J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY
UGC AUTONOMOUS
(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NBA, NAAC)

Bhaskar nagar, Moinabad Mandal, R.R. District,
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ACADEMIC REGULATIONS (JBIET R-14), COURSE STRUCTURE AND SYLLABI FOR B. TECH

B.Tech. Regular Four Year Degree Programme
(For the batches admitted from the Academic Year 2014 - 2015)

&

B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the Academic Year 2015 - 2016)

Note: The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council of JBIET.

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ACADEMIC REGULATIONS- R14 FOR B. TECH. (REGULAR)
**Applicable for the students of B. Tech. (Regular) from the Academic Year
2014-15 and onwards**

1. Award of B. Tech. Degree

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

1.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years(i.e. No student is allowed to have more than four times detention)

1.2 After eight academic years of course of study, the candidate is permitted to write the examinations for two more years.

1.3 The candidate shall register for 213 credits and secure 206 credits with compulsory subjects as listed in Table-1.

Table-1	
Serial Number	Subject Particulars
1	All practical subjects
2	Industry oriented mini project
3	Comprehensive Assignment
4	Industrial Internship
5	Comprehensive Viva-Voce
6	Seminar
7	Project work

2. Forfeiting B.Tech Degree

The students, who fail to fulfill all the academic requirements for the award of the degree within ten academic years from the year of their admission, shall forfeit their seats in B. Tech. course.

3. Courses of study

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

Branch Code	Branch
01	Civil Engineering
02	Electrical and Electronics Engineering
03	Mechanical Engineering
04	Electronics and Communication Engineering
05	Computer Science and Engineering
12	Information Technology
19	Electronics and Computer Engineering
25	Mining Engineering

4. Credits

Each course is normally assigned a certain number of credits as follows:

	Semester	
	Periods /Week	Credits
Theory	04+1*/4	04
	03+1*/3	03
Practical	03	02
Drawing	01+03	03
Mini Project	--	02
Comprehensive Assignment	-	02
Industrial Internship	-	02
Comprehensive Viva Voce	--	02
Seminar	6	02
Project	15	10

*Tutorial

5. Distributions and Weightage of Marks

5.1 The performance of a student in each semester shall be evaluated subject-wise for a maximum of 100 marks for a theory and 75 marks for a practical subject. In addition, industry-oriented mini-project, Comprehensive Assignment, Industrial Internship, seminar, Comprehensive viva and project work shall be evaluated for 50, 50, 50, 50, 100 and 200

marks, respectively.

5.2 For theory subjects the distribution shall be 25 marks for Internal Evaluation and 75 marks for the End-Examination.

5.3 For theory subjects, during a semester there shall be 2 mid-term examinations. Each mid-term examination consists of 2 parts. Part-A contains objective and Part-B contains descriptive questions and assignment. The Part-A and Part-B shall be for 10 marks each with a total duration of 1 hour 20 minutes. The Part-A is set with 20 bits of multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The Part-B shall contain 4 full questions (two from each unit for first mid and minimum one from each unit in the second mid) out of which, the student has to answer 2 questions, each carrying 5 marks. While the first mid-term examination shall be conducted in first Two Units of the syllabus, the second mid-term examination shall be conducted in last Three Units. Five (5) marks are allocated for Assignments (as specified by the subject teacher concerned). The first Assignment should be submitted before the conduct of the first mid-examination, and the second Assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each candidate. . If any candidate is absent from any subject of a mid-term examination with a valid reason (only medical reasons are allowed), re-examination will be conducted for such student.

The details of End Examination Question Paper pattern is as follows:

- *The End semesters Examination will be conducted for 75 marks which consist of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks*
- *Part-A is compulsory question which consists of Five questions, one from each unit and carries 5 marks each.*
- *Part-B consists of five Questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question)*

5.4 For practical subjects there shall be a continuous evaluation during a semester for 25 sessional marks and 50 end semester examination marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The end semester examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the other colleges which are decided by the examination branch of JBIET.

5.5 For the subject having design and/or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and Estimation, the distribution shall be 25 marks for internal

evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end semester examination. There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests.

5.6 There shall be Science based Mini-Project, to be taken up during the vacation after I year II Semester examination for regular students, after II year I Semester for Lateral Entry students and it will be evaluated in II Year II semester. However, the Science based mini-project marks will be added in II year II Semester. The Comprehensive Assignment shall be submitted in a report form and presented before the committee. It shall be evaluated for 50 marks. The committee consists of head of the department, and the supervisor of the Comprehensive Assignment and a senior faculty member of the department. There shall be no external marks for Comprehensive Assignment.

5.7 As per the direction from the state Government a New Course 'Gender Sensitization' has been introduced for B.Tech 2-2 Students who are studying under JBIET R14 regulation. This is a compulsory Subject and posses '2' Credits. It should be treated as a lab subject with two credits from the academic Year 2015-2016.

5.8 There shall be an Industrial internship, in collaboration with an industry of their specialization, to be taken up during the vacation after II year II Semester examination and it will be evaluated in III Year II semester. The Industrial internship report shall be submitted in a report form and presented before the committee. It shall be evaluated for 50 marks. The committee consists of head of the department, and internship supervisor and a senior faculty member of the department. There shall be no external marks for internship.

5.9 There shall be an industry-oriented Mini-Project, in collaboration with an industry of their specialization, to be taken up during the vacation after III year II Semester examination. However, the mini-project and its report shall be evaluated along with the project work in IV year II Semester. The industry oriented mini-project shall be submitted in a report form and presented before the committee. It shall be evaluated for 50 marks. The committee consists of an external examiner, head of the department, the supervisor of the mini-project and a senior faculty member of the department. There shall be no internal marks for industry-oriented mini-project.

5.10 There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for the seminar.

5.11 There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he studied during the B. Tech. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

5.12 Out of a total of 200 marks for the project work, 50 marks shall be allotted for Internal Evaluation and 150 marks for the End Semester Examination (50 marks for thesis, 50 marks for successful execution of the project and 50 marks for Viva Voce). The End Semester Examination of the project work shall be conducted by the same committee as appointed for the industry-oriented mini-project. In addition, the project supervisor shall also be included in the committee. The topics for Comprehensive Assignment, Industrial Internship, industry oriented mini project, and seminar and project work shall be different from one another. The evaluation of project work shall be made at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.

5.13 The Laboratory marks and the sessional marks awarded by the examiners are subject to scrutiny and scaling by the college wherever necessary. In such cases, the sessional and laboratory marks awarded by the examiners will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Committee will be final and binding. The laboratory records and internal test papers shall be preserved and should be produced before the Committees as and when required.

6. Attendance Requirements

6.1 A student is eligible to write the End Semester examinations only if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

6.2 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

6.3 Shortage of Attendance below 65% in aggregate shall not be condoned and student will be detained on account of shortage of attendance below 65%.

6.4 A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration stands cancelled.

6.6 A stipulated fee shall be payable towards condonation of shortage of attendance.

6.7 A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester, as applicable, including the days of attendance in sports, games, NCC and NSS activities.

6.8 If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

7. Minimum Academic Requirements

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

7.1 A student is deemed to have satisfied the minimum academic requirements if he/she has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the mid-term and end semester exams.

7.2 A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.

7.3 A student will not be promoted from II year to III year unless he fulfills the academic requirement of 40 credits up to II year II semester or 30 credits up to II year I semester from all the examinations, whether or not the candidate takes the examinations.

7.4 A student shall be promoted from III year to IV year only if he fulfils the academic requirements of 60 credits up to III year II semester or 50 credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations.

7.5 A student shall register and put up minimum attendance in all 213 credits and earn 206 credits. Marks obtained in the best 204 credits shall be considered for the calculation of percentage of marks.

7.6 Students who fail to earn 206 credits as indicated in the course structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of their admission, shall forfeit their seat in B.Tech. Course and their admission stands cancelled.

8 Course Pattern

8.1 The entire course of study is for four academic years. I , II, III and IV years shall be on semester pattern.

8.2 A student, eligible to appear for the end examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject during the period of supplementary exams.

8.3 When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the next semester. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

9 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	% of marks to be secured	From the aggregate marks secured from **204** Credits.
First Class with Distinction	70% and above	
First Class	Below 70 but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

The marks obtained in internal evaluation and end semester examination shall be shown separately in the memorandum of marks.

10 Minimum Instruction Days

The minimum instruction days for each semester shall be 90 days. Tentatative Schedule must be as per the pattern given below.

First Semester	Instructions Days	16 Weeks
	Mid Term Examinations	2 Weeks
	Preparation & Practical Examinations	2Weeks
	End Examinations	2Weeks
Semester Break		2Weeks
Second Semester	Instructions Days	16 Weeks
	Mid Term Examinations	2 Weeks
	Preparation & Practical Examinations	2Weeks
	End Examinations	2Weeks
Summer Break		6 weeks

11. Branch Transfer of students

There shall be no branch transfers after the completion of the admission process.

12. Transfer of students from other colleges/universities

Transfer of students from the Constituent Colleges of *JNTUH* or from other Colleges/Universities shall be considered only on a case-to-case basis by the Academic Council of the Institute while following rules as in the force at that time promulgated by JNTUH and State government of Telangana.

13. Withholding Of Results

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

1. Transitory regulations

Discontinued, detained, or failed candidates are eligible for readmission, as and when next offered.

After the revision of the regulations, the students of the previous batches will be given two chances for passing in their failed subjects, one supplementary and the other regular. If the students cannot clear the subjects in the given two chances, they shall be given equivalent subjects as per the revised regulations which they have to pass in order to obtain the required number of credits.

In case of transferred students from other Universities and colleges, the credits shall be transferred to JBIET as per the academic regulations and course structure of the JBIET.

2.   General

Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

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

In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

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

15.5   The students seeking transfer to JBIET from various other Universities/ Institutions have to pass the failed subjects which are equivalent to the subjects of JBIET, and also pass the subjects of JBIET which the candidates have not studied at the earlier Institution on their own without the right to sessional marks. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JBIET, the candidates have to study those subjects in JBIET in spite of the fact that those subjects are repeated.

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ACADEMIC REGULATIONS R14 FOR B. TECH. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. (LES) from the Academic Year 2014-15 and onwards

1   Eligibility for award of B. Tech. Degree (LES)

1.1 The LES candidates shall pursue a course of study for not less than three academic years and not more than six academic years.

1.2 They shall be permitted to write the examinations for two more years after six academic years of course work.

1.3 The candidate shall register for 163 credits and secure 156 credits from II to IV year B.Tech. Program (LES) for the award of B.Tech. degree with compulsory subjects as listed in Table-2.

Table-2	
Serial Number	Subject Particulars
1	All practical subjects
2	Industry oriented mini project
3	Comprehensive Assignment
4	Industrial Internship
5	Comprehensive Viva-Voce
6	Seminar
7	Project work

1.4 The students, who fail to fulfil the requirement for the award of the degree in 8 consecutive academic years (6 years of study + 2 years additionally for appearing exams only) from the year of admission, shall forfeit their seats.

1.5 The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

2. Promotion Rule

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year only if he fulfils the academic requirements of 40 credits up to III year II semester or 30 credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations.

3. Award of Class

After a student has satisfied the requirement 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	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured for 154 Credits. (i.e. II year to IV year)
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

The marks obtained in the internal evaluation and the end semester examination shall be shown separately in the marks memorandum.

4. All other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)**.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that Subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and kept with the examination branch.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated,

		shall be cancelled in all the subjects of the examination (including practicals 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 End semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, 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 End semester 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 of any injury to his person or to any of his relations whether by words, either spoken or written or by signs	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the

	or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all End semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the Examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the

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

Malpractices identified by squad or special invigilators
1.	Punishments to the candidates as per the above guidelines.
2.	Punishment for invigilators : (if the squad reports that the invigilator is also involved in encouraging malpractices)
	(i)	A show cause notice shall be issued to the invigilator.
	(ii)	Impose a suitable fine on the invigilator.

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MECHANICAL ENGINEERING

COURSE STRUCTURE

I B.Tech – I Semester

Sl. No	Code	Subject	L	T-P-D	C
1	C110A	English	3	0-0-0	3
2	C110B	Mathematics-I	4	1-0-0	4
3	C110D	Applied Chemistry	3	1-0-0	3
4	C115A	Computer Programming	3	1-0-0	3
5	C113C	Engineering Drawing-I	1	0-0-3	3
6	C1103	Engineering Chemistry lab	0	0-3-0	2
7	C1101	Computer Programming lab	0	0-3-0	2
8	C1104	Engineering Workshop	0	0-3-0	2
9	C1105	English Lab	0	0-3-0	2
		Total	**14**	**3-12-3**	**24**

I B.Tech – II Semester

Sl. No	Code	Subject	L	T-P-D	C
1	C120A	Technical English	3	0-0-0	3
2	C120B	Mathematics-II	4	1-0-0	4
3	C123A	Engineering Mechanics	4	1-0-0	4
4	C123C	Engineering Drawing-II	1	0-0-3	3
5	C120C	Applied Physics	3	0-0-0	3
6	C125A	Data structures	3	1-0-0	3
7	C1202	Applied Physics Lab	0	0-3-0	2
8	C1201	Data structures Lab	0	0-3-0	2
9	C1205	Engineering & IT Workshop	0	0-3-0	2
		Total	**18**	**3-9-3**	**26**

II B.Tech – I Semester

Sl. No	Code	Subject	L	T-P-D	C
1	C210C	Professional Ethics	3	0-0-0	3
2	C210A	Probability and statistics	3	1-0-0	3
3	C212B	Basic Electrical and Electronics Engineering	4	0-0-0	4
4	C213A	Mechanics of Solids	4	1-0-0	4
5	C213D	Thermodynamics	4	0-0-0	4
6	C213C	Metallurgy and Materials Science	3	1-0-0	3
7	C2107	Electrical and Electronics Engineering Lab	0	0-3-0	2
8	C2108	Metallurgy Lab	0	0-3-0	2
9	C2109	Mechanics of Solids Lab	0	0-3-0	2
		Total	**21**	**3-9-0**	**27**

II B.Tech – II Semester

Sl. No	Code	Subject	L	T-P-D	C
1.	C223A	Production Technology	3	1-0-0	3
2.	C223B	Kinematics of Machinery	4	1-0-0	4
3.	C223C	Applied Thermodynamics –I	4	1-0-0	4
4.	C223D	Mechanics of Fluids and Hydraulic Machines	4	0-0-0	4
5.	C223E	Machine Drawing	0	0-0-6	3
6.	C220B	Environmental Studies	3	0-0-0	3
7.	C2210	Production technology Lab	0	0-3-0	2
8.	C2211	Mechanics of Fluids & Hydraulic Machines Lab	0	0-3-0	2
9.	C2212	Comprehensive Assignment	0	0-0-0	2
10.	C2213	Gender Sensitization	0	0-3-0	2
		Total	**18**	**3-9-6**	**29**

