CO1	Acquire knowledge in necessity and techniques of mathematical modelling, to develop analytical and designing skills in mathematical models through trigonometry.	PO1,PO2
CO2	Demonstrate knowledge in Ordinary differential equations of first order, mathematical modelling through differential equations, Linear growth and decay modelsand Develop analytical skills in modelling geometrical problems through Ordinary differential equations of first order	PO1,PO2
CO3	Demonstrate knowledge in Linear programming and various techniques including Graphical method and Simplex method. Develop analytical and designing skillsin modelling and solving Transportation and assignment models	PO1,PO2,P03
CO4	Acquire knowledge in difference equations, theory of difference equations with constant coefficients. Develop designing and analytical skills in modelling and solving mathematical models difference equations in probability theory.	PO1,PO2
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, 1999, John Wiley, NewYork.

Reference Books:

1. Principles of Mathematical Modelling, Clive L. Dyne, 2004, Elsevier Publication.
2. Mathematical Modelling - A Case Study Approach, R Illner, C Sean Bohun, S McCollum, T van Roode, 2005, AMS Publication.
3. Mathematical Modelling, D N P Murthy, N W Page, E Y Rodin, 1990, Pergamon Press.
4. OR Theory and Applications, J.K. Sharma, 1998, Mac Milian India Ltd.
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
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCSE321 OBJECT ORIENTED PROGRAMMING

Course Educational Objectives:

CEO1: To study the syntax, semantics and features of Java Programming Language.
CEO2: To understand the principles of packages and inheritance.
CEO3: To develop Java application programs using exceptions and interfaces.
CEO4: To gain knowledge on multithreading and applets
CEO5: To create GUI applications & perform event handling.

UNIT – 1: OBJECT ORIENTED THINKING

Need for OOP paradigm, OOP concepts, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions. C++ class overview-class definition, objects, class members, access control, class scope, constructors and destructors, inline functions, static class members, this pointer, friend functions, dynamic memory allocation and de-allocation.

UNIT – 2: POLYMORPHISM AND INHERITANCE

Function overloading, operator overloading, generic programming, function and class templates, inheritance basics, base and derived classes, different types of inheritance, base class access control, virtual base class, function overriding, run time polymorphism using virtual functions, abstract classes.

UNIT – 3: BASICS OF JAVA

History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, classes and objects – Concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT – 4: INHERITANCE, PACKAGES AND INTERFACES

Inheritance: Basics of inheritance, using super, creating a multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the object class. **Packages:** Defining, creating and accessing a package, understanding CLASSPATH, importing packages. **Interfaces:** differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT – 5: EXCEPTION HANDLING AND MULTITHREADING

Exception Handling: Exception handling fundamentals, exception types, uncaught exceptions, exception hierarchy, using try-catch, throw, throws, finally, creating own exception sub classes. **Multithreading:** Multithreading, differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads.

Course Outcomes:

On Successful completion of this course student should 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. Object-Oriented Programming with C++, E Balaguruswamy, 6/e, Tata McGraw-Hill, New Delhi.
2. Java; The complete Reference, Herbert Schildt, 7/e, Tata McGraw-Hill, New Delhi.

Reference Books:

1. Introduction to Java programming, Y. Daniel Liang, 6/e, Pearson Education.
2. Fundamentals, Core Java 2 Vol.1, Cay.S.Horstmann and Gary Cornell, 7/e, Pearson Education.
3. C++ Primer, S.B. Lippman, 3/e, Pearson Education.
4. Problem Solving with C++ and The OOP, W.Savitch, 4/e, Pearson Education.
5. The C++ Programming Language, B. Stroustrup, 3/e, Pearson Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2
CO3	3	3	2	3	3	-	-	-	-	-	-	2
CO4	3	3	2	-	3	-	-	-	-	-	-	-
CO5	3	3	2	-	3	-	-	-	-	-	-	-
CO*	**3**	**3**	**2.4**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCSE322 PYTHON PROGRAMMING

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, software development method, applying software development method, flow charts, 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 associatively, 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. **Computational 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. **Computational 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. Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Charles Dierbach, 2016, Wiley India Edition.
2. Programming Python, Mark Lutz, 4/e, 2011, O'Reilly Publications.

Reference Book:

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

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	2	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-
CO4	3	3	2	-	2	-	-	-	-	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	-	-
CO*	**3**	**2.8**	**2.3**	**2**	**2**	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCSE323 WEB PROGRAMMING

Course Educational Objectives:

CEO1: To understand how to write a valid HTML document involving a variety of element types, including hyperlinks, images, lists, tables, and forms.

CEO2: To Analyze advanced concepts of HTML5 and use CSS to implement a variety of presentation effects in HTML documents.

CEO3: To develop client-side scripting on web pages to provide interactivity and rapid response to user actions at client side.

CEO4: To understand basics of server side scripting language.

CEO5: To gain knowledge about sending the data from client side to server, creating sessions and interact with database.

UNIT – 1: INTRODUCTION TO INTERNET AND WORLD WIDE WEB

Introduction to networks, LAN, MAN and WAN, history of the internet, E-mail concepts, sending and receiving files by E-mail, intranet, web system architecture, exploring HTTP, URL, domain name system, web browsers, web pages.

UNIT – 2: HYPERTEXT MARKUP LANGUAGE AND WEB DESIGN

Basics of HTML, HTML document display, formatting text, link, lists, images, tables, forms, frames, website design consideration.

UNIT – 3: USAGE OF CASCADING STYLE SHEET

Syntax of CSS, style sheets types, properties and text attributes padding, list properties, list properties, positioning, margins, colors, properties and table attributes.

UNIT – 4: FUNDAMENTALS OF JAVA SCRIPT

DHTML, HTML and JavaScript, JavaScript elements, variables, operators, flow control statements, arrays, functions, event handling, browsers and JavaScript, web pages and JavaScript, frames and JavaScript, validation of user form.

UNIT – 5: SERVER-SIDE PROGRAMMING

PHP: client-side scripting and server-side scripting, introduction to PHP, data types, variables, constants, expressions, string interpolation, control structures, functions, arrays, embedding PHP code in web pages.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	Create web pages using different elements of HTML	PO1,PO2,PO5
CO2	Apply styles to the HTML elements in web pages using CSS	PO1,PO2,PO3,PO5
CO3	Use client side scripting to make the web pages responsive and interactive.	PO1,PO2,PO3,PO5
CO4	Demonstrate knowledge on basics of server side scripting language: PHP	PO1,PO2,PO3,PO5
CO5	Develop web applications with database interaction	PO1,PO2,PO4,PO5

Text Books:

1. A Complete Guide to Internet and Web Programming, Deven N. Shah, 2012, Dream Tech Press, New Delhi.
2. Beginning PHP and MySQL, W. Jason Gilmore, 4/e, 2011, Apress.

References Books:

1. Web Programming, Building Internet Applications, Chris Bates, 3/e, Dream Tech Press, New Delhi.
2. Internet and Web Technologies, Raj Kamal, Tata McGraw Hill, New Delhi.
3. Internet: The Complete Reference, Margaret Levine Young, 2/e, Tata McGraw Hill, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	3	-	-	-	-	-	-	-
CO2	2	3	3	-	3	-	-	-	-	-	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	-
CO4	2	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	-	2	3	-	-	-	-	-	-	-
CO*	**2.4**	**2.8**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV321 CONSTRUCTION EQUIPMENT, PLANNING AND MANAGEMENT

Course Educational Objectives:

CEO1: To learn basics of construction management

CEO2: To learn various equipment and financial aspects involved in construction project management

CEO3: To develop ability to analyze and develop network diagrams for better monitoring of the project

UNIT – 1: FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY

Fundamentals of Construction Technology: 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. **Preparatory Work and Implementation:** Site layout – Infrastructure development – Construction methods – Construction materials – Deployment of construction equipment – Prefabrication in construction – False work and temporary works.

UNIT – 2: EARTHWORK AND CONSTRUCTION EQUIPMENT

Earthwork: Classification of soils – Project site – Development – Setting out – Mechanized excavation – Groundwater control – Trenchless (no-dig) technology – Grading – Dredging. **Construction Equipment:** Introduction to construction equipment: their contribution and importance in construction industry classification of construction equipment – Earth moving equipment – Excavation equipment – Hauling equipment – Earth-compaction equipment – Hoisting equipment – Concreting plant and equipment – Selection of equipment – Task consideration – Cost consideration – Factors affecting the selection – Factors affecting cost owning and operating the equipment – Equipment maintenance.