III B.Tech – I Semester

S.No.	Course Code	Course Title	L	T-P-D	C
1		**Open Elective**	3	0-0-0	3
	C310O	Numerical Methods			
	C313P	Reliability Engineering			
	C315R	Artificial Neural Networks			
2	C313A	Metrology & Surface Engineering	3	0-0-0	3
3	C313B	Dynamics of Machinery	3	1-0-0	3
4	C313C	Machine Tools	3	0-0-0	3
5	C313D	Design of Machine Members – I	4	1-0-0	4
6	C313E	Applied Thermodynamics -II	4	1-0-0	4
7	C3106	Machine Tools Lab	0	0-3-0	2
8	C3107	Metrology Lab	0	0-3-0	2
9	C3108	Thermal Engineering Lab	0	0-3-0	2
		Total	**20**	**3-9-0**	**26**

III B.Tech – II Semester

S.No.	Course Code	Course Title	L	T-P-D	C
1	C320A	Management Science for Engineers	4	0-0-0	4
2	C323A	Finite Element Method	3	1-0-0	3
3	C323B	Refrigeration and Air-conditioning	3	1-0-0	3
4	C323C	Design of Machine Members – II	4	1-0-0	4
5	C323D	Heat Transfer	4	0-0-0	4
6		**Elective - I**	3	0-0-0	3
	C323E	Nanotechnology			
	C323F	Mechanical Vibrations			
	C323G	Composite Materials			
7	C3208	Heat Transfer lab	0	0-3-0	2
8	C3209	Fuels & Lubricants and Automobile Engineering Lab	0	0-3-0	2
9	C3210	Industrial Internship	0	0-0-0	2
		Total	**21**	**3-6-0**	**27**

IV B.Tech – I Semester

S.No.	Course Code	Course Title	L	T-P-D	C
1	C413A	Operations Research	4	1-0-0	4
2	C413B	Power Plant Engineering	4	0-0-0	4
3	C413C	CAD/CAM	4	0-0-0	4
4	C413D	Instrumentation and Control Systems	3	1-0-0	3
		Elective –II			
5	C413E	Robotics	3	0-0-0	3
	C413F	Design for Manufacturing			
	C413G	Jet Propulsion and Rocket Engineering			
		Elective – III			
6	C413H	Unconventional Machining Processes	3	0-0-0	3
	C413I	CNC Technology & RPT			
	C413J	Automation in Manufacturing			
7	C4107	Computer Aided Design & Manufacturing Lab	0	0-3-0	2
8	C4108	Production Drawing Practice and Instrumentation Lab	0	0-3-0	2
9	C4109	Soft Skills Lab- I	0	0-3-0	2
		Total	**21**	**2-9-0**	**27**

IV B.Tech – II Semester

S.No.	Course Code	Course Title	L	T-P-D	C
1	C423A	Automobile Engineering	3	1-0-0	3
		Elective – IV			
2	C423B	Mechatronics	3	1-0-0	3
	C423C	Maintenance and Safety Engineering			
	C423D	Production Planning and Control			
		Elective – V			
3	C423E	Renewable Energy Sources	3	1-0-0	3
	C423F	Computational Fluid Dynamics			
	C423G	Gas Dynamics			
4	C4211	Soft Skills Lab-II	0	0-3-0	2
5	C4212	Industry Oriented Mini Project	0	0-0-0	2
6	C4213	Seminar	0	0-6-0	2
7	C4214	Project Work	0	0-15-0	10
8	C4215	Comprehensive Viva	0	0-0-0	2
		Total	**9**	**3-24-0**	**27**

L- Lecture, T- Tutorials, P- Practical, D- Drawing, C- Credits
TOTAL NUMBER OF CREDITS = 213

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	3	0-0-0	3

ENGLISH
(Common to all branches)

UNIT - I:
-Word Formation-Word Disintegration/ Synthesis
-Root/Base Word- Word Origin
-Affixation-Prefix & Suffix
-Synonym/Antonym-Homophone/Homonym/Homograph
Use of Dictionary &Thesaurus
-Phrasal Verbs, Idioms
-One Word Substitutes
-Collocations
-Technical Vocabulary

UNIT - II:
Grammar
-Parts of Speech- Introduction to English Grammar
-All about- Noun, Pronoun, Verb, Adverb
- Adjective, Preposition, Conjunction, Interjection
- Articles- Use of Articles A, An and The.
-Punctuations
Tenses
-Tenses in English
-Use of appropriate Tenses in different contexts
-Use of Tenses in Narration

UNIT - III:
Improving Reading Skills
-Reading for Specific Purposes
-Reading for General Information
-Reading for facts
-Reading between/beyond the lines
-Reading for Skimming & Scanning
-Dialogue Reading
-Comprehension

UNIT - IV:
Basics of Writing
-Syntax & Sentence Structure
-Construction of Proper Sentences in English
-Sentences Types- Purposes
-Email Etiquette
-Note Making and Note Taking

UNIT - V:
Common Errors in English
-Subject-Verb Agreement

TEXT BOOKS:

1. Language In Use - Intermediate: Self-Study Workbook with Answer Key/2008 Adrian Doff , PB Cambridge University Press.
2. English Vocabulary in Use: Pre-Intermediate & Intermediate (PB +CD ROM)/3rd Edition Stuart Redman Cambridge University Press.

REFERENCE BOOKS:

1. Technical Communication: Principles And Practice (With Dvd) 2nd Edition (English) 2nd Edition, Sangeeta Sharma, Meenakshi Raman, Oxford Univesity Press
2. The Fundamental Aspects of Communication Skills**:** 2009, Dr.P. Prasad, S.K Kataria & Sons Active Grammar with Answer Level 1,2 &3 Davis Cambridge University Press

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**1-0-0**	**4**

MATHEMATICS – I
(Common to all branches)

UNIT - I:
Sequences – Series
Basic definitions of Sequences and Series – Convergence and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence.
Function of Single Variable
Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized mean value theorem (all theorems without proof).

UNIT - II:
Function of Several Variables
Functional dependence – Jacobian – Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT - III:
Curve Tracing : Cartesian, polar and parametric curves.
Geometrical applications of Differential Calculus: Radius of Curvature, Centre and Circle of Curvature-Evolutes and Envelopes

UNIT - IV:
Multiple Integrals: Double and triple integrals – change of order of integration – change of variable.

UNIT - V:
Vector Calculus: Gradient-Divergence-Curl and their related properties, Potential function – Laplacian and second order operators. Line integral – work done – surface integrals-Flux of a vector valued functions.
Vector integrals theorem: Green's –Stoke's and Gauss's Divergence Theorems (Statement & their verification).

TEXT BOOKS:
1. Higher Engineering Mathematics: Grewal B.S, Khanna publications, 42nd edition 2012
2. Advanced Engineering Mathematics**:** Jain and S.R.K. Iyangar, Narosa Publications.

REFERENCE BOOKS:
1. Engineering Mathematics: B.V.Ramana, Tata McGrawhill Publishing company Ltd .New Delhi, 5th edition, 2011.
2. Engineering Mathematics-I: T.K.V. Iyengar & B.Krishna Gandhi & Others, S.Chand
3. Advanced Engineering Mathematics: KREYSZIG. E, JohnWiley & Sons Singapore, 10th Edition, 2012.

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	**3**	**1-0-0**	**3**

APPLIED CHEMISTRY
(Common to CE, ME, MIE)

UNIT I:
Electrochemistry and Batteries: Concept of Electrochemistry, Conductance-Electrolyte in solution, Conductance-Specific, Equivalent and molar conductance, Kolrausch's Law, application of conductance. EMF: Galvanic Cells, Reference Electrode, Nernst equation, galvanic series, Application of EMF measurements.
Batteries: Primary and secondary cells, (lead-Acid cell, Ni-Cd cell, Lithium cells). Application's of batteries. Fuel cells – Hydrogen – Oxygen fuel cells, advantages of fuel cells.

UNIT II:
Polymers: Introduction-classification-natural and synthetic polymers; Types of Polymerization (Chain growth & Step growth).Plastics: Thermoplastic & Thermoset resins. Engineering applications of: Teflon, Bakelite, Nylon. Conducting polymers- Poly acetylene, polyaniline- conduction, doping, and its application. Fibers – polyester, fiber reinforced plastics (FRP), applications.

UNIT III:
Energy sources: Introduction- fuels, classification – conventional fuels (solid, liquid, gaseous). Calorific value-HCV and LCV. Solid fuels – coal –processing of coal. Liquid fuels – primary – petroleum – refining of petroleum-cracking knocking synthetic petrol – Bergius and Fischer-tropsech's process

UNIT IV:
Water Technology: Introduction, Hardness: Causes, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water. Boiler troubles – Scale & sludge formation, caustic embrittlement, corrosion, priming & foaming Softening of water (Internal & external treatment-Lime soda, Zeolites, Ion exchange process) Reverse osmosis, electro dialysis.

UNIT V:
Phase rule: Introduction- Phase rule equation –terms involved. One Component system-water system. Two component system- Pd-Ag System and Fe-carbon system. Hardening and annealing.
Nanochemistry: Introduction. Synthesis: Top down and bottom up processes, Properties and Applications and future prospects.

TEXT BOOKS:
1. Text Book of Engineering Chemistry**,** Shasi Chawla, Dhantpat Rai publishing Company, New Delhi (2008).
2. Engineering Chemistry, P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).

REFERENCE BOOKS:

1. Text of Engineering Chemistry, S.S. Dara & Mukkati S. Chand & Co, New Delhi(2006)
2. Engineering Chemistry, B. Siva Shankar Mc.Graw Hill Publishing Company Limited , New Delhi(2006)
3. Engineering Chemistry:J.C. Kuriacase & J. Rajaram, Tata McGraw Hills co., New Delhi (2004).

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B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	**3**	**1-0-0**	**3**

COMPUTER PROGRAMMING
(Common to all branches)

UNIT - I:
Computer fundamentals-Hardware, software, computer language, translators, Compiler, Interpreter, Loader, and linker, Program Development steps-Algorithms, Pseudo code, flow charts, Specification for Converting Algorithms into Programs basic,
Introduction to C Language – History, Simple C Program, Structure of a C Program, Identifiers, Basic data types, user defined data types, Variables, Constants, type qualifiers, Managing Input / Output, Operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Simple C Programming examples.

UNIT - II:
Selection Statements – if and switch statements, Repetitive statements – while, for, do-while statements, C Programming examples, other statements related to looping – break, continue, go to, C Programming examples. Arrays– Basic concepts, one-dimensional arrays, two – dimensional arrays, multidimensional arrays, C programming examples.

UNIT - III:
Introduction to Structured Programming, Functions- basics, user defined functions, inter function communication, Standard functions, Storage classes-auto, register, static, extern, scope rules, arrays to functions, recursive functions, example C programs.
Strings – Basic concepts, String Input / Output functions, arrays of strings, string handling functions, strings to functions, C programming examples.

UNIT - IV:
Derived types – Structures – Basic concepts, nested structures, arrays of structures, structures and functions, unions, bit fields, C programming examples.
Pointers – Basic concepts, pointers and functions, pointers and strings, pointers and arrays, pointers and structures, self-referential structures, example C programs.

UNIT - V:
Introduction Using Files in C, Declaration of File Pointer, Opening a File, Closing and Flushing Files, Working with Text Files, Character Input and Output, End of File (EOF)
Working with Binary Files, Direct File Input and Output, Sequential Versus Random File Access, Files of Records, working with Files of Records, Random Access to Files of Records, Other File Management Functions, Deleting a File Renaming a File.

TEXT BOOKS:

1. Programming in C**.,** P. Dey and M Ghosh, Oxford University Press.
2. The C Programming Language, Brian W. Kernighan , Dennis M. Ritchie, 2nd edition

REFERENCE BOOKS:
1. C programming A Problem-Solving Approach, Behrouz A.Forouzan
2. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
3. Graphics Under C, Yashavant Kanetkar, BPB Publications, 2003

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B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	**1**	**0-0-3**	**3**

ENGINEERING DRAWING - I
(Common to all branches)

UNIT – I
Introduction To Engineering Drawing: Principles of Engineering Drawing and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions.
Scales: Different types of Scales, Plain scales, Vernier Scale, Digonal Scale, Scales of chords.

UNIT - II
Construction of curves used in engineering practice:
a. Conic Sections , Ellipse- General, Concxentric Circle, Arcs of circle and Oblong Method, Parabola- General, Tangent and Rectangle Methods, Hyperabola-General, Point/Rectangle Method
 b. Cycloid, Epicycloid and Hypocycloid
 c. Involute for Circle, Rectangle and Triangle

UNIT – III
Projections of Points and Lines: Principles of Orthographic Projections – Conventions – First and Third Angle, Projections of Points and Lines inclined to planes, True lengths, traces.

UNIT – IV
Projections of Planes: Projections of regular Planes, auxiliary planes and Auxiliary projection inclined to both planes.

UNIT – V
Projections of Solids: Projections of Regular Solids inclined to both planes – Auxiliary Views.

TEXT BOOKS:
1. Engineering Drawing, N.D. Bhat, Charotar Publishing House, 2014, 53rd Edition.
2. Engineering Drawing and Graphics, Venugopal / New age Publication.

REFERENCE BOOKS:
1. Engineering Drawing – Basant Agrawal, Tata McGraw Hill, 2010.
2. Engineering Drawing: Narayana and Kannaiah, Scitech publishers.
3. Computer Aided Engineering Drawing: Trymbaka Murthy, I.K. International.

B.Tech. ME	L	T-P-D	C
I Year - I Semester	0	0-3-0	2

ENGINEERING CHEMISTRY LAB
(Common to CE, ME, MIE)

List of Experiments
Introduction:
- Laboratory safety and precautions.
- Preparation of solution.
- Determination of unknown concentration of given solutions and calculations.

Titrimetry:
1. Estimation of hardness of water by EDTA method.

Mineral Analysis:
2. Determination of percentage purity of pyrolusite.

Instrumental Methods:
3. Conductometric titration of a) strong acid Vs strong base
   b) Weak acid vs strong base
   c) Mixture of acids vs strong base
4. Effect of dilution on conductance for
   i) Strong acids, ii) weak acids and iii) Ionic salts.
5. Determination of ferrous iron in cement by colorimetric method
6. Estimation of Copper by Colorimetric method.

Physical Properties:
7. Determination of viscosity of sample oil by Oswald's viscometer
8. Determination Surface Tension of given unknown liquid using stalganometer.

Preparations:
9. Preparation of organic compound Asprin.

Demonstration Experiments: (Any two)
10. Preparation of Thiokol rubber.

TEXT BOOKS:

1. **Practical Engineering Chemistry**: K. Mukkanti,etal, B.S. Publications, Hyderabad.
2. **Text Book of engineering chemistry** : R. N. Goyal and Harrmendra Goel.

REFERENCE BOOKS:

1. **Inorganic quantitative analysis**, Vogel.
2. **A text book on experiments and calculation Engg**. S.S. Dara.
3. **Instrumental methods of chemical analysis**, Chatwal, Anand, Himalaya Publications.

B.Tech. ME	L	T-P-D	C
I Year - I Semester	0	0-3-0	2

COMPUTER PROGRAMMING LAB
(Common to all branches)

EXPERIMENT - I:
Simple C programs -to implement basic arithmetic operations – sum, average, product, smallest, largest of the numbers, difference, quotient and remainder of given numbers etc.

EXPERIMENT - II:
Programs on if, else-if, nested if, else if ladder - largest and smallest of given numbers, to find the grade of a student based on marks, roots of a quadratic equation etc.

EXPERIMENT - III:
a. Programs on switch-case – to check the type of a given character, to find the grade of a student etc.
b. Programs on while and do-while- to find factorial, Fibonacci series, GCD, Sin(x), Cos(x) series, to check whether a given number is an Armstrong, Palindrome, Perfect, number conversion, and Prime number etc.

EXPERIMENT - IV:
Programs on "for loop" - sum of n natural numbers, factorial, sin(x), to generate Pascal's triangle etc.

EXPERIMENT - V:
a. Programs on nested loops – check for Fibonacci prime, Pyramids of numbers, generation of prime numbers in the given range, multiplication table etc.
b. Programs using break, go to, continue.

EXPERIMENT - VI:
a. Programs on 1-D array-finding Minimum and maximum element,Sorting and Searching etc.
b. Programs on 2-D array – Sum, product and Multiplication of two Matrices etc.

EXPERIMENT - VII:
a. Programs on Functions-Implementation of user defined functions categories, passing of arrays to functions etc.
b. Programs on recursion - factorial of a given integer, GCD of two given integers etc.

EXPERIMENT - VIII:
a. Programs on String handling functions-Copying, reverse, substring, concatenation.
b. Programs on structure and unions.

EXPERIMENT - IX:
Programs using pointers- pointer basic operations, pointers and functions etc

EXPERIMENT - X:
Programs on pointers and structures, Pointers and arrays, pointers and strings.

EXPERIMENT - XI:
Programs on files-Implementation of file handling functions. Programs on files error handling. Programs on Dynamic memory allocation.

EXPERIMENT - XII:
Programs on command line arguments. Programs on preprocessor directives

EXPERIMENT - XIII:
Program draws basic shapes such as circle, line, rectangle, ellipse and display text on screen using c graphics. Smiling face Animation using c graphics displaying face at random position on screen

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	**0**	**0-3-0**	**2**

ENGINEERING WORKSHOP
(Common to all branches)

Trades for Experiments: (Three experiment from each trade)

      (i) Carpentry

      (ii) Fitting

      (iii) Black Smithy

      (iv) Welding

      (v) Power Tools in Construction, Wood working, Electrical, Engineering works and

        Mechanical Engineering

Trades for Demonstration & Exposure

      (vi) Plumbing

TEXT BOOKS:
1. Work shop manual: P.Kannaiah, K.Narayana, Scitech Publishers
2. Workshop Manual: Venkat Reddy, Scitech Publishers

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B.Tech. ME	**L**	**T-P-D**	**C**
I Year - I Semester	0	0-3-0	2

ENGLISH LAB
(Common to all branches)

MULTI- MEDIA LANGUAGE LAB

Experiment/ Activity- 1   Introduction to Phonetics

Experiment/ Activity- 2   Sounds of English - Vowels, Diphthongs

Experiment/ Activity- 3   Consonants

Experiment/ Activity- 4   Introduction to Stress, Rhythm and Intonation

Experiment/ Activity-5   Improving Listening Skills

ENGLISH COMMUNICATION SKILLS LAB

Experiment/ Activity- 6   Self Introduction,

Experiment/ Activity- 7   Introducing others

Experiment/ Activity- 8   Agreeing/Disagreeing and Asking questions

Experiment/ Activity- 9   Just A Minute' Sessions (JAM) & Situational Dialogues

Experiment/ Activity- 10   Describing Objects / Situations / People.

Experiment/ Activity- 11   Oral Presentations - Prepared and Extempore

Experiment/ Activity- 12   Debate

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B.Tech. ME   **L**   **T-P-D**   **C**

I Year - II Semester   **3**   **0-0-0**   **3**

TECHNICAL ENGLISH
(Common to all branches)

UNIT-I
Formal & Informal Writing
-Formal & Informal Writing, Cover Letter

UNIT-II
Writing Techniques
-Developing Paragraphs- Cohesion, Developing passage by arranging paragraphs

UNIT-III
Official Correspondence
- Types of Business Correspondence
-Technical Vocabulary, Report writing, Applications, Complaints & Requisitions

UNIT-IV
e-Writing
-e-Mail Etiquette

UNIT-V
Presentation Skills
- Paper, Seminars, Conferences, Symposia, Workshop presentation
-Power Point Presentation(Microsoft Office Suit), -Project Proposal Presentation

TEXT BOOK:
1. Fundamentals of Technical Communication: Sangeetha, Sharma, Oxford.
2. Strengthen Your Writings: V.R. Narayanaswamy, Orient Logamen.

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B.Tech. ME   **L   T-P-D   C**

I Year - II Semester   **4   1-0-0   4**

MATHEMATICS – II
(Common to all branches)

UNIT - I
Differential equations of first order and their applications
Overview of differential equations – exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories
Higher Order Linear differential equations and their applications
Linear differential equations of second and higher order with constant coefficients, RHS term of the $f(X)=e^{ax}$, Cosax, Sinax, x^n, $e^{ax} V(x)$, $x^n V(x)$ and method of variation of parameters. Applications on bending of beams, Electrical circuits, simple harmonic motion.

UNIT - II
Laplace transform and its application to Ordinary differential equations
Laplace transform of standard functions – Inverse transform – first shifting theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Convolution theorem-Periodic function – differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations.

UNIT - III
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 - IV
Transforms
Fourier Transform: Fourier integral theorem – Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms, Parseval's formula.
Z-Transform: Z-Transform-Properties-Damping rule-shifting rule-Initial & Final value theorems-convolution theorem –solution of difference equations by Z-transform.

UNIT - V
Partial differential equations
Introduction and Formation of partial equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations-Classification of PDE-Finite difference methods for: Elliptic, Hyperbolic & Parabolic equations-solution of Heat equation(one dimensional)

TEXT BOOKS:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna publications, 42nd edition 2012
2. Advanced Engineering Mathematics by Jain and S.R.K. Iyengar, Narosa Publications.

REFERENCE BOOKS:

1. Engineering Mathematics-I: B.V.Ramana, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi. 5th edition, 2011.
2. Engineering Mathematics-I, Mathematical Methods by T.K.V. Iyengar & B.Krishna Gandhi & Others, S.Chand
3. Engineering Mathematics-I, Mathematical methods' by G.Shankar Rao, I.K.International Publications.

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**1-0-0**	**4**

ENGINEERING MECHANICS
(Common to CE, ME, MIE)

UNIT–I:
Introduction to Engineering Mechanics–Basic Concepts. Systems of Forces: Coplanar Concurrent Forces–Forces in Space–Moment of Force and its Application–Couples and Resultant of Force Systems.
Equilibrium of Force Systems: Free Body Diagrams, Equations of Equilibrium -
Equilibrium of planar Systems -Equilibrium of Spatial Systems.

UNIT–II:
Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, pappus theorem.

UNIT–III:
Area moment of Inertia: Definition–Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT–IV:
 Kinematics: Rectilinear and Curvilinear motions–Velocity and Acceleration–Motion of Rigid Body Types and their Analysis in Planar Motion. **Kinetics:** Analysis as a Particle and Analysis as a RigidBody in Translation–Central Force Motion Equations of Plane Motion–Fixed AxisRotation–Rolling Bodies.

UNIT–V:
Work–Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System Fixed Axis Rotation and Plane Motion. Impulse momentum method.
Principle of virtual work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums

TEXT BOOKS:
1.Engineering Mechanics: Timoshenko & Young, TATA McGraw-Hill Education, 5th Edition.
2.Engineering Mechanics: Basudev Bhattacharya, Oxford Univ. Press, New Delhi, Second Edition, 2014.

REFERENCES:
1.Engineering Mechanics: S.S. Bhavikatti & J.G. Rajasekharappa, J. Wiley, 1994
2.Engineering Mechanics: Irving. H. Shames Prentice–Hall.
3.Engineering Mechanicas-Basic Concepts: Y.V.D.Rao, M.Manzoor Hussain, K.Govinda
  Rajulu, Academic Publishing Company

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B.Tech. ME	**L**	**T-P-D**	**C**
I Year - II Semester	**1**	**0-0-3**	**3**

ENGINEERING DRAWING-II
(Common to CE, ME, MIE)

UNIT- I
Section of right regular solids, -Prism, Cylinder, Pyramid and Cone-Auxillery Views.

UNIT – II
DEVELOPMENT OF SURFACES: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

UNIT – III
INTERSECTION OF SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT – IV
ISOMETRIC PROJECTIONS: Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions -Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines, Isometric Projection of spherical Parts.

UNIT–V
ORTHOGRAPHIC PROJECTIONS: Conversion of Isometric Views to Orthographic Views – Conventions.

TEXT BOOKS:
1. Engineering Drawing, N.D. Bhat, Charotar Publishing House, 2014, 53rd Edition.
2. Engineering Drawing and Graphics: Venugopal, New age Publications

REFERENCES:
1. Nanochemistry: A Chemical Approach to Nanomaterials, G.A. Ozin and A.C. Arsenault, RSC Publishing, 2005.
2. Engineering Drawing: Narayana and Kannaiah, Scitech publishers.
3. Computer Aided Engineering Drawing: Trymbaka Murthy,I.K. International.

B.Tech. ME	**L**	**T-P-D**	**C**
I Year - II Semester	**3**	**0-0-0**	**3**

APPLIED PHYSICS
(Common to CE, ME, MIE)

UNIT-I
Crystallography- Space Lattice**,** Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Packing Factor of SC, BCC, FCC, Diamond structure, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal System.
XRD and its Applications: Basic Principles of XRD, Bragg's Law, X-Ray diffraction methods: Laue Method, Powder Method and Applications of XRD.

UNIT-II
Defects in solids: Vacancies, Substitution, Interstitial, concentration of Frenkel and Schottky Defects(Qualitative), line defects & Burger's Vector.
Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germer's Experiment, Physical Significance of the Wave Function, Schrödinger's Time Independent Wave Equation —Particle in a One-Dimentional potential well(Zero point energy).

UNIT-III
Acoustics of Building: Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine's Formula for reverberation Time (Quantative treatment), Measurement of Absorption Coefficient of a Material, Factors Affecting The Architectural Acoustics and their Remedies.
Ultrasonics: Concept of ultrasonic wave generation, Properties of Ultrasonic's, Different methods of generation of Ultrasonic's   (Piezostriction and Magnetostriction), Applications of ultrasonic's.

UNIT-IV
Physical Optics: Interference: Types of Interferences, Interference in thin films (reflected light) - Newton's rings..
 Diffraction: Types of diffraction, Frounhoffer's Diffraction due to single slit Polarization: Introduction to polarization, Double refraction, Nicol's prism.

UNIT-V
Lasers: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and Relation between them, Population Inversion, Lasing Action, Ruby Laser, Helium-Neon Laser, Applications of Lasers
Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Top-down Fabrication: Chemical Vapour Deposition, Characterization by TEM.

TEXT BOOKS:
1. Applied Physics : P.K.Mettal,I.K.International Hosese Pvt Ltd (New Edition)
2. Enginnering Physics: P.K Palaniswamy,Scitech Publications India Pvt Ltd, Fifth Print 2010.

REFERENCES

1. Engineering Physics: Senthilkumar, VRB Publishers Limited, (New Edition)
2. Applied Physics for Engineers : A.J. Dekker, MacMillan Publication
3. Introduction to Solid State Physics : C. Kittel, Wiley Eastern.

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B.Tech. ME	**L**	**T-P-D**	**C**
I Year - II Semester	**3**	**1-0-0**	**3**

DATA STRUCTURES
(Common to All Branches)

UNIT-I
Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, circular linked list implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists.

UNIT –II
Stacks-Operations, array and linked representations of stacks, stack applications-infix to postfix conversion, postfix expression evaluation, recursion implementation. Queues-operations, array and linked representations. Circular Queue operations, Dequeue, applications of queue.

UNIT-III
Trees – Definitions, Binary tree representation, Binary search tree, binary tree traversals.

UNIT-IV
Graphs: Terminology, sequential and linked representation, graph traversals : Depth First Search & Breadth First Search implementation. Spanning trees, Prims and Kruskals method.

UNIT-V
Searching and Sorting – Big O Notation, Sorting- selection sort, bubble sort, insertion sort, quick sort, merge sort, Searching-linear and binary search methods.

TEXT BOOKS:

1. Data Structures Using C: Reema Thareja, Oxford University Press Learning 2011.
2. Data Structures Using C : Aaron M. Tenenbaum

REFERENCE BOOKS:
1. C Programming & Data Structures: B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage.
2. C& Data structures: P. Padmanabham, Third Edition, B.S. Publications.
3. Data Structures using C : A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education

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APPIED PHYSICS LAB
(Common to CE, ME, MIE)

EXPERIMENT- I: Dispersive power of the material of a prism – Spectrometer

EXPERIMENT- II: Newton's Rings - Radius of curvature of plano convex lens.

EXPERIMENT- III: Frequency of AC Supply by Using Sonometer.

EXPERIMENT- IV: Time constant of an R-C circuit.

EXPERIMENT- V: Time constant of an LCR circuit.