UNIT – 3: PROJECT MANAGEMENT

Project Management: 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 net work problems. **Elements of Network and Development of Network:** 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 – 4: PERT

Time Estimates and Time Computations: Introduction – Uncertainties: Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time Problems – Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems.

UNIT – 5: CPM

Network Analysis: Introduction - Slack – Critical path – Illustrative examples – Probability of meeting scheduled date Problems – 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.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	Describe fundamentals of construction technology and preparatory works	**PO1, PO6, PO7**
CO2	List various construction equipment and explain associate factors in choosing the right one	**PO1, PSO2**
CO3	Analyze and develop network diagrams	**PO1, PO2, PO3, PO11**
CO4	Apply PERT and compute required parameters	**PO1, PO2, PO3, PO11**
CO5	Analyze network diagrams using CPM	**PO1, PO2, PO11**

Text Books:

1. Construction Technology, SubirK.Sarkar and SubhajitSaraswati, Oxford Higher Education Univ.Press, Delhi.
2. Project Planning and Control with PERT and CPM, Dr.Punmia, B.C, Khandelwal, K.K., Lakshmi Publications New Delhi.
1. Construction Project Management, Jha, Pearson publications, New Delhi.

Reference Books:

1. Optimal Design of Water Distribution Networks, Bhave, P.R., 2003, Narosa Publishing house.
2. Operations Research, SankarIyer, P., TMH Pubilications, New Delhi.
3. Operations Research, Ramanathan, N., TMH Pubilications, New Delhi.
4. Total Project Management, The Indian Context, Joy, P.K., Mac Millan Publishers India Limited.
5. Construction Planning, Equipment and Methods, Robert L.Peurifoy, Mcgraw Hill publishing company.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV322 REMOTE SENSING AND GIS

Course Educational Objectives:

CEO1: To know the basics, importance, analysis and applications of RS and GIS

CEO2: To study the various types of operating systems of RS and GIS

CEO3: To know the applications of RS and GIS

UNIT – 1: EMR AND ITS INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL

Definition of remote sensing and its components – Electromagnetic spectrum – Wavelength regions important to remote sensing – Wave theory, particle theory, Stefan-Boltzman and Wein's displacement law – Atmospheric scattering, absorption – Atmospheric windows – Spectral signature concepts – Typical spectral reflective characteristics of water, vegetation and soil.

UNIT – 2: PLATFORMS AND SENSORS

Types of platforms – Orbit types, sun-synchronous and geosynchronous – Passive and active sensors – Resolution concept – Pay load description of important earth resources and meteorological satellites – Airborne and space borne TIR and microwave sensors.

UNIT – 3: IMAGE INTERPRETATION AND ANALYSIS

Types of data products – Types of image interpretation – Basic elements of image interpretation – Visual interpretation keys – Digital image processing – Pre-processing – Image enhancement techniques – Multispectral image classification – Supervised and unsupervised.

UNIT – 4: GEOGRAPHIC INFORMATION SYSTEM

Introduction – Maps – Definitions – Map projections – Types of map projections – Map analysis – GIS definition – Basic components of GIS – Standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – Measurement scales – Data Base Management Systems (DBMS).

UNIT – 5: DATA ENTRY, STORAGE AND ANALYSIS

Data models – Vector and raster data – Data compression – Data input by digitization and scanning – Attribute data analysis – Integrated data analysis – Modeling in GIS highway alignment studies – Land information system.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	List various theories associated with remote sensing and spectral reflective characteristics	**PO1**
CO2	Discuss various types of platforms and sensors used in remote sensing applications	**PO1**
CO3	Know various data interpretation techniques and perform basic analysis	**PO1, PO2**
CO4	Explain basic features and components of GIS	**PO1**
CO5	Analyze the data for GIS	**PO1, PO2, PO5**

Text Books:

1. Remote Sensing and Image Interpretation, Lillesand,T.M., Kiefer, R.W. and J.W.Chipman, 5/e, 2004, John Willey and Sons Asia Pvt. Ltd., New Delhi.
2. Textbook of Remote Sensing and Geographical Information System, Anji Reddy, M. 2/e, 2001, BS Publications, Hyderabad.

Reference Books:

1. Concepts and Techniques of Geographic Information Systems,Lo. C.P.and A.K.W.Yeung, 2002, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Principles of GIS, Peter A.Burrough, Rachael A. McDonnell, 2000, Oxford University Press.
3. An Introduction to GIS, Ian Heywood, 2000, Pearson Education Asia.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV323 GREEN BUILDINGS AND ENERGY CONSERVATION

Course Educational Objectives:

CEO1: Explore alternate building materials for sustainability

CEO2: Learn mechanism of thermal flow in buildings

CEO3: Learn various governing codes and guidelines for the green buildings

UNIT – 1: GREEN BUILDING CONCEPTS

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

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

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

Material properties, energy efficiency using various materials, emerging new materials construction techniques – Techniques for roof, wall and foundations.

UNIT – 5: ECONOMY OF GREEN BUILDING

Cost of building, operation and maintenance – Green building rating system, evaluation criteria of LEED, TERI GRIHA case studies, case studies in different climate zones.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	Explain the basic features of green buildings	**PO1, PO6, PO7**
CO2	Describe various architectural features of green buildings	**PO1, PO6, PO7**
CO3	Analyze thermal flow in buildings and compute basic computations relevant to thermal flow	**PO1, PO2, PO6, PO7**
CO4	Name various green building materials and describe their basic properties	**PO1, PO6, PO7, PSO2**
CO5	Explain economy aspects of green buildings and Analyze case studies	**PO1, PO2, PO6, PO7, PO9**

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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–Hill Publishing Company, New Delhi.
2. Sustainable building design manual (Vol.II), TERI & ICAEN (Institut Catalad Energia), 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.
2. Manual of Tropical Housing and Building, Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V., 2011, Universities Press, Hyderabad.
3. Building Design and Drawing, Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan, 2008, Calicut:Spades Publishers.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OECE321 MACHINE VISION SYSTEM

Course Educational Objectives:

CEO1: To introduce theory, applications and techniques of machine vision to students

CEO2: Provide the students with an understanding of the problems involved in the development of machine vision systems.

CEO3: Introduces the "low-level" algorithms of image processing that are necessary for the "mid-level" vision or feature extraction.

CEO4: To describe and analyze the pattern recognition, and 3D analysis and modeling of objects and scenes.

CEO5: lay emphasis on the practical integration of machine vision systems, and the related applications in real time.

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UNIT – 1: INTRODUCTION

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

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.

UNIT – 3: IMAGE PROCESSING

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 – Colour image processing.

UNIT 4: IMAGE ANALYSIS

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

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.

Course Outcomes:

Upon completion of this course, the 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, PO3
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, PO3,PO4

Text Books:

1. Handbook of Machine Vision, Alexander Hornberg, 1/e, 2006, Wiley VCH.
2. Machine Vision Theory, Algorithms and Practicalities, Davis E.R., 2005, Elsevier.

Reference Books:

1. Understanding and Applying Machine Vision, Nello Zuech, 2000, Marcel Decker.
2. Introductory Techniques For 3D Computer Vision, Emanuele Trucco, Alessandro Verri, 1/e.
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
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.8**	**2**	**2**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OECE322 MEMS AND MICROSYSTEMS

Course Educational Objectives:

CEO1: To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.

CEO2: To educate on the rudiments of Micro actuators, micro accelerometers.

CEO3: To introduce various Materials of Mems and Microsystems.

CEO4: To provide knowledge on deposition of Epitoxy & etching

CEO5: To provide knowledge on Process design, Mechanical desing , Computer aided design.

UNIT – 1: OVERVIEW OF MEMS AND MICROSYSTEMS

MEMS and Microsystems – Typical mems and microsystems products – Evolution of micro fabrication – Microsystems and microelectronics – The multidisciplinary nature of microsystems design and manufacture – Microsystems and miniaturization – Application of microsystems in automotive industry – Application of microsystems in other industries introduction – Micro sensors – Micro actuation – MEMS with micro actuators – Micro accelerometers – Micro fluidics – Markets for microsystems.