EXPERIMENT- VI: Diffraction Grating using LASER

EXPERIMENT- VII: Torsional pendulum.

EXPERIMENT- VIII: Study the characteristics of LASER source

EXPERIMENT- IX: Study the characteristics of Light emitting diode.

EXPERIMENT- X: Analysis of XRD Spectra.

EXPERIMENT- XI: Energy gap of Semiconductor

EXPERIMENT- XII: Evaluation of numerical aperture of given fiber.

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DATA STRUCTURES LAB
(Common to all branches)

EXPERIMENT- 1: Write a C program that uses functions to perform the following operations on singly linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal v) merge two single linked lists

EXPERIMENT- 2: Write a C program that uses functions to perform the following operations on doubly linked list.:   i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways

EXPERIMENT- 3: Write a C program that uses functions to perform the following operations on circular linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal

EXPERIMENT- 4: Write C programs that implement stack operations using i) Arrays   ii) Linked Lists

EXPERIMENT- 5: 1. Write a program to convert infix expression to postfix expression using stack. 2. Write a program to evaluate postfix expression

EXPERIMENT- 6: 1. Programs using recursion. 2. Write a program to convert infix expression to prefix expression using stack

EXPERIMENT- 7: Write a program to implement Linear queue using, i) Arrays   ii) Linked Lists

EXPERIMENT- 8: Write a program to perform following operations on a circular Queue, I) insertions II) deletions III) search and count

EXPERIMENT- 9: Write a program to perform following operations on a circular DeQueue
 I) insertions II) deletions III) search and count

EXPERIMENT- 10: 1. Write a program to implement Linear search
2. Write a program to implement Binary Search

EXPERIMENT- 11: Write C programs that implement the following sorting methods to sort a given list of integers in ascending order: I) Bubble sort ii) Selection sort II) Insertion Sort

EXPERIMENT- 12: Write C programs that implement the following sorting methods to sort a given list of integers in ascending order: I) Merge sort   II) Quick sort

EXPERIMENT- 13: Implementation of a binary tree representation using, i) Arrays   ii) Linked Lists

EXPERIMENT- 14: 1. Implementation of a Graph representation using Adjacency Matrix
2. Write a program to implement graph traversals.

TEXT BOOKS:
> 1.C Programming & Data Structures: B.A.Forouzan and R.F. Gilberg, Third Edition,
>   Cengage Learning.
> 2.Data Structures Using C: Aaron M. Tenenbaum

REFERENCE BOOKS:
> 1**.**C& Data structures**:** P. Padmanabham, Third Edition, B.S. Publications.
> 2.Data Structures using C : A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein,
>   Pearson Education / PHI
> 3.C Programming & Data Structures: E. Balagurusamy, TMH.

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ENGINEERING & IT WORKSHOP
(Common to CE, ME, MIE)

TRADES FOR EXERCISES (Three exercises from each trade)
1. House-wiring
2. Foundry
3. Tin-Smithy and Development of jobs carried out and soldering.

4. **IT Workshop-I** : Computer hard ware , identification of parts , Disassembly, Assembly of computer to working ,condition, Simple diagnostic exercises.
5. **IT workshop-II** : Installation of Operating system windows and Linux .
6. **IT Workshop-III**: Working with Microsoft word, Excel and Power Point
7. **IT Workshop IV**: Internet Browsing and Etiquette.

TRADES FOR DEMONSTRATION & EXPOSURE
8. Machine Shop

TEXT BOOKS:
1. Work shop Manual : P.Kannaiah, K.L.Narayana, Scitech Publishers.
2. Workshop Manual: Venkat Reddy
3. IT Workshop Manual

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PROFESSIONAL ETHICS
(Common to all branches)

UNIT - I :
Basic Concepts
Introduction, terminology, stake holders, governing edicts, contextual aspects, ethical dilemmas, life skills, emotional, intelligence, Indian and western thoughts on ethics, value education, dimensions of ethics, setting goals in life, importance of morality and ethics, basic ethical principles, moral developments theories, classification of ethical theories, some basic theories, moral issues, moral dilemmas autonomy.

UNIT - II :
Professional and professionalism
Introduction, meaning of profession, professionals, professionalism, professional association, professional's roles and professional risks, professional accountability, successful professional, ethics and profession, engineering profession, engineering as social experimentation, engineering professionals, engineering ethics, roles of engineers, balanced outlook on law, rights and responsibilities as citizens, professional responsibilities, professional rights.

UNIT - III :
Global issues and safety
Introduction, current scenario, business ethics, environmental ethics, computer ethics, media ethics, war ethics, bio-ethics, research ethics, intellectual property right, safety and risk, assessment of risk, risk and cost, engineers responsibility for safety, risk benefit, analysis, risk cause and management, case studies, providing for safe exit, ethical issues of safety.

UNIT - IV:
Ethical codes and audits
Introduction, need for ethical codes, sample codes, corporate codes, limitations of the codes, need for ethical audit, ethical profile of organizations, ethical standards and bench marketing, audit brief, ethical auditors, procedure for ethical audit, ethical audit report, examples.

UNIT - V:
Human values and ethical living
Introduction, terminology, domains of learning, human values, attitudes, values, attitudes and professionals, needs of life, harmony in life, what is ethical living, case studies.

TEXT BOOKS:
1. **Professional ethics** by R. Subramanian, Oxford press.
2. **Text book on Professional ethics** and human values by R.S.Nagarajan, New age international.

REFERENCE BOOKS:
1. **Professional ethics** and human value by D.R.Kiran, Tata McGraw Hills education.
2. **Ethics in engineering** by Mike W. Martin and Roland Schinzinger, Tata McGraw Hills education.
3. **Fundamental of Ethics** by Edmund G Seebauer and Robert L.Barry, Oxford university press.

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PROBABILITY AND STATISTICS
(Common to CE, CSE, IT, ME, MIE,)

UNIT-I
Probability
Review of Probability. Definitions of Random variables (Discrete and continuous).
Distributions
Binomial, Poisson & normal distributions related properties . Sampling distributions – Sampling distribution of means (σ known and Unknown)

UNIT-II
Testing of Hypothesis
Testing of Hypothesis I: Tests of hypothesis point estimations – interval estimations. Large samples, Null hypothesis – Alternate hypothesis type I, & type II errors – critical region, confidence interval for mean testing of single variance. Difference between the mean.
 Testing of Hypothesis II: Confidence interval for the proportions. Tests of hypothesis for proportions single and difference between the proportions.

UNIT-III
Small samples
Confidence interval for the t- distribution – Tests of hypothesis – t- distributions, F- distributions, χ^2 distribution. Test of Hypothesis.

UNIT-IV
Correlation & Regression: Coefficient of correlation – Regression Coefficient – The lines of regression – The rank correlation
Curve Fitting: Fitting of straight-second degree curve- exponential curve-power curve by method of Least squares.

UNIT-V:
Queuing Theory: Arrival Theorem - Pure Birth process and Death Process M/M/1 Model .
Time Series analysis: Time series – utility of time series analysis, components of time series. Preliminary adjustments before analyzing time series. Measurement of trend by the method of least squares, method of moments.

TEXT BOOKS:
1. Grewal B.S, "Higher Engineering Mathematics: Khanna publications, 42nd edition 2012.
2. Advanced Engineering Mathematics : Jain and S.R.K. Iyangar, Narosa Publications.

REFERENCES:

1. Engineering Mathematics: B.V.Ramana, Tata McGrawhill Publishing company Ltd New Delhi, 5th edition, 2011
2. Engineering Mathematics-I: G.Shankar Rao, I.K.International Publications.
3. KREYSZIG. E, "Advanced Engineering Mathematics: JohnWiley & Sons Singapore, 10th edition, 2012.

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CE, ME, MIE)

UNIT-I
Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, Capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations.

UNIT II
DC & AC Machines
DC Machines: Principle of operation of DC Generator – emf equation - types – DC motor types – torque equation – applications – three point starter.
AC Machines: Principle of operation of alternators – regulation by synchronous impedance method – Principle of operation of induction motor – slip – torque characteristics – applications. Principle of operation of single phase transformers – emf equation-OC and SC tests on 1phase transformer– losses – efficiency and regulation

UNIT III
Instruments: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT IV
Diode and its Characteristics: P-N junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems)
Transistors: P-N-P and N-P-N Junction transistor, Transistor as an amplifier, SCR characteristics and applications

UNIT V
Cathode Ray Oscilloscope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS:
1. Basic Electrical & Electronics Engineering: D.P.Kothari & I.J.Nagarath, TMH, 2013.
2. Principles of Electrical and Electronics Engineering: V.K.Mehta, S.Chand & Co.

REFERENCE BOOKS:
1. Essentials of Electrical and Computer Engineering: David V. Kerns, JR. J. David Irwin
2. Principles of Electrical Engineering: V. K Mehta, Rohit Mehta, S.Chand Publications.
3. Electronic Devices and Circuits: S.Salivahanan, N.Suresh Kumar, A.Vallavaraj,Tata McGraw-Hill companies.

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MECHANICS OF SOLIDS

UNIT – I
Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual and impact loadings.

UNIT – II
Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – Shear Force and Bending Momnet diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between Shear Force and Bending Moment.

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

UNIT-IV
Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal
stresses and strains – Analytical and graphical solutions.
Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V
Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.
Thin and Thick Cylinders: Thin seamless cylindrical shells – Derivation of formulae for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter and volume of thin cylinders– Thin spherical shells. Thick Cylinders - Lami's eqations, Compound cylinders.

TEXT BOOKS:

1. Engineering Mechanics of solids: Popov, PHI Publications, 2nd Edition, 2011.
2. Strength of Materials: S.Timshenko.
3.

REFERENCES:

1. Strength of Materials: R.S. Kurmi and Gupta, S Chand Publications, 2013.
2. Strength of Materials: Jindal, Umesh Publications.
3. Mechanics of Structures Vol –I: H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.

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THERMODYNAMICS

UNIT – I
Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries and Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale-Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT- II
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III
Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non - flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes. Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables-
Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT - IV
Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart.

UNIT - V

Thermodynamic Cycles: Power cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency,Mean Effective Pressures on Air standard basis – comparison of Cycles. Refrigeration Cycles: Bell-Coleman cycle- Vapour compression cycle-performance Evaluation.

TEXT BOOKS:
1. Engineering Thermodynamics: PK Nag /TMH, 5th Edition
2. Engineering Thermodynamics/E Rathakrishnan, PHI, second Edition, 2013

REFERENCE BOOKS:
1. Engineering Thermodynamics/DP Mishra/ Cengage Learning, Second impression 2012
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles,TMH
3. Thermodynamics – J.P.Holman, McGrawHill

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METALLURGY AND MATERIAL SCIENCE

UNIT – I
Structure of Metals: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods.
Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

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

UNIT –III
Engineering Materials –I STEELS:
Iron-Carbon Phase Diagram and Heat Treatment: Study of $Fe-Fe_3C$ phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

UNIT –IV
Engineering Materials –II: CAST IRONS: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.
Engineering Materials-III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V
Engineering Materials –IV:
Ceramics, Polymers and Composites: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.

TEXT BOOKS:
1. Introduction to Physical Metallurgy: Sidney H. Avner, S Chand Publications, 2nd Edition, 1997.
2. Material Science and Metallurgy for Engineers: Kodgire, Everest Publications, 14th Edition, 2003

REFERENCES:
1. Materials Science and engineering: William and callister.
2. Engineering Material and Metallurgy: Er Amandeep Singh Wadhva
3. Materials Science for Engineering Students: Traugott Fischer 2009 Edition.

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ELECTRICAL AND ELECTRONICS ENGINEERING LAB

SECTION A: ELECTRICAL ENGINEERING:

EXPERIMENT- I: Swinburne"s test on D.C. Shunt machine. (Predetermination of efficiency of D.C. Shunt machine working either as motor or generator).

EXPERIMENT- II: OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors)

EXPERIMENT- III: Brake test on 3-phase Induction motor (Determination of performance characteristics)

EXPERIMENT- IV: Regulation of alternator by Synchronous impedance method. In addition to the above four experiments, any one of the experiments from the following list is required to be conducted :

EXPERIMENT- V: Speed control of D.C. Shunt motor by
a) Armature Voltage control b) Field flux control method

EXPERIMENT- VI: Brake test on D.C Shunt Motor

SECTION B: ELECTRONICS ENGINEERING:

EXPERIMENT- I: Transistor CE & CB Characteristics (Input and Output)
EXPERIMENT- II: Full wave and half wave Rectifier with and without filters
EXPERIMENT- III: CE Amplifiers.
EXPERIMENT- IV: RC Phase Shift Oscillator
EXPERIMENT- V: Class A, B, C Power Amplifier
EXPERIMENT- VI: PN-Junction diode & Zener diode.

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METALLURGY LAB

EXPERIMENT- I: Preparation and study of the Micro Structure of pure metal Fe.

EXPERIMENT- II: Preparation and study of the Micro Structure of pure metal Cu.

EXPERIMENT- III: Preparation and study of the Micro Structure of pure metal Al.

EXPERIMENT- IV: Preparation and study of the Microstructure of Mild steels.

EXPERIMENT- V: Preparation and study of the Microstructure of low carbon steels

EXPERIMENT- VI: Preparation and study of the Microstructure of high carbon steels.

EXPERIMENT- VII: Study of the Micro Structures of Cast Irons.

EXPERIMENT-VIII: Study of the Micro Structures of Copper Alloys.

EXPERIMENT- IX: Study of the Micro Structures of Aluminum Alloys.

EXPERIMENT- X: Study of the Micro structures of Heat treated steels.

EXPERIMENT- XI: Hardenability of steels by Jominy End Quench Test.

EXPERIMENT-XII: To find out the hardness of various heat treated steels.

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MECHANICS OF SOLIDS LAB

EXPERIMENT- I: Direct tension test

EXPERIMENT- II: Bending Test

EXPERIMENT- III: Deflection test on Simply supported beam

EXPERIMENT- IV: Deflection test on Cantilever beam

EXPERIMENT- V: Torsion test

EXPERIMENT- VI: Brinells hardness test

EXPERIMENT- VII: Rockwell hardness test

EXPERIMENT-VIII: Test on springs

EXPERIMENT- IX: Compression test on cube

EXPERIMENT- X: Impact test by Izod method

EXPERIMENT- XI: Impact test by Charpy method

EXPERIMENT-XII: Punch shear Test

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PRODUCTION TECHNOLOGY

UNIT – I
CASTING: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns ,pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems
Solidification of casting – Concept – Solidification of pure metal and alloys, short and long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes, Centrifugal casting, Die casting, Investment casting.
Methods of Melting: Crucible melting and cupola operation, steel making processes.