UNIT – 2: WORKING PRINCIPLES OF MICROSYSTEMS

Introduction – Micro sensors – Micro actuation – MEMS with micro actuators – Micro accelerometers – Micro fluidics.

UNIT – 3: MATERIALS FOR MEMS AND MICROSYSTEMS

Introduction – Substrates and wafers – Active substrate materials – Silicon as a substrate material – Silicon compounds – Silicon piezo resistors – Gallium arsenide – Quartz – Piezoelectric crystals – Polymers – Packaging materials.

UNIT – 4: MICROSYSTEMS FABRICATION PROCESSES

Introduction – Photolithography – Ion implantation – Diffusion – Oxidation – Chemical vapor deposition – Physical vapor deposition – Sputtering – Deposition by epitaxy – Etching – Summary of micro fabrication.

UNIT – 5: MICROSYSTEM DESIGN

Introduction – Design considerations – Process design – Mechanical design – Mechanical design Using finite element method – Design of silicon die of a micro pressure sensor – Design of Micro fluidics network systems – Computer-aided design.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Be familiar with the important concepts applicable to MEMS, their fabrication.	**PO1, PO2**
CO2	Be fluent with the design, working principles of micro systems	**PO1, PO2, PO3**
CO3	To educate on the rudiments of materials of Mems and micro systems	**PO1, PO2, PO4**
CO4	To introduce the fabrication concepts of micro systems and Etching.	**PO1, PO2,PO4**
CO5	Apply the MEMS for different applications including process desing and Mechanical design	**PO1,PO2,PO3**

Text Books:

1. MEMS and MICROSYSTEMS Design and Manufacture, Tai Ran Hsu, 2012, Tata McGraw-Hill Edition.
2. Design and Manufacturing of Active Microsystems (Micro Technology and MEMS) Paperback – Import, 21 Mar 2014, Stephanus Büttgenbach , Arne Burisch Jürgen Hesselbach.
3. Radioisotope Thin-Film Powered Microsystems (MEMS Reference Shelf) Paperback – Import, 7 Nov 2012, Rajesh Duggirala , Amit Lal , Shankar Radhakrishnan

Reference Books:

1. Micro Fluidics and Bio Mems Application, Francis E.H. Tay and Choong .W.O, 1997, IEEE Press New York.
2. Micromechanics and MEMS, Trimmer William S., Ed., 1997, IEEE Press New York.
3. An Introduction to Micro Electro Mechanical Systems Engineering, Maluf, Nadim, 2000, AR Tech house, Boston.
4. Micro sensors MEMS and Smart Devices, Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, 2001, John Willy & sons Ltd.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.6**	**2**	**2**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OECE323 FOUNDATION OF NANO-ELECTRONICS

Course Educational Objectives:

CEO1:To learn and understand basic concepts of Tunneling and applications

CEO2:To know the techniques of Tunneling Microscope, Double Barrier Tunneling .

CEO3:To gain knowledge about Resolution Enhancement, Electron Lithography, micro machining.

CEO4: To acquire knowledge on Mems Devices , working principles and thermo electricity.

CEO5: TOobtain knowledge on FET, SET structures, Nano wire concepts.

UNIT – 1: INTRODUCTION TO TUNNELING

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

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

Introduction to lithography, contact, proximity printing and projection printing, resolution enhancement techniques, positive and negative photoresists, 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

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: NANOELECTRONIC DEVICES

Scaling of physical systems – Geometric scaling and electrical system scaling. the single-electron transistor: the single- electron transistor single-electron transistor logic, other SET and FET structures, carbon nano tube transistors (FETs and SETs), semiconductor nano wire FETs and SETs, molecular SETs and molecular electronics.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	To understand and analyze the fundamental physics of nano electronics	**PO1**
CO2	Describe deep insight techniques of Tunneling Microscope, Double Barrier Tunneling	**PO1,PO2**
CO3	Discuss various Properties of Resolution Enhancement, Electron Lithography, micro machining	**PO1,PO2**
CO4	Familiarize with concepts of MEMS devices	**PO1**
CO5	Acquire the knowledge on FET, SET and Molecular Electronics	**PO1,PO2,PO4**

Reference Books:

1. Nano Technology and Nano Electronics - Materials, Devices and Measurement Techniques, WR Fahrner, Springer.
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology, T.Pradeep, Tata Mc.Graw Hill.
3. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices, Karl Goser, Peter Glosekotter, Jan Dienstuhl
4. Quantum-Based Electronic Devices and Systems, M. Dutta and M.A. Stroscio, World Scientific.
5. Micro Sensors MEMS and Smart Devices, Julian W.Gardnes, Vijay K. Varda, 2001.

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	1	-	-	-	-	-	-	-	-
CO*	**3**	**1.6**	-	**1**	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OEEE321 POWER PLANT INSTRUMENTATION

Course Educational Objectives:

CEO1: To provide an overview of different methods of power generation with a particular stress on thermal power generation.

CEO2: To bring out the various measurements involved in power generation plants.

CEO3: To provide knowledge about the different types of devices used for analysis.

CEO4: To impart knowledge about the different types of controls and control loops.

CEO5: To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.

UNIT – 1: OVERVIEW OF POWER GENERATION

Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes - UP&I diagram of boiler – Cogeneration.

UNIT – 2: MEASUREMENTS IN POWER PLANTS

Electrical measurements – Current, voltage, power, frequency, power factor etc. – Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

UNIT – 3: ANALYSERS IN POWER PLANTS

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments.

UNIT – 4: CONTROL LOOPS IN BOILER

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler operation.

UNIT – 5: TURBINE-MONITORING AND CONTROL

Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Understand the basics of Power plant and power generation	**PO1**
CO2	Analyze the design of Analyzers and control loops used in power plant	**PO1, PO2**
CO3	Detailed study of the P&I diagram of various power plant.	**PO1, PO2**
CO4	Acquire knowledge on Pollution monitoring instruments	**PO1**
CO5	Know the distributed control system in power plants	**PO1**

Text Books:

1. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 2001.

Reference Books:

1. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi,1994.
2. R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.
3. E.Al. Wakil, 'Power Plant Engineering', Tata McGraw Hill, 1984

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.5**	-	-	-	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OEEE322 NEURAL NETWORKS AND FUZZY LOGIC

Course Educational Objectives:

CEO1: To understand the fundamental theory and concepts of neural networks, neuro modeling, several neural network paradigms and its applications.

CEO2: To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning.

CEO3: To know about fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.

CEO4: To understand the basics of an evolutionary computing paradigm known as genetic algorithms

CEO5: To know application of genetic algorithms for engineering optimization problems.

UNIT – 1: ARTIFICIAL NEURAL NETWORKS

Introduction – Biological neuron – Artificial neuron – Basic concepts of neural networks – Basic models of ANN connections – Mc-Culloch-pitts model – Characteristics of ANN – Artificial neuron model – Operations of artificial neuron – Types of neuron activation function – ANN Architectures – Classification taxonomy of ANN – Connectivity – Neural dynamics (activation and synaptic) – Learning strategy (supervised - unsupervised - reinforcement) – Learning rules – Types of application.

UNIT – 2: SUPERVISED LEARNING NETWORKS

Perceptron network – Perceptron learning rule – Architecture – Perceptron training algorithm – ADALINE – MADALINE – Back propagation network – BP Learning rule – Input layer computation – Hidden layer computation – Output layer computations – Radial basis function.

UNIT – 3: ASSOCIATIVE MEMORY NETWORK

Training algorithm for pattern association – Auto associative memory network – Hetero associative memory network – BAM – Hopfield network.

UNIT – 4: FUZZY LOGIC

Introduction to classical sets – Properties – Operations and relations; fuzzy sets – Member ship – Uncertainty – Operations – Properties – Fuzzy relations – Cardinalities – Membership functions – Fuzzification – Member ship value assignment – Development of rule base and decision making system – Defuzzification to crisp sets – Defuzzification methods.

UNIT – 5: GENETIC ALGORITHMS

Introduction – Basic operators and terminology in GA – Traditional Vs genetic algorithm – encoding – Fitness function – Reproduction – Cross over – Mutation operator.

Course Outcomes

On successful completion of course, student will be able to		POs related to COs
CO1	Understand importance of soft computing.	**PO1, PO2**
CO2	Understand different soft computing techniques like, Fuzzy Logic, Neural Networks and their combination.	**PO1, PO2**
CO3	Implement algorithms based on soft computing.	**PO1**
CO4	Apply soft computing techniques to solve engineering or real life problem.	**PO1**
CO5	Know the concepts of Fuzzy Logic.	**PO1, PO2**

Text Books:

1. Introduction to Artificial Neural Systems, Jacek M Zurada, 2/e , 2012 , West publishing company USA.
2. Neural Networks - Fuzzy Logic - Genetic Algorithms: Synthesis and Applications, Rajasekharan and Pai, 1/e, 2003, PHI publications, New Delhi.

Reference Books:

1. Principles of Soft Computing, S. N. Sivanandam and S.N.Deepa, 2/e, Wiley India Pvt Ltd, New Delhi.
2. Neural Networks and Learning Machines, Simon Haykin, 3/e, 2009, PHI Learning, New Delhi.
3. Soft Computing & Intelligent Systems, Madan M Gupta, 1/e, 2007, Naresh K Sinha, Elsevier India Pvt Ltd, New Delhi.

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

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OEEE323 SENSORS AND INSTRUMENTATION

Course Educational Objectives:

CEO1: To understand operation of sensors and transducers
CEO2: To gain knowledge in pressure and flow measurement using sensors
CEO3: To gain knowledge in displacement and velocity measurement using sensors
CEO4: To understand how electrical sensors are used to measure non-electrical quantities
CEO5: To understand about photoelectric phenomenon, photoelectric transducers, Photo-voltaic transducers

UNIT – 1: MEASUREMENT, INSTRUMENTATION AND CALIBRATION

Introduction, classification of transducers, performance characteristics – Static and dynamic characteristics – Errors in measurement – Gross errors, systematic errors, statistical analysis of random errors, calibration and standards – Process of calibration, classification for standards, standards for calibration.

UNIT – 2: PASSIVE ELECTRICAL TRANSDUCER-I

Introduction, resistive transducers – Resistance thermometers, hot wire resistance transducers, resistive displacement transducer, resistive strain transducer, resistive pressure transducer, resistive optical radiation transducers.

UNIT – 3: PASSIVE ELECTRICAL TRANSDUCER-II

Inductive transducers – Inductive thickness transducers, inductive displacement transducers, movable core-type inductive transducers, eddy current type inductive transducers – Capacitive transducers, capacitive thickness transducers, capacitive displacement transducers, capacitive moisture transducers.

UNIT – 4: ACTIVE ELECTRICAL TRANSDUCERS-I

Introduction, thermoelectric transducers, thermoelectric phenomenon, common thermocouple systems, piezoelectric transducers, piezoelectric phenomenon piezoelectric materials, piezoelectric force transducers, piezoelectric strain, piezoelectric torque transducers, piezoelectric pressure transducers, piezoelectric acceleration transducers – Magnetostrictive transducers, magnetostrictive force transducers, magnetostrictive acceleration transducers, Magnetostrictive torsion transducers, Hall effect transducers, and application of Hall transducer.

UNIT – 5: ACTIVE ELECTRICAL TRANSDUCERS-II

Electromechanical transducers – Tachometers, variable reluctance tachometers – Electrodynamic vibration transducers, electromagnetic pressure electromagnetic flow meter – Photoelectric transducers – Photoelectric phenomenon, photoelectric transducers, photo-volatile transducers, photo emissive transducers.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Acquire knowledge on Temperature measurement sensors.	PO1, PO2
CO2	Know the concepts of Pressure and flow measurement	PO1, PO2,
CO3	Understand Displacement and velocity measurement	PO1, PO2
CO4	Gain knowledge on electrical passive transducers.	PO1, PO2,
CO5	Understand using electrical active transducers.	PO1, PO2,

Text Books:

1. Transducers and Instrumentation, D.V.S. Murthy, 2/e, 2010, PHI Ltd.

Reference Books:

1. Measurement Systems: Applications and Design, Ernest O. Doebelin, 5/e, 2004, TMH.
2. Sensors for Measurement and Control, Peter Elgar, 1998, Addison-Wesley Longman Ltd.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**2.4**	**2.6**	-	-	-	-	-	-	-	-	-	-

OPEN ELECTIVE-II

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OSAH411 APPLICATIONS OF GRAPH THEORY

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques thatare essential for an engineering course.

CEO2: To provide knowledge on

- Graph Theory, Graph coloring
- Matrix Representation of Graphs
- Graph Based Electrical Networks
- Applications in Operations Research

CEO3: To learn the representation of graphs and understanding the Graph Isomorphism, Sub graph-Vertex degrees, Walk, Paths, Cycles-graph connection, Bipartite graphs, Trees

CEO4: To understand the Chromatic number, partitioning, Matching, covering and four colorproblem and to familiarize the knowledge of graph theory

CEO5: To understand the matrix representation of graphs, designing incidence matrix, Adjacency matrix and circuit matrix

CEO6:To identify the important graph based real time applications of electrical networks such as PLC Networks with Independent sources, LOOP circuits

CEO7: To explore the use of graphs in various applications in Operations Research such as Shortest Path between Two Points, The Travelling Salesman and Chinese Postman Problems

UNIT – 1: INTRODUCTION

Graph and simple graphs (complete graphs, complement of graph) – Graph isomorphism – Sub graph – Vertex degrees, walk, paths, cycles – Graph connection and components – Bipartite graphs – Trees – Cut edges – Cut vertices – Blocks.

UNIT – 2: COLOURING AND DIRECTED GRAPHS

Chromatic number – Chromatic – Partitioning – Chromatic polynomial – Matching – covering – Four color problem directed graphs types of directed graphs – Digraphs and binary relations –Directed paths and connectedness.

UNIT – 3: MATRIX REPRESENTATION OF GRAPHS

Introduction – Adjency matrix – Applications of Adjancy 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: ELECTRICAL NETWORK ANALYSIS

Introduction – Kirchhoff's current and Voltage laws – Loop currents and node voltages – PLC networks with independent sources: nodal analysis, loop analysis.

UNIT – 5: APPLICATIONS IN OPERATION RESEARCH

Introduction – Shortest route problems: shortest path between two points – The shortest path problem: General case – The travelling salesman and chinese postman problems – Reduction based methods for solving TSP – The chinese postman problem and matching.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Demonstrateknowledge in reading and writing rigorous mathematical proofs involving introductory aspects of graphs and develop analytical skills in solving graph theoretic problems	**PO1,PO2**
CO2	Demonstrateknowledge in chromatic number, partitioning, matching, graph coloring, directed graphsand Develop analytical skills in solving problems involving graph coloring, partitioning and directed graphs	**PO1,PO2**
CO3	Demonstrateknowledge in matrix representation of graphs, designing incidencematrix, Adjacency matrix and circuit matrixand explore analytical skills in solving problems involving adjacency matrix and incidence matrix	**PO1,PO2,P03**
CO4	Demonstrate knowledge in significant real time applications of electrical networks such as PLC Networks Independent sources, explore analytical skills in solving practical problems involving using graph theory conceptsand Develop skills in designing Mathematical models for real time electrical networks.	**PO1,PO2**
CO5	Demonstrate knowledge in significant practical applications of graphs in Operations Research, explore analytical skills in solving practical problems involving using graph theory concepts and Develop skills in designing Mathematical models for real time applications including shortest path problem, Travelling Salesman problem, and The Chinese Postman Problem.	**PO1,PO2,PO3 PO4**

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science, J.P.Trimblay and R.Manohars, 27/e, 2006, Tata Mc Graw Hill Publications, New Delhi.
2. Graph Theory with Applications to Engineering and Computer SCIENCE, Narasingh Deo, 25/e, 2003, Printice Hall of India Private Limited, New Delhi.