UNIT – II
A) Welding: Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, Arc welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.
B) Cutting of Metals: Oxy Acetylene Gas cutting, water plasma cutting and Cutting of ferrous, non-ferrous metals.

UNIT – III
Inert Gas welding, TIG and MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering and Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive nondestructive testing of welds.

UNIT – IV
Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements.
EXTRUSION OF METALS: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.
Forging processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.
Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools. Forces and power requirement in the above operations.

UNIT - V
Processing of Plastics: Types of Plastics, Properties, applications and their Processing methods & Equipment (blow &injection modeling). Introduction to Polymer based composite materials.

TEXT BOOKS:
1. Manufacturing Technology: P.N. Rao, TMH, 2nd Edition, 2000.
2. Manufacturing Processes for Engineering Materials: Serope Kalpakjian and Steven R
     Schmid, Pearson Pubishers.

REFERENCES:
1. Production Technology: Sharma P C, S. Chand Publications, 6th Edition, 2006.
2. Production Technology: R.K. Jain, Khanna Publications, 2005.
3. Production Engineering: Suresh Dalela & Ravi Shankar, Galgotia Publications Pvt. Ltd.

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KINEMATICS OF MACHINERY

UNIT – I
Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained.
Machines: Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains. Mechanical Advantage –Grubler's criterion.

UNIT – II
Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.
Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.
Plane motion of body: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – III
Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio.
Hooke's Joint: Single and double Hooke's joint – Universal coupling – application – problems.
Straight Line Motion Mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

UNIT – IV
Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower Motion - Uniform Velocity – Simple Harmonic Motion and Uniform Acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

UNIT – V

Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

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

TEXT BOOKS:
1. Theory of Machines: Thomas Bevan, Pearson Publications, 3rd Edition, 2011.
2. Theory of Machines: R.K Bansal, S Chand, 5th Edition, 2010.

REFERENCES:
1. Theory of Machines: R.S Khurmi & J.K Gupta, S Chand, 14th Edition, 2013
2.Theory of Machines: PL. Ballaney, Khanna publishers.
3.Mechanism and Machine Theory: JS Rao and RV Dukkipati, New Age

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APPLIED THERMODYNAMICS – I

UNIT – I
Actual Cycles and Their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles Of CI Engines.
I.C. Engines : Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication.

UNIT – II
Combustion in S.I. Engines: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.
Combustion in C.I. Engines: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

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

UNIT – IV
COMPRESSORS – Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.
Reciprocating: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, undercooling, saving of work, minimum work condition for stage compression.

UNIT V
Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor –mechanical details and principle of working – efficiency considerations.
Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.
Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytropic efficiency.

TEXT BOOKS:
1. I.C. Engines: V. Ganesan, TMH, 4th Edition, 2012.
2. IC Engines :Ramalingam, Scietech Publishers.

REFERENCES:
1. IC Engines: Mathur & Sharma : Dhanpath Rai & Sons.
2. Thermal Engineering: Rajput, Lakshmi Publications.
3. I.C. Engines: Heywood, McGrawHill.

J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY
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B.Tech. ME	**L**	**T-P-D**	**C**
II Year - II Semester	**4**	**0-0-0**	**4**

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

UNIT- I
Fluid Statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, surface tension- vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT- II
Fluid Kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady and unsteady, uniform and non uniform, laminar and turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow and three dimensional flows.
Fluid Dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT- III
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter, and orifice meter, Flow nozzle
Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

UNIT- IV
Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.
Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.
Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT- V
Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.
Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:
1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH, Stadanrd Book House, 20th Edition, 2015.
2. Fluid Mechanics and Hydraulic Machines by Rajput, Laxmi Publications

REFERENCES:

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

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B.Tech. ME	**L**	**T-P-D**	**C**
II Year - II Semester	**0**	**0-0-6**	**3**

MACHINE DRAWING

Machine Drawing Conventions:

Need for drawing conventions – introduction to SI conventions
   a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
   b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
   c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
   d) Title boxes, their size, location and details - common abbreviations & their liberal usage
   e) Types of Drawings – working drawings for machine parts.

I. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.
   a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
   b) Keys, cottered joints and knuckle joint.
   c) Rivetted joints for plates
   d) Shaft coupling, spigot and socket pipe joint.
   e) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.
   a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.
   b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.
   c) Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

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

TEXT BOOKS:
 1. Machine Drawing : K.L.Narayana, P.Kannaiah & K. Venkata Reddy, New Age Publishers, 4th Edition, 2010.
 2. Machine Drawing : N.D. Bhatt., Charotar Publications, 47th Edition, 2012.

REFERENCES:
 1. Machine Drawing : Ajeet Singh, TMH Publications, 4th Edition, 2010
 2. Machine Drawing: P.S.Gill, Kataria Publications16th Edition, 1996
 3. Machine Drawing :Junarkar.N.D., Pearson, 2009.

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B.Tech. ME   **L   T-P-D   C**

II Year - II Semester   **3   0-0-0   3**

ENVIRONMENTAL STUDIES
(Common to all branches)

UNIT-I
Ecosystems & Natural Resources, **Biodiversity:** Classification of Resources: Living and Non-Living resources, Renewable and Non-Renewable resources. Water resources: use and over utilization, Land resources, land degradation, Forest resources, Mineral resources uses & Exploitation Energy resources: growing energy needs, use of alternate energy sources. Concept of ecosystem, Classification of ecosystem, Functions of ecosystem, Food chains, Food webs and ecological pyramids, Flow of energy, Biogeochemical cycles, Biomagnifications, carrying capacity. Species, Ecosystem Diversity, Hotspots, Value Of Biodiversity, Threats To Biodiversity, Conservation Of Biodiversity: In-Situ And Ex-Situ Conservation.

UNIT-II
Environmental Pollution and Control: Classification of pollutions and pollutants, causes, effects of water, air, noise pollution, Introduction to control technologies: Water (primary, secondary, tertiary), Air (particulate and gaseous emissions), Soil(conservation and remediation), Noise(controlling devices) Solid waste, (Municipal) types, collection and disposal methods, characteristics of e-waste & hazardous waste, biomedical waste management. Biological disasters, pandemic and epidemics, Biological warfare.

UNIT-III
Global Environmental Problems and Global Efforts: Green house effect, Green House Gases(GHG), Global Warming, Sea level rise, climate change and their impacts on human environment. Ozone depletion and Ozone depleting substances(ODS). Deforestation and desertification, International conventions/protocols: Earth Summit, Kyoto Protocol and Montreal Protocol, green-belt-development, Concept of Green Building, Clean Development Mechanism(CDM). Biological disasters, pandemic and epidemics, Biological warfare.

UNIT-IV
Environmental Impact Assessment (EIA) And Environmental Management Plan: definition of Impact, classification of impacts, methods of baseline data acquisition. Impacts on different components: such as human health resources, air, water, flora, fauna and society, EIA guide lines as per ministry of environment & forest, impact assessment methodologies. Environmental Impact Statement (EIS). Environmental management plan (EMP).

UNIT-V
Environmental Policy, Legislation, Rules and Regulations & Towards Sustainable Future: Concept of Sustainable Development, Threats to Sustainability, Strategies for achieving Sustainable development, Environmental Ethics, Environmental Economics, Concept of Green Computing, Green chemistry and low Carbon life styles..**:** National Environmental Policy, Environmental Protection Act: Air (Prevention and control of pollution) Act-1981, Water (Prevention and control of pollution) Act-1974, Water pollution Cess Act-1977, Forest Conservation Act, solid waste (biomedical waste and hazardous waste)management and handling rules.

TEXT BOOK:
1. Text Book of Environmental Science and Technology: M.Anji Reddy 2007
2. Principles of Environmental Science and Engineering : P.Venugopal Rao

REFERENCES
1. Tata McgrawHill : Introduction to Environmental Studies: Benny Joseph
2. Environmental studies: Erach Bharucha 2005, University Grants Commission, University Press
3. Introduction to Environmental Studies: K.Mukkanti

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B.Tech. ME			
II Year - II Semester	0	0-3-0	2

PRODUCTION TECHNOLOGY LAB

I. METAL CASTING LAB:

EXPERIMENT-I: Pattern Design and making - for one casting drawing.
EXPERIMENT-II: Permeability test on moulding sand
EXPERIMENT-III: Moulding Melting and Casting - 1 Exercise

II. WELDING LAB :

EXPERIMENT-I: ARC Welding Lap & Butt Joint - 2 Exercises
EXPERIMENT-II: Spot Welding - 1 Exercise
EXPERIMENT-III: TIG welding
EXPERIMENT-IV: Gas Welding-1 Excercise
EXPERIMENT-V: Brazing-1 Exercise
EXPERIMENT –VI: Plasma welding

III. MECHANICAL PRESS WORKING :

EXPERIMENT-I: Hydraulic Press: for drawing operations.
EXPERIMENT-II: Blanking and piercing operations and study of simple, compound and **progressive** press tools
EXPERIMENT-III: Bending, other operations

IV. PROCESSING OF PLASTICS

EXPERIMENT-I: Injection Moulding
EXPERIMENT-II: Blow Moulding

REFERENCE BOOK:

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

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B.Tech. ME   **L**   **T-P-D**   **C**

II Year - II Semester   **0**   **0-3-0**   **2**

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

EXPERIMENT-I: Impact of jets on Vanes.

EXPERIMENT-II: Performance Test on Pelton Wheel.

EXPERIMENT-III: Performance Test on Single Stage Centrifugal Pump.

EXPERIMENT-IV: Performance Test on Multi Stage Centrifugal Pump.

EXPERIMENT-V: Performance Test on Reciprocating Pump.

EXPERIMENT-VI: Calibration of Venturimeter.

EXPERIMENT-VII: Calibration of Orifice meter.

EXPERIMENT-VIII: Determination of friction factor for a given pipe line.

EXPERIMENT-IX: Determination of loss of head due to sudden contraction in a
pipeline.

EXPERIMENT-X: Verification of Bernoulli's Theorems.

EXPERIMENT-XI: Performance test on Francis Turbine.

EXPERIMENT-XII: Calibration of Mouth piece / Orifice apparatus

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II Year - II Semester	0	0-3-0	2

GENDER SENSITIZATION
(Common to all branches)

UNIT-I
Gender: Why should we study it?, Socialization: Making women, Making Men, Introduction, Preparing For Womanhood, Growing up male, First lessons in caste, Different masculinities.

UNIT-II
Housework: The Invisible Labour,
"My mother does not work", "Share the load", Missing Women: Sex Selection and Its Consequences, Declining sex ratio, Demographic consequences, Point of view, Gender and the structure of knowledge, Further reading : Unacknowledged women artists of Telangana, Sexual Harassment: Say No! Sexual harassment, not eve-teasing, Coping with everyday harassment, Further reading. "Chupulu"

UNIT-III
Women's Work: Its Politics and Economics,
Fact and fiction, Unrecognized and unaccounted work, Further reading: Wages and conditions of work, Domestic Violence: Speaking Out, Is home a safe place?, When women unite [Film], Rebuilding lives, Further reading: New forums for justice.

UNIT-IV
Whose History? Questions for Historians and Others,
Reclaiming a past, Writing other histories, further reading: Missing pages from modern Telangana history. Gender Spectrum: Beyond the Binary, Two or many?, Struggles with discrimination, Thinking about Sexual Violence, Blaming the victim, "I fought for my life…", Further reading: The caste face of violence.

UNIT-V
Just Relationships: Being Together as Equals,
Mary kom and Onler, Love and acid just do not mix, Love letters, Mothers and fathers, Further Reading: Rosa Parks – The brave heart.

TEXT BOOK:
1. Towards a world of equals : A.Suneetha Susic Tharu publication Telugu academy Hyderabad.

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B.Tech. ME   **L**   **T-P-D**   **C**

III Year - I Semester   **3**   **0-0-0**   **3**

(C310O) NUMERICAL METHODS
(Open Elective)

UNIT-I
Roots of Nonlinear equations
. Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.
Solution of linear equations:
Existence of solution – Gauss Elimination method – Gauss elimination with Pivoting. Gauss Jordon Method- Ill conditioned systems – Jacobi iterative method – Gauss Seidel Method – Convergence of Iterative methods.

UNIT-II
 Interpolation:
Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences – Symbolic relations and separation of symbols- Difference Equations - Differences of a polynomial-Newton's formulae for interpolation –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.   - Cubic spline.

UNIT– III
 Least squares method:
Linear, Nonlinear and curvilinear curve fitting – Multiple linear regression
Numerical differentiation and integration
Numerical differentiation and integration Trapezoidal rule, simpson's 1/3 rule and 3/8th rule.

UNIT – IV
Numerical solution of Initial Value Problems in Ordinary Differential Equations
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 Methods- Adams- Bashforth Method.

UNIT-V
Boundary values & Eigen value problems
Shooting method, Finite difference method and solving eigen values problems, power method.
Solution of partial differential equations
Classification of partial differential equation –Finite difference methods for: Elliptic equations –Laplace equations – Leibmann's iterative method – Parabola equations – Solution of heat equation (One dimensional).

TEXT BOOKS:
1. Numerical Methods: E. Balaguruswamy : Tata Mc Graw Hill, 29th Edition, 2010
2. An Introduction to Numerical Analysis: S.S.Sastry, PHI Learning, 2nd Edition, 2010

REFERENCES:
1. Numerical Methods: Jain, Iyengar & Jain, NewAge Publications, 2008.
2. Numerical Methods: S. Armugam & Others, Scitech, Publications.
3. Introduction to Numerical Analysis: K.E. Aitkinson, Wiley Publications.

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B.Tech. ME   **L**   **T-P-D**   **C**

III Year - I Semester   **3**   **0-0-0**   **3**

(C313P) RELIABILITY ENGINEERING
(Open Elective)

UNIT - I
Basics concepts of reliability: Introduction, Reliability and quality ,Failures and failure modes, Causes of failures and reliability, Maintainability and availability, History of reliability, reliability literature.
Reliability mathematics: Introduction, Random experiment , Probability , Random variables, Distribution functions, Discrete distribution ,Continuous distribution, Numerical characteristics of random variables , Laplace transform.