Reference Books:

1. A First Look at Graph Theory, Clark J. And Holton D.A., 1999, Allied Publishers,
2. Graphs and Matrices, R.B.Bapat, 2010, Springer, London Dordrecht Heidelberg, New York.
3. Discrete Mathematics for Computer Science, Gary Haggard John Schlipf, Sue Whitesides, 4/e, 2007, 2008, Thomson Publication, New Delhi.
4. Operation Research, S.D Sharma, Kedar, 11/e, 2007, Nath Ram Nath & Co., Meerut
5. Graph Theory with Application, J.A.Bonday and U.S.R. Murty, 2/e, 1976, North Holland.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OSAH412 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

Course Educational Objectives:

CEO1: To Understand the basic scientific concepts of Nanoscience, and various types of Nanomaterials

CEO2: To study various methods of synthesising Nanomaterials

CEO3: To identify different characterisation techniques for Nanomaterials

CEO4: To Understand the properties of Nanomaterials and the applications of Nanomaterials in various fields

CEO5: To study various carbon Nanomaterials

UNIT – 1: INTRODUCTION TO NANO SCIENCE

Nanotechnology – Definition of nanoscale – Significance of nanoscale – Surface to volume ratio – Quantum confinement – Definition of nano materials – Types of nano materials – 1-dimentional, 2-dimentional and 3-dimentional nano materials.

UNIT – 2: FABRICATION OF NANOMATERIALS

Top-down approach – Bottom-up approach – **S**ol gel method – Physical vapour deposition – Chemical vapour deposition – Plasma arching – Ball milling – Electro-chemical deposition.

UNIT – 3: CHARACTERIZATION AND PROPERTIES OF NANOMATERIALS

Properties of materials – Physical properties – Chemical properties – Mechanical properties – Electrical properties – Thermal properties – Magnetic properties – Characterization – X-ray diffraction – UV – Visible spectroscopy.

UNIT – 4: CARBON BASED NANOMATERIALS

Nanowires and nanotubes – Carbon nanotubes – Different types of carbon nanotubes – Single walled carbon nanotubes – Multiwalled nanotubes – Fabrication of caron nanotubes – Plasma arching method – Graphene – Fullerences.

UNIT – 5: APPLICATIONS OF NANOTECHNOLOGY

Applications in material science, biology and medicine, surface science, energy and environment – Applications of quantum dots

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	**Acquire** the basic knowledge on Nanoscience, and various types of Nanomaterials .	PO1, PO12
CO2	**Identify** appropriate method for the preparation of Nanomaterials	PO1, PO12
CO3	**Develops** skill to characterize Nanomaterials by various techniques	PO1, PO4,PO12
CO4	**Analyze** the different properties of Nanomaterials and identify their applications in various fields	PO1,PO12
CO5	**Develop** Knowledge on carbon Nanomaterials	PO1,PO12

Text Books:

1. Engineering Physics, M.R. Srinivasan, 2011, New Age International, Chennai.
2. Engineering Physics, K. Thyagarajan, 1/e, 2014, Mc Graw Hill Publishers, New Delhi.

Reference Books:

1. Nanotechnology - A Gentle Introduction to the Next Big Idea, 2003, Dorling Kindersely (India .Pvt), New Delhi.
2. Nano - The Essentials (Understanding nano Science and Nanotechnology), 2010, Tata McGraw Hill Publications.

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

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OSAH413 ENTREPRENEURSHIP DEVELOPMENT

Course Educational Objectives:

CEO1: To understand the concepts of entrepreneurship and role of government in the promotion of entrepreneur

CEO2: To understand idea generation, intellectual property rights, financing of enterprises and Government grants & subsidies

CEO3: To elucidate the process of project planning and report preparation

CEO4: To understand the scope and objectives of micro and small enterprises and their promotional measures

CEO5: To understand rural entrepreneurship and evaluation of entrepreneurship development programmes

UNIT – 1: NATURE OF ENTREPRENEURSHIP

Meaning and concepts, intrapreneurship – Entrepreneur's competencies, attitudes, qualities, functions – Types of entrepreneurs – Barriers to entrepreneurship – Entrepreneurial scenario in india and abroad – Forms of entrepreneurship – Small business, types of ownership – Role of government in the promotion of entrepreneur.

UNIT – 2: PROMOTION AND FINANCIAL ASPECTS OF THE ENTREPRENEURSHIP

Idea generation – Intellectual property rights – Financing of enterprises – Government grants and subsidies.

UNIT – 3: PROJECT PLANNING AND FEASIBILITY STUDIES

The concept of project – Project life cycle – Project planning – Feasibility – Project proposal and report preparation.

UNIT – 4: MICRO AND SMALL ENTERPRISES

Meaning and definitions – Micro and macro units – Essentials, features and characteristics – Relationship between micro and macro enterprises – Rational behind micro and small enterprises – Scope and objectives of micro and small enterprises – Enterprise and society – Role of micro enterprises in economic development – Package for promotion of micro and small-scale enterprises – Problems of micro and small enterprises.

UNIT – 5: RURAL ENTREPRENEURSHIP AND EDPs

Need – Rural industrialization – Role of NGOs – Organizing EDPs – Need, objectives and evaluation of EDPs.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Learn entrepreneurship and role of government in the promotion of entrepreneurship	PO3, PO7, PO12
CO2	Understand an idea generation, intellectual property rights, financing of enterprises and Government grants & subsidies	PO3, PO6, PO7, PO8, PO11, PO12
CO3	Prepare project report to start a business	PO10, PO11, PO12
CO4	Choose a particular form of enterprise	PO9, PO12
CO5	Start rural entrepreneurship and learn the importance of entrepreneurship development programmes	PO9, PO12

Reference Books:

1. Entrepreneurial Development, S.S. Khanka, 4/e, 2012, S.Chand and Company Limited, New Delhi.
2. Fundamentals of Entrepreneurship, H.Nandan, 2/e, 2011, PHI publications, New Delhi.
3. Entrepreneurship, Rajeev Roy, 2/e, 2011, Oxford University Press, New Delhi.
4. Entrepreneurship, Robert D Hirsrich, Michael P Peters, Dean A Shepherd, 6/e, 2010, TMH, New Delhi.
5. The Dynamics of Entrepreneurial Development and Management, Vasanth Desai, 6/e, 2010, Himalaya Publishing House, Mumbai.
6. Entrepreneurship Management- Text and Cases, Bholanath Dutta, 1/e, 2010, Excel Books, New Delhi.

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

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE411 FUNDAMENTAL OF DBMS

Course Educational Objectives:

CEO1: To discuss the basic database concepts, applications, data models, schemas and instances and design Entity Relationship (E-R) model for a database.
CEO 2: To demonstrate the use of integrity constraints, relational algebra operations and relational calculus.
CEO 3: To describe the basics of SQL, construct queries using SQL, SQL functions, trigger and cursor concepts in PL/SQL
CEO 4: Tounderstand reasoning about functional dependency and to make the students to identify the role of normalization in database management systems
CEO 5: To gain knowledge of Transaction, concurrency and recovery strategies of DBMS

UNIT – 1: DATABASE SYSTEMS AND ENTITY RELATIONSHIP MODELING
Database system applications – Purpose of database systems – View of data – Database languages – Database users and administrators – The entity–Relationship model – Attributes and entity sets – Relationship sets – Entity – Relationship diagrams.

UNIT – 2: RELATIONAL DATA MODEL AND LANGUAGE
Introduction to the relational model – Integrity constraints – Fundamental relational algebra operations – Tuple relational calculus – Domain relational calculus.

UNIT – 3: INTRODUCTION TO SQL
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 – Introduction to nested queries – Views – Indexes – SQL functions – Database triggers.

UNIT – 4: NORMALIZATION
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 CONCEPTS AND CONCURRENCY CONTROL TECHNIQUES
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.

Course Outcomes:

On successful completion of the course the student 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:

4. Database System Concepts, Korth, Silberschatz, Sudarshan, 5/e, 2006, Tata McGrawHill, New York.
5. Database Management System, Raghu Ramakrishnan, 2/e, 2000, Tata McGrawHill, New York.

Reference Books:

1. Fundamentals of Database Systems, Elmasri, Navathe, 5/e, 2008, Pearson Education, USA.
2. Database Management Systems, Peter Rob, A.Ananda Rao, Carlos Coronel, 5/e, 2003, Cengage Learning, USA.
3. SQL, PL/SQL Programming, Ivan Bayross, 2/e, 2011, BPB Publications, New Delhi, India.
4. Introduction to Database Systems, C.J.Date, 8/e, 2004, Pearson Education, USA.
5. Fundamentals of Database Management Systems, .L. Gillenson, 1/e, 2006, MWiley, New Delhi, India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.6**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE412 BASICS OF IOT

Course Educational Objectives:

CEO1: To understand the fundamentals of internet of things.
CEO2: To learn about the basics of IoT protocols.
CEO3: To learn about building state of the art architecture in IoT.
CEO4: To learn use of devices, gateways and data management in IoT.
CEO5: To build a small low cost embedded system using raspberry Pi.

UNIT - 1: INTRODUCTION TO IOT

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 – Communication protocols – Embedded systems.

UNIT - 2: IOT AND M2M

The Vision – Introduction – From M2M to IoT – M2M towards IoT **-** The global context – A use case example – Differing characteristics. A market perspective – Introduction – Some definitions – M2M value chains – IoT value chains – An emerging industrial structure for IoT

UNIT - 3: IOT ARCHITECTURE

M2M high – IETF architecture for IoT – OGC architecture – IoT reference model – Domain model – Information model – Functional model – Communication model – IoT reference architecture.

UNIT - 4: M2M AND IOT TECHNOLOGY FUNDAMENTALS

Devices and gateways – Local and wide area networking – Data management – Business processes in IoT – Everything as a service (XaaS) – M2M and IoT analytics – Knowledge management.

UNIT - 5: BUILDING IOT WITH ARDUINO AND RASPBERRY PI

Building IOT with arduino – Building IoT with rasperry Pi – IoT systems – Logical design using python – IoT physical devices and endpoints – IoT device – Building blocks – Pi – Raspberry Pi interfaces.

Case study: Smart home and smart industry.

Course Outcomes:

On successful completion of the course the student will be able to,		**POs related to COs**
CO1	Analyze various protocols for IoT.	PO1, PO2, PO3
CO2	Building state of the art architecture in IoT.	PO1, PO2
CO3	Design a portable IoT using rasperry Pi.	PO1, PO2, PO3,
CO4	Use of devices, gateways and data management in IoT.	PO1, PO2
CO5	Deploy an IoT application and connect to the cloud.	PO1, PO3,PO4

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, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1/e, 2014, Academic Press.

Reference Books:

1. Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, 1/e, VPT, 2014.
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Francis da Costa, 1/e, 2013, Apress Publications.
3. Architecting the Internet of Things, Bernd Scholz-Reiter, Florian Michahelles,ISBN 978- 3842-19156-5, Springer.
4. The Internet of Things-Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, ISBN 978-1-119-99435-0, Wiley Publications.
5. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.6**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE413 INFORMATION SECURITY

Course Educational Objectives:

CEO1: To understand basics of Cryptography and Network Security. Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
CEO2: Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms.
CEO3: Analyze existing authentication and key agreement protocols; identify the weaknesses of these protocols.
CEO4: Download and install an e-mail and file security software, PGP, and efficiently use the code to encrypt and sign messages.
CEO5: Develop SSL or Firewall based solutions against security threats, employ access control techniques.

UNIT – 1: NUMBER THEORY FOR INFORMATION SECURITY

Introduction – Modular arithmetic – Prime numbers and factoring – Groups and fields defined mod primes – Euler totient function – euler's theorem – Fermat's theorem – Chinese Remainder theorem – Bit complexity.

UNIT – 2: CLASSICAL ENCRYPTION TECHNIQUES

Security attacks – Security services and mechanisms – A model for network security – Classical encryption techniques – Symmetric cipher model – Substitution techniques – Caesar cipher – Mono alphabetic cipher – Play fair cipher – Hill cipher – Transposition techniques.

UNIT – 3: BLOCK CIPHERS, DATA ENCRYPTION STANDARDS AND PUBLIC KEY CRYPTOGRAPHY

Block cipher principles – DES – AES – Block cipher design principles – Block cipher modes of operation – Public key cryptography – Principles of public key cryptosystems – RSA algorithm – Diffie-Hellman key exchange.

UNIT – 4: HASH FUNCTIONS AND DIGITAL SIGNATURES

Hash functions – Security of hash functions and MACs – Hash algorithms – SHA – HMAC – Digital signatures, digital signature standard (DSS) – Kerberos – X.509 authentication service.

UNIT – 5: IP SECURITY, INTRUDERS AND FIREWALLS

IPsec overview – Architecture – Authentication header – Encapsulating security pay load – Intruders – Intrusion detection – Firewall design and principles.

Course Outcomes:

On successful completion of this course the students should be able to:		**POs related to COs**
CO1	Understand basics of Cryptography and Network Security.	PO1, PO2
CO2	Encrypt and decrypt messages, sign and verify messages using well known signature generation and verification algorithms.	PO1, PO2
CO3	Analyze existing authentication and key agreement protocols.	PO1, PO2, PO3, PO4
CO4	Use e-mail and file security software's.	PO1, PO2, PO3, PO5
CO5	Develop SSL/Firewall.	PO1, PO2, PO3, PO4

Text Books:

1. Cryptography and Network Security: Principles and Practices, William Stallings, 4/e, 2008, Low Price Edition, Pearson Education.
2. Network Security and Cryptography, Bernard Menezes, 1/e, 2010, Thomson Press Ltd, USA.

Reference Books:

1. Principles and Practices of Information Security, Michal E. Whitman and Herbert J. Mattord, 4/e, 2012, Cengage Learning, New Delhi.
2. Network Security Essentials (Applications and Standards), William Stallings, 4/e, Pearson Education.
3. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and Ryan Permeh, 2/e, 2002, wileyDreamtech.
4. Fundamentals of Network Security, Eric Maiwald 1/e, 2008, Dreamtech press.
5. Network Security - Private Communication in a Public World, Charlie Kaufman, Radia Perlman and Mike Speciner, 2/e, 2002, Pearson/PHI.

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	3	-	-	-	-	-	-	-	-
CO4	2	3	2	-	3	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2.3**	**2.5**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV411 TRANSPORT AND ENVIRONMENT

Course Educational Objectives:

CEO1: To impart knowledge on different concepts of Environmental Impact Assessment.
CEO2: To learn the EIA methodologies and the criterion for selection of EIA methods.
CEO3: To identify impact of air, water and land due to developmental activities
CEO 4: To know the procedures for environmental audit and some case studies.

UNIT – 1: INTRODUCTION

Environmental inventory, environmental assessment, environmental impact assessment (EIA), environmental impact of transportation projects, need for EIA, EIA guidelines for transportation project, historical development.

UNIT – 2: METHODOLOGIES

Elements of EIA – Screening and scoping – Methods of impact analysis – Applications – appropriate methodology.

UNIT – 3: ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT

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

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: EIA CASE STUDIES

EIA case studies on highway, railway, airways and waterways projects.

Course Outcomes:

Upon completion of this course, the students will be able to:		**POs related to COs**
CO1	Understand the basic concept of EIA	**PO1**
CO2	Analyse and Select the appropriate EIA methodology	**PO1**
CO3	Learn the impact of soil ,air and water due to developmental activities and analyze guidelines	**PO1,PO3**
CO4	Understand environmental audit procedure	**PO1, PO3,PO6, PSO2**
CO5	Analyze case studies and Apply concepts of EIA	**PO1, PO2, PSO2**

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.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-
CO4	2	-	2	-	-	2	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO*	**2**	**2**	**2**	-	-	**2**	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV412 DISASTER MANAGEMENT

Course Educational Objectives:

CEO1: Learn various hazards and vulnerabilities in India

CEO2: Lear scientific approach to manage disasters

CEO3: Understand various disaster mitigation and management plans in India

UNIT – 1: INTRODUCTION TO DISASTERS

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.

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UNIT – 2: APPROACHES TO DISASTER RISK REDUCTION (DRR)

Disaster cycle – Phases, culture of safety, prevention, mitigation and preparedness community based 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

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

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, programmes 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 AND FIELDWORKS

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.

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Describe basic features of disasters and classify them	PO1, PO7
CO2	Explain scientific approach to disaster risk reduction	PO1, PO7
CO3	Express the relation between the disaster and development	PO1, PO7
CO4	Describe disaster mitigation plan in India	PO1, PO7
CO5	Analyze case studies related to disaster and draw conclusions	PO1, PO2, PO7

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, Kapur Anu 2010, IIAS and Sage Publishers, New Delhi.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	-	-	2	-	-	-	-	-
CO5	2	2	-	-	-	-	2	-	-	-	-	-
CO*	**2**	**2**	-	-	-	-	**2**	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV413 AIR POLLUTION AND CONTROL ENGINEERING

Course Educational Objectives:

CEO1:To provides the knowledgeabout the various sources of Airpollution and itseffects on humanbeings , Vegetation and Materials.