UNIT- II
Component reliability and hazard models: Introduction, Component reliability from test data, Mean time to failure, Time – dependent hazard models, Stress- Dependent hazard models , Derivation of reliability function using Markov, Treatment of field data.
System reliability models: Introduction - Systems with component with in series - Systems with parallel components - k-out – of- m systems - Non series parallel systems - Systems with - mixed – mode failures - Fault- tree technique

UNIT- III
Maintainability and availability concepts: Introduction - Maintainability function - Availability function - Frequency of failures - Two-unit parallel systems with repair - k-out-of-m systems - Preventive maintenance.
Reliability improvement: Introduction - Improvement components   - Redundancy - Element redundancy - Unit redundancy - Stand by redundancy - Optimization - Reliability – cost trade – off .

UNIT- IV
Economics of reliability engineering : Economic issues - Manufacture's cost - Customer's cost -   Reliability achievement cost   -   models   -   Reliability utility cost models - Depreciation cost models - Availability – cost – model of parallel systems.

UNIT- V
Reliability management: Reliability programming - Management policies and decision - Reliability management by objectives - Reliability group - Reliability data : Acquisition and analysis - Managing people for reliability

TEXT BOOKS ;
1. Reliability Engineering: Balaguruswamy, Tata McGraw Hill
2. Reliability Engineering: L.B.Srinath, East West Publications.

REFERENCE BOOKS:
1. Reliability Engineering: Patrick DTO, Wiley Conor-India
2. Reliability Engineering and life testing, Naikan-PHI Publications.

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B.Tech. ME   **L**   **T-P-D**   **C**

III Year - I Semester   **3**   **0-0-0**   **3**

(C315R) ARTIFICIAL NEURAL NETWORKS
(Open Elective)

UNIT- I
Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks
Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Asssignment Problem, Memory, Adaption, Statistical nature of the learning process

UNIT- II
Single layer perceptrons – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron –convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment
Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection

UNIT- III
Back Propagation - back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT-IV
Self Organization Maps – Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification

UNIT- V
Neuro Dynamics – Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm
Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:
1. Neural networks: A comprehensive foundation, Simon Hhaykin, Pearson Education, 2nd Edition, 2012.
2. Artificial neural networks: B.Vegnanarayana Prentice Hall of India P Ltd 2005.

REFERENCES:
1. Neural networks in Computer intelligence: Li Min Fu TMH, 2003.
2. Neural networks: James A Freeman David M S kapura, Pearson education, 2004.

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B.Tech. ME   **L**   **T-P-D**   **C**

III Year - I Semester   **3**   **0-0-0**   **3**

(C313A) METROLOGY & SURFACE ENGINEERING

UNIT – I
Systems of Limits and Fits: Introduction, nominal size, tolerance limits, deviations and variation of quality characteristics, fits and their types – unilateral and bilateral tolerance system – international tolerance grades, hole and shaft basis systems – interchangeability and selective assembly. BIS system – British Standard system, International Standard system for plain and screwed work.
Linear Measurement: Length standard, line and end standard, slip gauges – calibration of slip gauges, Dial indicator, micrometers.
Measurement of Angles And Tapers: Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar, sine plate, rollers and spheres used to determine tapers.

UNIT – II
Limit Gauges: Taylor's principle – Design of GO and NO GO gauges, plug, ring, snap, gap, taper, profile and position gauges.
Optical Measuring Instruments: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.
Flat Surface Measurement: Measurement of flat surfaces – instruments used – straight edges – surface plates – optical flat and Autocollimator.

UNIT – III
Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA,R_T, R_A, RMS Values – Rz values, Methods of measurement of surface roughness - profilograph. Talysurf, BIS symbols for indication of surface roughness.
Measurement Through Comparators: Comparators – Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

UNIT-IV
Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.
Surface Engineering: Surface texture and properties, Surface cleaning techniques, Surface integrity, Wear and its measurements, Lubricants and selection for reducing wear, Principles of corrosion and remedial measures, Laser applications for surface modifications.

UNIT – V
Surface Treatments: Mechanical surface treatment and coating, casehardening and surface coating, thermal spraying, Vapour deposition, Ion implantation, Diffusion coating, Electroplating, Electroless plating and Electro forming, Ceramic, Organic and Diamond coating

TEXT BOOKS:
1. Manufacturing Engineering and Technology: Serope Kalpakjian and Steven R. Schmid, 4th Edition, Pearson Publications, 2001.

2. Metrology and Measurement: Anand Bewoor, Vinay A. Kulkarni, TMH, 2009.

REFERENCES:
1. Fundamentals of Dimensional Metrology: Connie Dotson, Thomson, 4th Edition, 2003.
2. Surface Engineering for corrosion and wear resistance: JR Davis, Woodhead Publishers.
3. Precision Engineering and Manufacturing: R.L Murty, Newage Publications, 2009.

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B.Tech. ME	L	T-P-D	C
III Year - I Semester	3	1-0-0	3

(C313B) DYNAMICS OF MACHINERY

UNIT – I

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships.

Static and Dynamic Force Analysis Of Planar Mechanisms: Introduction – Free Body Diagrams – Conditions for equilibrium – Two, three and four force systems – Inertia forces and D' Alembert's Principle – planar rotation about a fixed center.

UNIT – II

Synthesis of Linkages: Three position synthesis – Four Position Synthesis – Precision positions – structural error – Chebychev's spacing, Freudentein's Equation, Problems.

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes and Dynamometers: Simple block brakes, internal EXPANDING brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operations.

UNIT – III

Turning Moment Diagram and Flywheels: Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Flywheels and their design.

Governers : Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism and hunting.

UNIT-IV

Balancing : Balancing of rotating, Single and multiple masses in single and different planes, Balancing of Reciprocating Masses**:** Primary and Secondary balancing of reciprocating masses, Analytical and graphical methods - Unbalanced forces and couples – Balancing of V, multi cylinder inline and radial engines for primary and secondary balancing, locomotive balancing.

UNIT – V

Vibration: Free Vibration of mass attached to vertical spring – Simple problems on forced damped vibration, Vibration Isolation and Transmissibility- whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

TEXT BOOKS :
1. Theory of Machines: T.Beven, S Chand Publications, 3rd Edition.
2. Theory of Machines: SS Ratan, Tata Mc Graw Hill, 2007 reprint.

REFERENCES:
1. Theory of Machines and Mechanisms: P.L.Ballaney, Orient Publishers
2. Kinematics and Dynamics of Machinery: R.L.Norton, Mc Graw - Hill
3. Mechanism and Machine Theory: JS Rao and RV Dukkipati, New Age

B.Tech. ME	**L**	**T-P-D**	**C**
III Year - I Semester	3	0-0-0	3

(C313C) MACHINE TOOLS

UNIT – I

Elementary treatment of metal cutting theory – Basics of cutting process – Geometry of single point tool - angles chip formation and types of chips – builtup edge and its effects, chip breakers - Mechanics of orthogonal cutting –Merchant's diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, machinability – Tool materials.
Kinematic schemes of machine tools – Constructional features of speed gear box and feed gear box. Gearing and speed layout diagrams.

UNIT – II

Engine lathe: Principle of working, specifications of lathe – types of lathe – work holders, tool holders – Box tools Taper turning, thread turning and attachments.
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 multispindle automatic lathes – tool layout and cam design.

UNIT – III

Shaping slotting and planing machines – Principles of working – Principal parts – specification classification and operations performed. Kinematic mechanisms of the shaping slotting and planing machines, machining time calculations.
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. Gearing diagrams of drilling and boring machines.

UNIT – IV

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, kinematic scheme of milling cutters.
Grinding machine: Fundamentals – Theory of grinding – classification of grinding machines – cylindrical surface and centerless grinding machine – Tool and cutter grinding machine – special types of grinding machines – Different types of abrasives - specifications and selection of grinding wheel.

UNIT- V

Lapping, honing and broaching machines: – comparison to grinding – lapping and honing. Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed Units, machining time calculations.
Design of Jigs and fixtures, Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices - Typical examples and applications.

TEXT BOOKS:
1. Production Technology : R.K. Jain and S.C. Gupta, Khanna Publication, 2005.
2. Production Technology : H.M.T. (Hindustan Machine Tools), Tata McGraw Hill, 2009.

REFERENCES:
1. Machine Tools:C.Elanchezhian and M. Vijayan, Anuradha Agencies Publishers, 2nd Edition, 2012.
2. Workshop Technology, Vol II: B.S.Raghu Vamshi, Dhanpatrai Publications, 9th Edition, 2009.

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III Year - I Semester	**4**	**1-0-0**	**4**

(C313D) DESIGN OF MACHINE MEMBERS – I

UNIT – I
Introduction: General considerations in the selection of Engineering Materials and their properties, Manufacturing considerations in design, BIS codes for steels.
Stresses in Machine Members: Types of stresses– stress strain relations – static theories of failure – factor of safety – Design for strength and rigidity – preferred numbers - The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II
Fatigue Loading: Stress concentration – Theoretical stress Concentration factor, Fatigue stress concentration factor notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength –Goodman and Soderberg theories of failures.
Design o f Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined loads – Shaft sizes – BIS codes – Design of shaft for gear and belt drives.

UNIT – III
Riveted Joints: Modes of failure of riveted joints – Strength Equations – efficiency of riveted joints - Design of boiler joints – eccentrically loaded riveted joints.
Welded Joints: Design of Fillet welds - axial loads - Circular fillet welds - bending and torsion – eccentrically loaded joints.
Bolted Joints: Design of bolts with prestresses – Design of joints under eccentric loading – bolts of uniform strength, Cylinder cover joints.

UNIT – IV
Axially Loaded Joints: Keys, Cotters and Knuckle Joints: Design of Keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.
Shaft Couplings: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Pinbush coupling.

UNIT – V
Mechanical Springs: Stresses and deflections of helical springs – Extension -compression springs – Springs for static and fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Coaxial springs.

TEXT BOOKS :
1. Mechanical Engineering Design: Bahl and Goel, Standard Publications
2. Machine Design: R.L.Norton, Mc Graw Hill

REFERENCES :
1. Machine Design: Timothy H, Wenzell PE, Cengage
2. Machine Design: Schaum Serie, Mc Graw Hill, 1997.
3. Machine Design: Pandya & shah, Mc Graw Hill, 2007.

B.Tech. ME	**L**	**T-P-D**	**C**
III Year - I Semester	**4**	**1-0-0**	**4**

(C313E) APPLIED THERMODYNAMICS -II

UNIT – I
Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temp0erature of Heat addition, Methods to improve cycle performance – Regeneration and reheating.
Combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, flue gas analysis
Boilers : Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Boiler horse power, equivalent evaporation, efficiency and heat balance

UNIT – II
Draught: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught- induced and forced.
Steam Nozzles: Functions- types – applications; Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit, Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, effects, degree of super saturation and degree of under cooling - Wilson line.

UNIT – III
Steam Turbines: Classification – Impulse turbine - Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency.
De-Laval Turbine - features. Methods to reduce rotor speed, Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine.

UNIT IV
Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.
Steam Condensers: Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and affects, air pump; cooling water requirement.

UNIT – V
Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, concepts about compressors, combustion chambers and turbines of Gas Turbine Plants.

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

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

TEXT BOOKS:
1. Thermal Engineering: R.K. Rajput , Lakshmi Publications, 3rd Edition, 2001.
2. Gas Turbines: V.Ganesan, TMH, 3rd Edition, 2002.

REFERENCES :
1. Thermodynamics and Heat Engines: R. Yadav, Central Book Depot
2. Gas Turbines and Propulsive Systems: P.Khajuria & S.P.Dubey , Dhanpatrai and sons, 1997
3. Gas Turbines: Cohen, Rogers and Saravana Muttoo, Addison Wesley,Longman Publishers.

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III Year - I Semester   **0   0-3-0   2**

(C3106) MACHINE TOOLS LAB

EXPERIMENT-I: Introduction of general purpose machines -Lathe, Drilling machine, Milling machine.
EXPERIMENT-II: Study parts of Shaper machine, slotting machine.
EXPERIMENT-III: Study of parts of all grinding machines
EXPERIMENT-IV: Study of material, geometry of tools used in metal cutting like single point, multipoint cutting tools
EXPERIMENT-V: Plain and step turning on lathe machine
EXPERIMENT-VI: Taper turning on lathe machine
EXPERIMENT-VII: Thread cutting and knurling on -lathe machine.
EXPERIMENT-VIII: Drilling and Tapping
EXPERIMENT-IX: Shaping
EXPERIMENT-X: Slotting
EXPERIMENT-XI: Milling
EXPERIMENT-XII: Surface Grinding
EXPERIMENT-XIII: Cylindrical grinder
EXPERIMENT-XIV: Tool and cutter grinder

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III Year - I Semester   **0**   **0-3-0**   **2**

(C3107) METROLOGY LAB

EXPERIMENT-I: Measurement of lengths, heights and diameters by vernier calipers and micrometers.

EXPERIMENT-II: Measurement of bores by internal micrometers and dial bore indicators.

EXPERIMENT-III: Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear.

EXPERIMENT-IV: Alignment Tests on Lathe Machine

EXPERIMENT-V: Alignment Tests on Drilling Machine

EXPERIMENT-VI: Alignment Tests on milling Machine

EXPERIMENT-VII: Alignment Tests on grinding Machine

EXPERIMENT-IIIV: Tool maker's microscope and its applications

EXPERIMENT-IX: Angle and taper measurements by Bevel protractor and Sine bars.

EXPERIMENT-X: Flatness testing of surface plate.

EXPERIMENT-XI: Thread measurement by Three wire method.

EXPERIMENT-XII: Usage of Ring and Plug Gauges.

EXPERIMENT-XIII: Surface roughness measurement using Tally surf

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(C3108) THERMAL ENGINEERING LAB

EXPERIMENT-I: I.C. Engine Valve Timing Diagram

EXPERIMENT-II: I.C. Engine Port Timing Diagram

EXPERIMENT-III: I.C. Engine Performance Test (4 -Stroke Diesel Engine)

EXPERIMENT-IV: I.C. Engine Performance Test on 2-Stroke Petrol Engine

EXPERIMENT-V: Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol Engine

EXPERIMENT-VI: Evaluation of engine friction by conducting motoring and retardation test on 4 stroke diesel Engine.

EXPERIMENT-VII: Heat balance sheet on IC Engines.

EXPERIMENT-VIII: Determination of Air -Fuel Ratio and Volumetric Efficiency on IC Engines.

EXPERIMENT-IX: Determination of Economical speed test for fixed load on 4-stroke Engine.

EXPERIMENT-X: Determination optimum cooling water temperature on IC Engine

EXPERIMENT-XI: Dis-assembly and Assembly of Engines.

EXPERIMENT-XII: Performance test on Reciprocating Air-compressor test rig.