CEO 2: To Analyse various the air pollutant dispersion models

CEO 3: To provideknowledgeaboutcontrolmethods and details of control equipments

CEO 4: To demonstrateVarious sources of Noisepolltion and controlmeasures

UNIT – 1: INTRODUCTION

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

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

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

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

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

Course Outcomes:

Upon completion of this course, the students will be able to:		POs related to COs
CO1	Identify the major sources of air pollution and understand their effects on health and environment.	PO1, PO7
CO2	Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models	PO2, PO3
CO3	Design the control techniques for particulate and gaseous emissions	PO1, PO3
CO4	Understand the standards of air quality and legal framework	PO1, PO6
CO5	Identify the major sources of noise pollution, effects and control measures	PO1, P07

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, Mc Graw Hill, New York.

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

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OECE411 MEDICAL ELECTRONICS

Course Educational Objectives:

CEO1: To gain knowledge and analyze the various Measurement such as ECG, EEG and trouble shooting.
CEO2: To understand the trasnducers for Bio medical , featuers applicable for Bio medical instrumentation.
CEO3: To study about the various signal conditioning and recording devices, Bio telemetry.
CEO4: To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.
CEO5: To Know the recent trends in digital filtering and data reduction techniques.

UNIT – 1: INTRODUCTION

Cell structure – Electrode – Electrolyte interface, electrode potential, resting and action potential electrodes for their measurement, ECG, EEG, EMG – Machine description – Methods of measurement – Three equipment failures and trouble shooting.

UNIT – 2: TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION

Basic transducer principles types – Source of bioelectric potentials – Resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – Description and feature applicable for biomedical instrumentation – Bio and nano sensors **–** Applications.

UNIT – 3: SIGNAL CONDITIONING, RECORDING AND DISPLAY

Input isolation, DC amplifier, power amplifier, and differential amplifier – Feedback, op-ampelectrometer amplifier, carrier amplifier – Instrument power supply **–** Oscillagraphic – Galvanometric **–** X-Y, magnetic recorder, storage oscilloscopes – Electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT – 4: MEDICAL SUPPORT

Electrocardiograph measurements – Blood pressure measurement: by ultrasonic method – Plethysonography – Blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – Phonocardiography – Vector cardiography **–** Heart lung machine – Artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – Laser equipment and application – Cardiac pacemaker – DC – Defibrillator patient safety **–** Electrical shock hazards **–** Centralized patent monitoring system.

UNIT – 5: BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION

Introduction – Computers in medicine – Basis of signal conversion and digital filtering data reduction technique – Time and frequency domain technique – ECG Analysis.

Course Outcomes:

Upon completion of this course, the 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 transducers and their description along with the feature applicable for Bio medical.	PO1,PO2
CO3	Analyze function of telemetry and Bio telemetry principles.	PO1,PO2, PO4
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 time and frequency domain techniques and analysis.	PO1,PO2

Text Books:

1. Mechatronics in Medicine – A Bio Medical Engineering Approach, Siamak Najarian, 2011, McGraw-Hill Education.
2. Biomedical Instrumentation and Measurements, Cromwell, Weibell and Pfeiffer, 1999, 2/e, Printice Hall of India.
3. Handbook of Biomedical Instrumentation, Khandpur, R.S., 1989, TMH.

Reference Books:

1. Bio Medical Instrumentation, Arumugam M., 2002, Anuradha Agencies Pub.
2. Principles of Applied Bio-medical Instrumentation, Geddes L.A., and Baker, L.E., 3/e, 1995, John Wiley and Sons.
3. Biomedical Digital Signal Processing, Tompkins W.J., 1998, Prentice Hall of India.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	-	**2**	**2**	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OECE412 FUNDAMENTALS OF EMBEDDED SYSTEMS

Course Educational Objectives:

CEO1: To provide a basic knowledge like characteristics, classification and Application areas of Embedded systems.

CEO2: Students learn the Architecture, Memory Interfacing and Interrupt Structures of 8051.

CEO3: By learning instruction sets we can write the Assembly Language Programs and get knowledge in Interfacing techniques.

CEO4: Students will learn the Real time operating systems.

CEO5: To learn Communication and Interfacing Techniques and its buses.

UNIT – 1: INTRODUCTION

History of embedded systems – Major application areas of embedded systems – Purpose of embedded systems – Core of the embedded system – Sensors and actuators – Embedded firmware.

UNIT – 2: THE 8051 ARCHITECTURE

Introduction – 8051 micro controller hardware – Register set of 8051 – Input/output ports and circuits – External memory – Memory and I/O interfacing of 8051 counter and timers – Serial data input/output – Interrupt structure of 8051.

UNIT – 3: BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS

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):

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.

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.

Course Outcomes:

After completion of this course, the students will be able to:		POs related to COs
CO1	Understanding and designing of embedded systems	P01, P02
CO2	Learning the Architecture and its functions	PO1,P02
CO3	Knowledge to write the programs in Assembly Language programs	P01, P02, P03, Po4
CO4	Knowledge in real time operating systems	P01, P02,P04,P05
CO5	Understanding the transmissions through different types of buses	P01, PO2,P04

Text Books:

1. Introduction to Embedded System, Shibu KV, 2/e, 2003, Mc-Graw Hill, New Delhi.
2. The 8051 Microcontroller, Kenneth J.Ayala, 3/e, 2007, Thomson Delmar Learning, New Delhi.
3. Embedded System Architecture - Programming and Design, Rajkamal, 6/rp, 2005, TMH, New Delhi.

Reference Books:

1. Micro Controllers (Theory and Applications), Ajay V Deshmukhi, 7/rp, 2005, TMH, New Delhi.
2. An Embedded Software Primer, David E. Simon, 5th impression, 2007, Pearson Education Private limited, New Delhi.
3. Microcontrollers Architecture-Programming and Design, Raj Kamal, 1/e, 2007, Pearson Education, New Delhi.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley, TMH, New Delhi.
5. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazdi, Janice Gillispie Mazidi, 2/e, 2002, Pearson Edition Private Limited, New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	2	-	-	-	-	-	-	-	-
CO4	3	2	-	3	2	-	-	-	-	-	-	-
CO5	2	3	-	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2.3**	**2**	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OECE413 DATA COMMUNICATION AND NETWORKS

Course Educational Objectives:

CEO1: Build an understanding of the fundamental concepts of computer networking.
CEO2: Familiarize the student with the basic taxonomy and terminology of the computer networking area.
CEO3: Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
CEO4: Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
CEO5: Obtain the knowledge about recent web based protocols.

UNIT – 1: NETWORKS AND PROTOCOLS

Introduction: Network topologies, protocols and standards, layered architecture LAN, WAN, MAN, OSI reference model, TCP/IP reference model, Guided and unguided media.

UNIT – 2: DATA LINK LAYER

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 – The 802.11 MAC sub layer protocol – The 805.11 frame structure – Services.

UNIT – 3: CHANNEL ALLOCATION AND NETWORKING

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

Transport Layer: UDP, TCP, congestion control mechanisms, QOS, techniques to improve QOS.

UNIT – 5: APPLICATION LAYER

Application Layer: Cryptography, DNS, electronic mail, FTP, HTTP, SNMP, DHCP.

Course Outcomes:

After completion of this course, the students will be able to:		POs related to COs
CO1	Independently understand basic computer network technology	PO1, PO2
CO2	Understand and explain Data Communications System and its components..	PO1, PO2,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

Text Books:

1. Computer Networks, Tanenbaum and David J Wetherall, 5/e, 2010, Pearson Edu.
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education.