EXPERIMENT-XIII: Study of Boilers.

EXPERIMENT-XIV: Determination of COP of Refrigeration test rig.

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(C320A) MANAGEMENT SCIENCE FOR ENGINEERS
(Common to CE, ME, MIE)

UNIT I
Introduction to Managerial Economics, Concepts of Managerial Economics:
Demand Analysis: Law of Demand, Elasticity of demand & Demand Forecasting.
Production and cost Analysis: Production functions, Laws of Returns, Economies of scale.
Cost Concepts: Different types of costs: Variable cost, Fixed cost, Marginal cost, Semi-variable cost. Break-even Analysis.

UNIT II
Market Structures: Different types of Markets.
Pricing: Methods of Pricing and strategies, Skimming and Penetration Pricing.
Capital budgeting: Estimation of fixed and working capital, Methods & sources of raising capital. Methods of capital budgeting, Traditional and Discounted Techniques.
Financial accounting & Financial Analysis: Overview of financial Accounts, Journal, Subsidiary books, Ledger, Trial Balance and Preparation of Trading Account, Profit & Loss Account and Balance Sheet. Financial Analysis with the help of Ratios.

UNIT III
Management: Functions of management. Taylor's scientific management theory, Fayol's principles of management.
Designing of organization structures: Different Methods with Merits and demerits and their suitability.
Human Recourse Management: Recruitment, Selection, Training and Development and Permanence Appraisal.

UNIT IV
Operation Management: Types of plant layout, Methods of production, work, study-procedure involved in Methods study and work Measurement. Statistical quality control.
$\overline{X}$, R, C & P charts.
Project Management: Programme Evaluation and Review Technique (P E R T), critical path method
(C PM). Identification of critical path.

UNIT V
Material Management: Objectives, Need for Inventory Control, EOQ, ABC Analysis, VED Analysis, Purchase procedure, stores Management.
Marketing: Functions, Marketing Mix, Marketing strategies based on product life cycle, channels of distributions.

TEXT BOOKS :
1. Managerial Economics& Financial Accounting: Dr.M.Kasi Reddy, Dr. S.Saraswathi, Prentice Hall of India.
2. Managerial Economics: Varshney & Maheswari, Sultan Chand, 2009.

REFERENCES:
1. Financial Accounting for Management: Ambrish Gupta, Pearson Education, New Delhi, 2009.
2. Financial Accounting A Managerial Perspective: Narayanaswamy, PHI, 2008.
3. Financial Accounting, S.N.Maheswari & S.K. Maheswari, Vikas, 2008.

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B.Tech. ME   **L   T-P-D   C**

III Year - II Semester   **3   1-0-0   3**

(C323A) FINITE ELEMENT METHOD

UNIT -I
Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress – Strain and strain - displacement relations. Rayleigh- Ritz method, Weighted residual methods.

UNIT -II
One Dimensional problems : Stiffness equations for a axial bar element in local co-ordinates using Potential Energy approach and Virtual energy principle - Finite element analysis of uniform, stepped and tapered bars subjected to mechanical and thermal loads - Assembly of Global stiffness matrix and load vector - Quadratic shape functions - properties of stiffness matrix.

UNIT -III
Stiffness equations for a truss bar element oriented in 2D plane - Finite Element Analysis of Trusses – Plane Truss and Space Truss elements – methods of assembly.
Analysis of beams: Hermite shape functions – Element stiffness matrix – Load vector – Problems.

UNIT -IV
2-D problems: CST - Stiffness matrix and load vector - Isoparametric element representation – Shape functions – convergence requirements – Problems. Two dimensional four noded isoparametric elements - Numerical integration - Finite element modelling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements - 3-D problems – Tetrahedran element.

UNIT -V
Scalar field problems: 1-D Heat conduction – 1D fin elements – 2D heat conduction - analysis of thin plates – Composite slabs - problems.
Dynamic Analysis: Dynamic equations – Lumped and consistent mass matrices – Eigen Values and Eigen Vectors – mode shapes – modal analysis for bars and beams.

TEXT BOOKS:
1. The finite element methods in Engineering : S.S. Rao, Elsevier, 4th edition
2. Introduction to finite elements in engineering, Tirupathi K. Chandrupatla and Ashok D. Belagundu.

REFERENCES:

1. Finite Element Methods: Alavala, PHI, 2nd Edition, 2010.
2. An Introduction to Finite Element Methods: J. N. Reddy – Mc Grawhill
3. The Finite Element Method in Engineering Science: O.C. Zienkowitz, Mc Grawhill.

B.Tech. ME   **L**   **T-P-D**   **C**

III Year - II Semester   **3**   **1-0-0**   **3**

(C323B) REFRIGERATION AND AIR-CONDITIONING

UNIT – I
Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. –
Mechanical Refrigeration – Types of Ideal cycles of refrigeration.
Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems –
Actual air refrigeration system problems – Refrigeration needs of Air crafts.

UNIT – II
Vapour compression refrigeration: – working principle and essential components of the
plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on
T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle
Influence of various parameters on system performance – Use of p-h charts – numerical
Problems.

UNIT III
Principles of Evaporators: – classification – Working Principles Expansion devices – Types
– Working Principles
Refrigerants – Desirable properties – classification refrigerants used – Nomenclature –
Ozone Depletion – Global Warming .
Vapor Absorption System – Calculation of max COP – description and working of NH3 –
water system and Li Br –water (Two shell & Four shell) System. Principle of operation
Three Fluid absorption system, salient features.
Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and
operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – IV
Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization
of
Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltration – Load
concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

UNIT V
Requirements of human comfort and concept of effective temperature- Comfort chart –
Comfort Air conditioning – Requirements of Industrial air conditioning , Air conditioning
Load Calculations.
Air Conditioning systems - Classification of equipment, cooling, heating humidification and
dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources –
different heat pump circuits.

TEXT BOOKS :
1. Refrigeration and Air Conditioning: CP Arora, Mc Graw Hill, 1998.
2. A Course in Refrigeration and Air conditioning: SC Arora & Domkundwar, Dhanpatrai Publishers, 2009.

REFERENCES :
1. Principles of Refrigeration: Warren Marsh. R, 2nd Edition, Delmar Publications
2. Refrigeration and Air Conditioning: P.L.Bellaney, Khanna Publishers, 7th Edition, 1985.
3. Basic Refrigeration and Air-Conditioning : Ananthanarayanan, TMH.

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B.Tech. ME	**L**	**T-P-D**	**C**
III Year - II Semester	**4**	**1-0-0**	**4**

(C323C) DESIGN OF MACHINE MEMBERS – II

UNIT – I
Sliding Contact Bearings: Types of Journal bearings – basic modes of Lubrication – Bearing construction - bearing design - bearing materials – Selection of lubricants.
Rolling Contact Bearings: Types of rolling contact bearings – selection of bearing type – selection of bearing life - Design for cyclic loads and speeds – Static and dynamic loading of ball & roller bearings.

UNIT – II
Design of IC Engine Parts: Connecting Rod : Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts. Pistons, Forces acting on piston – Construction Design and proportions of piston., Cylinder, Cylinder
liners,

UNIT – III
Power Transmission Systems, Pulleys: Transmission of power by Belt and Rope drives , Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives, Materials, Chain drives.
Spur Gear Drives: Spur gears- Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT – IV
Helical and Bevel Gear Drives: Helical and Bevel gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of Helical and Bevel gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT – V
Design of Power Screws: Design of screw, Square ACME , Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.
Design of Worm Gears: Worm gears – Properties of worm gears – Selection of materials – Strength and wear rating of worm gears – Force analysis – Friction in worm gears- thermal considerations.

TEXT BOOKS :
1. Machine Design: S.G. Kulkarni, Tata Mc Graw Hill, 2007.
2. Machine Design: T.V.Sundararajan Murthy and N.Shanmugam, Mc Graw Hill, 8th Edition, 2000.

REFERENCES :

1. Machine Design: V.Bandari, TMH Publishers
2. Machine Design: R.N. Norton, PHI Publisher, 5th Edition.
3. Mechanical Engineering Design: JE Shigley, Mc Graw Hill, 1995.

B.Tech. ME	**L**	**T-P-D**	**C**
III Year - II Semester	**4**	**0-0-0**	**4**

(C323D) HEAT TRANSFER

UNIT – I
Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.
Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.
Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

UNIT – II
One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation.
One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.
One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Concept of Functional Body

UNIT – III
Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.
Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.
Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

UNIT – IV
Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.
Heat Transfer with Phase Change: Boiling: – Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling. **Condensation:** Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

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

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

TEXT BOOKS :
1. Heat Transfer: HOLMAN, Mc Graw Hill, 8th Edition, 2000.
2. Heat Transfer: P.K.Nag, TMH, 2002.

REFERENCE BOOKS:
1. Fundamentals of Engineering Heat and Mass Transfer: R.C.SACHDEVA, New Age International, 2008, 3rd Edition.
2. Heat Transfer: Ghoshdastidar, Oxford University Press –2nd Edition
3. Heat and Mass Transfer: R.K. Rajput – S.Chand & Company Ltd., 1st Edition, 2009.

B.Tech. ME	**L**	**T-P-D**	**C**
III Year - II Semester	**3**	**0-0-0**	**3**

(C323E) NANOTECHNOLOGY
(Elective – I)

UNIT-I
Introduction to nanotechnology: Importance of nanoscale, Nanostructure types, electronic, magnetic, optical Properties of Nanomaterials, top-down and bottom- up approach to nanostructures.
Quantum Mechanical phenomenon in nanostructures:
Quantum confinement of electrons in semiconductor Nano structures, one dimensional confinement (Quantum wires), two dimensional confinements (Quantum Wells), three dimensional confinements (Quantum dots).

UNIT-II
Carbon Nano Structures: Carbon nanotubes (CNTs), Fullerenes, C60, C80 and C240 Nanostructures, Properties (mechanical, optical and electrical) and applications.
Fabrication of Nanomaterials:
Physical Methods: Inert gas condensation, Arc discharge, RFplasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Molecular beam epitaxy, Chemical vapour deposition method.

UNIT-III
Nano scale characterization techniques: Scanning probe techniques (AFM, MFM, STM, SEM, TEM), XRD
Nanodevices and Nanomedicine: Lab on chip for bioanalysis, Core/shell Nanoparticles in drug delivery systems (site specific and targeted drug delivery), cancer treatment, and bone tissue treatment.

UNIT-IV
Nano and molecular electronics: Resonant-Tunneling structures, single electron tunneling, Single Electron transistors, coulomb blockade, giant magneto resistance, tunneling magneto resistance.

UNIT-V
Nanolithography and Nanomanipulation: e-beam lithography and SEM based nanolithography and nanomanipulation, Ion beam lithography, oxidation and metallization. Mask and its application. Deep UV lithography, X-ray based lithography.

TEXT BOOKS:
1. Introduction to Nanotechnology: Charles.P.Pode, Springer Publications, 2008.
2. Springer Handbook of Nanotechnology: Bharat Bhusan, Springer Publications, 2010.

REFERENCES BOOKS:

1. Principles of Nanotechnology: Phani Kumar, Scitech Publications.
2. Transport in Nano structures: David Ferry, Cambridge University Press 2000
3. Nanobiotechnology; C.M. Niemeyer, C.A. Mirkin, Wiley Publications, 2006.

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III Year - II Semester	3	0-0-0	3

(C323F) MECHANICAL VIBRATIONS
(Elective – I)

UNIT- I

Single degree of Freedom systems - I: Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility.

UNIT - II
Single degree of Freedom systems - II: Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.
Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT- III
Two degree freedom systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers;

UNIT- IV
 Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

UNIT- V
Numerical Methods: Raleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.
Continuous system: Free vibration of strings – longitudinal oscillations of bars- traverse vibrations of beams- Torsional vibrations of shafts.
Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

TEXT BOOKS:
1. Elements of Vibration Analysis: Meirovitch, TMH, 2001
2. Mechanical Vibrations: G.K.Groover, 2nd Edition, 1972, NemChand Publications.

REFERENCES:
1. Mechanical Vibrations: SS Rao, Pearson, 2009, 4th Edition.
2. Mechanical Vibration: Rao V.Dukkipati & J Srinivas, PHI, 2010.
3. Mechanical Vibrations Practice and Basic Theory: V. Ram Murthy, Narosa Publishing House, New Delhi, 2000.

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III Year - II Semester	3	0-0-0	3

(C323G) COMPOSITE MATERIALS
(Elective – I)

UNIT- I

Introduction to Composite Materials: Introduction ,Classification: Polymer Matrix Composites. Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber. Reinforced Composites and nature-made composites, and applications

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide. Fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT- II

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man lay up, pultrusion, RTM.

Macromechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli,Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT- III

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina. Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure. Envelopes, Maximum Strain Failure Theory ,Tsai–Hill Failure Theory, Tsai–Wu Failure Theory Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina

UNIT- IV

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT- V

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

Failure Analysis and Design of Laminates: Introduction , Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

TEXT BOOKS:
1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
2. R. M. Jones, Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.

REFERENCES:
1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. Ever J. Barbero, Finite Element Analysis of Composite Materials, CRC Press, 2007.
3. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2009.

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III Year - II Semester	0	0-3-0	2

(C3208) HEAT TRANSFER LAB

EXPERIMENT-I: Composite Slab Apparatus – Overall heat transfer co-efficient.

EXPERIMENT-II: Heat transfer through lagged pipe.

EXPERIMENT-III: Heat Transfer through a Concentric Sphere

EXPERIMENT-IV: Thermal Conductivity of given metal rod.

EXPERIMENT-V: Heat transfer in pin-fin Apparatus

EXPERIMENT-VI: Experiment on Transient Heat Conduction.

EXPERIMENT-VII: Heat transfer in forced convection apparatus.

EXPERIMENT-VIII: Heat transfer in natural convection

EXPERIMENT-IX: Parallel and counter flow heat exchanger.

EXPERIMENT-X: Emissive apparatus.

EXPERIMENT-XI: Stefan Boltzman Apparatus.

EXPERIMENT-XII: Critical Heat flux apparatus.

EXPERIMENT-XIII: Study of heat pipe and its demonstration.