Reference Books:

1. Computer Networks - A Systems Approach, Larry L. Peterson and Bruce S. Davie, 5/e, 2011, Morgan Kaufmann/ Elsevier.
2. Data and Computer Communication, William Stallings, 10/e, 2014, Pearson Education India.
3. Computer Networking: A Top–Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, 6/e, 2013, Pearson Education.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-
CO3	2	3	2		-	-	-	-	-	-	-	-
CO4	3	2	-	3	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2.5**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OEEE411 ENERGY AUDITING AND DEMAND SIDE MANAGEMENT

Course Educational Objectives:

CEO1: To know auditing, conservation of energy
CEO2: To know about various energy efficient motors and ratings
CEO3: To know about various lighting systems for conservation of energy
CEO4: To know methods of improving power factor
CEO5: To know about demand side management

UNIT – 1: INTRODUCTION

Energy situation – World and India, energy consumption, conservation, energy audit – Definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, energy conservation schemes-audit procedure.

UNIT – 2: ENERGY EFFICIENT MOTORS

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.

UNIT – 3: POWER FACTOR IMPROVEMENT & LIGHTING AND ENERGY INSTRUMENTS

Power factor – Methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f., p.f motor controllers – Synchronous condencers – Good lighting system design and practice, lighting control ,lighting energy audit – Energy Instruments – Watt meter, data loggers, thermocouples, pyrometers, lux meters, tong testers

UNIT – 4: ENERGY ECONOMIC ANALYSIS

The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – Numerical problems.

UNIT – 5: DEMAND SIDE MANAGEMENT

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – Time of day pricing, multi-utility power exchange model, time of day models for planning – Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation.

Course Outcomes:

On successful completion of the course, student will be able to		POs related to COs
CO1	Perform auditing of various energy consuming loads	PO1, PO2
CO2	Implement and find location of capacitor ratings	PO1, PO2, PO3
CO3	Evaluate Energy Economics in power systems.	PO1, PO2, PO4
CO4	Analyze good lighting system design and practice	PO1, PO2, PO4
CO5	Can implement demand side management	PO1, PO2

Text Books:

1. Industrial Energy Management Systems, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
3. Electrical Power Distribution, A S. Pabla, 5/e, 2004, TMH.
4. Demand Side Management, Jyothi Prakash, TMH Publishers.

Reference Books:

1. Energy Management, W.R. Murphy & G. Mckay, Butter worth, Heinemann publications.
2. Energy Management, Paul O' Callaghan, 1/e, 1998, Mc-Graw Hill Book Company.
3. Energy Efficient Electric Motors, John.C.Andreas, 2/e, 1995, Marcel Dekker Inc Ltd.
4. Energy Management Hand Book, W.C.Turner, John Wiley and Sons.
5. Energy Management and Good Lighting Practice: Fuel Efficiency, Booklet12, EEO.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3		-	-	-	-	-	-	-	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.4**	**3**	**2**	-	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OEEE412 FUNDAMENTALS OF ELECTRICAL ESTIMATION AND COSTING

Course Educational Objectives:

CEO1: To know estimating and costing aspects of all electrical equipment
CEO2: To know about design and estimation of wiring.
CEO3: To know about design of overhead and underground distribution lines.
CEO4: To know about different types of substations
CEO5: To know about design of illuminations.

UNIT – 1: DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS

Electric supply system, three phase four wire distribution system, protection of electric installation against over load, short circuit and earth fault, earthing, general requirements of electrical installations, testing of installations, indian electricity rules, neutral and earth wire, types of loads, systems of wiring, service connections, service mains, sub-circuits, location of outlets, location of control switches, location of main board and distribution board, guide lines for installation of fittings, load assessment, permissible voltage drops and sizes of wires, estimating and costing of electric installations – Load calculation and selection of cables for single phase and three phase system.

UNIT – 2: ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES

Electrical installations for residential buildings – Estimating and costing of material, electrical installations for commercial buildings, electrical installations for small industries – Street lighting estimation,cables for domestic applications.

UNIT – 3: OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES

Introduction, supports for transmission lines, distribution lines – Materials used, underground cables, mechanical design of overhead lines, design of underground cables.

UNIT – 4: SUBSTATIONS

Introduction, types of substations, outdoor substation – Pole mounted type, indoor substations – Floor mounted type.

UNIT – 5: DESIGN OF ILLUMINATION SCHEMES

Introduction, terminology in illumination, laws of illumination, various types of light sources, practical lighting schemes.

Course Outcomes:

On successful completion of course, student will be able to		POs related to COs
CO1	perform estimating and costing of all electrical equipment	PO1
CO2	Design and estimation of wiring.	PO1, PO2
CO3	Design of overhead and underground distribution lines	PO1
CO4	Know the different types of Outdoor substation.	PO1
CO5	Understand the Illumination Schemes.	PO1

Text Books:

1. Electrical Design Estimating and Costing, K. B. Raina, S. K. Bhattacharya, New Age International Publisher.
2. Design of Electrical Installations, Er. V. K. Jam, Er. Amitabh Bajaj, University Science Press.
3. Electricity Pricing Engineering Principles and Methodologies, Lawrence J. Vogt, P. E., CRC Press.

Reference Books:

1. Code of Practice for Electrical Wiring Installations (System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical Layout in Residential Buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation Buildings, Indian Standard Institution, IS: 2032.
4. Code of Practice for Selection, Installation of Maintenance of Fuse (Voltage not exceeding 650V), Indian Standard Institution, IS: 3106- 1966.
5. Code of Practice for Earthling, Indian Standard Institution, lS:3043- 1966.

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

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OEEE413 FUNDAMENTALS OF ELECTRICAL POWER UTILIZATION

Course Educational Objectives:

CEO1: To comprehend the different issues related to heating, welding
CEO2: To know about illuminations.
CEO3: To know about types of drives used in traction and techniques for braking system implementation
CEO4: To know about electrical drives
CEO5: To provide the students the fundamental concepts of electrolytic process

UNIT – 1: ELECTRIC HEATING AND WELDING

Electric heating – Advantages and methods of electric heating – Resistance heating – Arc heating – Induction heating and dielectric heating – Infrared or radiant heating – Electric welding – Definition of welding – Welding process – Resistance and arc welding – Electric welding equipment, comparison between AC and DC welding – Safty precautions during welding.

UNIT – 2: ILLUMINATION

Introduction – Terms used in illumination – Laws of illumination – Polar curves – Photometry – Sources of light – Lamps: Incandescent lamps – Discharge lamps – SV and MV lamps – Lighting schemes – Requirement of good lighting scheme – Types and design of lighting schemes – Calculation of illumination – Illumination standards for domestic, industrial and sports complexes – Numerical problems.

UNIT – 3: ELECTRIC TRACTION – I

Introduction – Systems of electric traction – Comparison between A.C. and D.C. traction – Special features of traction motor – Methods of electric braking – Rheostat braking and regenerative braking – Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves – Numerical problems.

UNIT – 4: ELECTRIC DRIVES

Introduction – Type of electric drives – Selection of electrical drives – Types of industrial loads – Continuous – Intermittent and variable loads – Starting and running characteristics – Speed control of motors – Size and rating of motors – Temperature rise – Load equalization – Motors for particular application.

UNIT – 5: ELECTROLYTIC PROCESS

Electrolysis, Faradays laws, application of electrolysis, power supply for electrolysis – VFD drives for different applications – Soft starters for different applications – Starters for different loads.

Course Outcomes:

On successful completion of course, student will be able to		**POs related to COs**
CO1	Articulate different types of Electric Heating, welding and Illumination	PO1
CO2	Design Electric Traction	PO1, PO2
CO3	Discuss mechanics of Train movement.	PO1
CO4	Plot trapezoidal and quadrilateral speed time curves.	PO1,PO2
CO5	Discuss specific energy consumption.	PO1,

Text Books:

1. Utilization of Electrical Energy, Open Shaw Taylor, 1/e, 2007, Orient Longman, Hyderabad.
2. Utilization of Electric power, R K Rajput, 1/e 2006, Lakshmi Publications, New Delhi.

Reference Books:

1. Utilization of Electric power and Electric Traction, J B Gupta, 10/e, 2009, S.K.Kataria and Sons Publications, New Delhi.
2. Utilization of Electrical Energy, Tarlok Singh, 1/e 2010, S. K.Kataria and Sons, New Delhi.
3. Generation and Utilization of Electrical Energy, S. Sivanagaraju, M. Balasubba Reddy and D. Srilatha,1/e, 2010, Dorling Kindersly. Pvt Ltd ,UP, INDIA.
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CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	-	-	-	-	-	-	-	-	-	-