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III Year - II Semester	**0**	**0-3-0**	**2**

(C3209) FUELS & LUBRICANTS & AUTOMOBILE ENGINEERING LAB

EXPERIMENT- I: To determine Flash and Fire point for a given liquid fuel- Pensky Marten Appartus

EXPERIMENT- II: To determine Flash and Fire point for a given liquid fuel- Abel's Appartus

EXPERIMENT -III: To determine viscosity of given oil by Red Wood Viscometer -I

EXPERIMENT- IV: To determine Carbon Residue of given fuel

EXPERIMENT- V: To determine Calorific Value of a given fuel/ oil

EXPERIMENT- VI: To study and prepare report on the constructional details, working and operation of the Automobile transmission systems

EXPERIMENT- VII: To study and prepare report on the constructional details, working and operation of the Automotive Drive Lines and Differentials

EXPERIMENT- VIII: To study and prepare report on the constructional details, working and operation of the Automotive Fuel Supply systems

EXPERIMENT- IX: To study and prepare report on the constructional details, working and operation of the Automotive Suspension System

EXPERIMENT- X: To study and prepare report on the constructional details, working and operation of the Automotive Brake System

EXPERIMENT- XI: To study and prepare report on the constructional details, working and operation of the Automobile steering system

EXPERIMENT- XII: To study and prepare report on the constructional details, working and operation of the Automotive Tyres and Wheels

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B.Tech. ME   **L   T-P-D   C**

IV Year - I Semester   **4   1-0-0   4**

(C413A) OPERATIONS RESEARCH

UNIT – I
Introduction: Development – Definition– Characteristics and Phases – Types of operation Research models – applications. **Allocation :** Linear Programming - Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT – II
Transportation Problem: Formulation – Optimal solution - unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

UNIT – III
Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.
Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.
Theory Of Games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games -graphical method.

UNIT – IV
Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.
Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost- Single period model.

UNIT – V
Dynamic Programming: Introduction –Terminology- Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Brief Introduction of Simulation Languages.

TEXT BOOKS:
1. Operations Research: J.K.Sharma, MacMilan, 4th Edition, 2010.
2. Operations Research: R.Pannerselvam, PHI Publications, 2nd Edition, 2009.

REFERENCES :
1. Operations Research: A.M.Natarajan, P.Balasubramani, A. Tamilaras, Pearson Education.
2. Operations Research: Methods & Problems: Maurice Saseini, Arhur Yaspan & Lawrence Friedman.
3. Introduction to Operations Research: Taha PHI, 8th Edition, 2004.

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IV Year - I Semester	**4**	**0-0-0**	**4**

(C413B) POWER PLANT ENGINEERING

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant : Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Steam Power Plant: Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II

Internal Combustion Engine Plant: DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparision.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

Hydro Projects And Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT IV

Power from Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types Of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V
Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOK :
1.   Power Plant Engineering : P.C.Sharma, S.K.Kataria Publications, 2012.
2.   A Course in Power Plant Engineering: Arora and S. Domkundwar, 7th Edition, 2000

REFERENCES:
1.   A Text Book of Power Plant Engineering: Rajput, Laxmi Publications
2.   Power plant Engineering: Ramalingam, Scietech Publishers
3.   Power Plant Engineering: P.K.Nag, 2nd Edition, TMH, 1998.

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IV Year - I Semester	**4**	**0-0-0**	**4**

(C413C) CAD/CAM

UNIT – I
Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II
Geometric modeling: Requirements, geometric models, geometric construction models, curve

representation methods, surface representation methods, modeling facilities desired.

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT – III
Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, **CNC Part Programming :** fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT – IV
Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

Computer aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-nonoptical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – V
Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS :
1. CAD / CAM: A Zimmers & P.Groover, PE, PHI, 1st Edition, 2009.
2. CAD / CAM Theory and Practice: Ibrahim Zeid, TMH, 3rd Edition, 2001.

REFERENCES :
1. Automation, Production systems & Computer integrated Manufacturing, Groover, Pearson Education, 2014.
2. CAD / CAM / CIM : Radhakrishnan and Subramanian: New Age, 2nd Edition, 2000.
3. Principles of Computer Aided Design and Manufacturing, Farid Amirouche Pearson.

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IV Year - I Semester   **3**   **1-0-0**   **3**

(C413D) INSTRUMENTATION AND CONTROL SYSTEMS

UNIT – I

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

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

UNIT – II

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

UNIT – III

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

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

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

UNIT – IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter

UNIT – V

Measurement Of Force,Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications and Design : D.S Kumar, Anuradha Agencies
2. Instrumentation, Measurement and Analysis : B.C.Nakra & K.K.Choudhary, TMH, 1999.

REFERENCE BOOKS:

1. Instrumentation and Control systems: S.Bhaskar,Newage Publications, 1998.
2. Experimental Methods for Engineers: Holman, MCH Publishers, 2001
3. Mechanical and Industrial Measurements: R.K. Jain, Khanna Publishers.

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B.Tech. ME   **L**   **T-P-D**   **C**

IV Year - I Semester   **3**   **0-0-0**   **3**

(C413E) ROBOTICS
(Elective - II)

UNIT – I
Introduction: Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems - **Components of the Industrial Robotics:** Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

UNIT – II
Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.
Manipulator Kinematics: D-H notations - Joint coordinates and world coordinates - Forward and inverse kinematics – problems.

UNIT – III
Differential Kinematics : Differential Kinematics of planar and spherical manipulators - Jacobians – problems.
Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV
Trajectory planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion:** Slew motion - joint interpolated motion – straight line motion – problems.

UNIT V
Robot actuators and Feed back components: Actuators: Pneumatic and Hydraulic actuators. **Electric Actuators:** DC servo motors - stepper motors. **Feedback components:** position sensors – potentiometers, resolvers and encoders – Velocity sensors – Tactile sensors.
Robot Application in Manufacturing: Material handling - Assembly and Inspection.

TEXT BOOKS:
1. Industrial Robotics : Groover M P, MCH Publishers, 2010.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd Edition, 2001.

REFERENCES :

1. Robotics: Fu K B, McGraw Hill, 1987.
2. Robot Analysis and Intelligence: Asada and Slotine, Wiley Inter-Science.
3. Robot Dynamics & Control: Mark W. Spong and M. Vidyasagar, John Wiley & Sons (ASIA) Pvt. Ltd.

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IV Year - I Semester	**3**	**0-0-0**	**3**

(C413F) DESIGN FOR MANUFACTURING
(Elective - II)

UNIT I:
Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.
Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

UNIT II:
Machining Process: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness – Design for Machining ease – Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts

UNIT III:
Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – casting tolerances – Use of Solidification Simulation in casting design – Product design rules for sand casting.
Metal Joining: Appraisal of various welding processes, Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.

UNIT IV:
Forging: Design factors for Forging – Closed die forging design – parting lines of dies – Drop forging die design – General design recommendations
Extrusion, Sheet Metal Work & Plastics: Design guidelines for Extruded sections - Design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

UNIT V:
Design for Assembly: General design guidelines for Manual Assembly- Development of Systematic DFA Methodology- Assembly Efficiency- Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time.

TEXT BOOKS:

1. Product design for Manufacture and Assembly: Geoffrey Boothroyd, Marcel Dekker Inc. NY, 2nd Edition, 2010.
2. Product Design: Kevin Otto and Kristin Wood, Pearson Education, 2004.

REFERENCE BOOK:

1. Product design and Manufacturing : A.K Chitale and R.C Gupta ,Prentice – Hall of India, New Delhi, 2003.

B.Tech. ME	**L**	**T-P-D**	**C**
IV Year - I Semester	**3**	**0-0-0**	**3**

(C413G) JET PROPULSION AND ROCKET ENGINEERING
(Elective - II)

UNIT-I
Elements of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters   of performances –cycle modifications for improvement of performance.

UNIT-II
Jet propulsion: Historical sketch-reaction principle –essential features of propulsion devices-Thermal Engines, Classification of –Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications

UNIT-III
Turboprop and Turbojet-1: Thermo dynamic cycles, plant layout ,essential components, principles of operation –performance evaluation
Turboprop and Turbojet-II: Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV
Ramjet: Thermo dynamic Cycle, plant lay-out, essential components –principle of operation-performance evaluation –comparison among atmospheric thermal jet engines-serqujet and pulse jet, elementary treatment.
Rocket Engines: Need for, applica**tions –**Basic principles of operation and parameter s of performance –classification ,solid and liquid propellant rocket engines ,advantages, domains of application –propellants –comparison of propulsion systems.

UNIT-V
Rocket Technology-I: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets ,need for –Feed systems, injectors and expansion nozzles –Rocket heat transfer and ablative cooling.
Rocket Technology- II: Testing & instrumentation –Need for Cryogenics –Advanced propulsion Systems, elementary treatment of Electrical Nuclear and plasma Arc propulsion.

TEXT BOOKS:
1. Gas Turbines and propulsive systems: P.Khajuria& S.P.Dubey, Dhanpatrai Publications, 1997.
2. Gas Dynamics & Space Propulsion: M.C.Ramaswamy, Jaico Publishing House.

REFERENCE BOOKS:

1. Rocket Propulsion –Sutton
2. Gas Turbines: Cohen, Rogers & Sarvana Muttoo, Addision Wesley & Longman.
3. Gas Turbines-V.Ganesan /TMH, 4th Edition, 1998.

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IV Year - I Semester	**3**	**0-0-0**	**3**

(C413H) UNCONVENTIONAL MACHINING PROCESSES
(Elective - III)

UNIT – I
Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.
Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II
Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.
Electro–Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.

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

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

UNIT-V
Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle- maskants –etchants- applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, Shaped tube electrolytic machining.

TEXT BOOKS:
1. Advanced Machining Processes; VK Jain, Allied publishers, 2010.
2. Manufacturing Engineering and Technology: Serope Kalpakjian and Steven R. Schmid, 4th Edition, Pearson Publications, 2012.

REFERENCES:
1. Modern Machining Process: Pandey P.C. and Shah H.S., TMH, 1980.
2. New Technology: Bhattacharya A, The Institution of Engineers, India 1984.
3. Unconventional Machining Processes: C. Elanchezhian, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005

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IV Year - I Semester	3	0-0-0	3

(C413I) CNC TECHNOLOGY & RPT
(Elective - III)

UNIT- I

Features of NC Machines: Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of N/C Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

CNC Machines Elements: Machine Structure- Guide ways - feed drives-spindles - spindle bearings - measuring systems-Tool monitoring systems.

UNIT- II

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

Compute-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT- III

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory, counters, timers and serial data I/O interrupts. Selection of Micro Controllers, Embedded Controllers, Applications and Programming of Micro Controllers.

UNIT- IV

Programming Logic Controllers (PLC's): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT- V

Rapid Prototyping: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method,Advantages, Limitations and Applications, Rapid tooling, Techniques of rapid manufacturing

TEXT BOOKS:

1. Computer Control of Manufacturing Systems: Yoram Koren, Mc Graw Hill Int. 2010.
2. CAD/CAM: Michel P.Groover, TMH, 1st Edition, 2009.

REFERENCES:

1. Machining Tools Hand Book Vol 3, (Automation & Control), Manfred Weck , John Wiley and Sons, 1984.
2. Mechatronics – HMT, TMH, 2003.
3. Manufacturing Engineering and Technology ,Kalpakijian, Pearson Publication, 4th Edition, 2012.

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IV Year - I Semester   **3**   **0-0-0**   **3**

(C413J) AUTOMATION IN MANUFACTURING
(Elective - III)

UNIT – I
Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.
Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

UNIT – II
Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III
Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – IV
Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.
Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – V
Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing
Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of Rapid Proto typing.

TEXT BOOK:
1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover 3e./PE/PHI, 2009
2. Computer Aided Manufacturing: Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.

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IV Year - I Semester   **0**   **0-3-0**   **2**

(C4107) COMPUTER AIDED DESIGN & MANUFACTURING LAB

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances.

2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.

3. a). Determination of deflection and stresses in 2D and 3D trusses and beams.
    b). Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
    c). Determination of stresses in 3D and shell structures
           (at least one example in each case)
    d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
    e). Steady state heat transfer Analysis of plane and Axisymmetric components.

4. a). Development of process sheets for various components based on tooling and Machines.
    b). Development of manufacturing defects and tool management system.
    c). Study of various post processors used in NC Machines.
    d). Development of CNC part program for turning components and milling components.
    e). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.
    f). Quality Control and inspection.

At least one Software Package from each category of modeling, Analysis and CAM packages from the following:
Use of Auto CAD, CATIA, Solid works, ANSYS, NASTRAN, CNC simulation software

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IV Year - I Semester	**0**	**0-3-0**	**2**

(C4108) PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

A) PRODUCTION DRAWING PRACTICE
UNIT – I
Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings,

UNIT – II
Limits and Fits :
Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables, Heat treatment and surface treatment symbols used on drawings.

UNIT – III
Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

UNIT – IV
Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components,

UNIT – V
Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc, Part drawing using computer aided drafting by CAD software

(B) INSTRUMENTATION LAB
EXPERIMENT-I: Calibration of Pressure Gauges

EXPERIMENT-II: Calibration of transducer for temperature measurement.

EXPERIMENT-III: Study and calibration of LVDT transducer for displacement measurement.

EXPERIMENT-IV: Calibration of strain gauge for temperature measurement.

EXPERIMENT-V: Calibration of thermocouple for temperature measurement.

EXPERIMENT-VI: Calibration of capacitive transducer for angular displacement.

EXPERIMENT-VII: Study and calibration of photo and magnetic speed pickups for the measurement of speed.

EXPERIMENT-VIII: Calibration of resistance temperature detector for temperature measurement.

EXPERIMENT-IX: Study and calibration of a rotameter for flow measurement.

EXPERIMENT-X: Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

EXPERIMENT-XI: Study and calibration of McLeod gauge for low pressure.

TEXT BOOKS:
1. Production Drawing: K.L. Narayana , P. Kannaiah, New Age, 4th Edition, 2011.
2. Machine Drawing with Auto CAD- Pohit and Ghosh, PE, 1st Edition, 2014.

REFERENCES:
1. Geometric Dimensioning and Tolerancing: James D. Meadows, B.S Publications, 1995.
2. Engineering Metrology, R.K. Jain, Khanna Publications, 19th Edition, 2005.

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IV Year - I Semester	**0**	**0-3-0**	**2**

(C4109) SOFT SKILLS LAB-I
(Common to all Branches)

Activity/ Experiment = 12

Activity I: Know Yourself/ Self Discovery and Soft Skills
1. Introduction—Importance of Knowing Yourself
   Process of knowing yourself—SWOT analysis
   Benefits of SWOT analysis---Using SWOT analysis
   SWOT analysis grid—questions to complete the grid
2. Introduction –What are soft skills?—importance of soft skills
   Selling your skills—Attributes regarded as soft skills—Soft Skills
   Social Soft Skills—Thinking Soft Skills—Negotiating –Exhibiting your Soft Skills
3. Identifying your soft skills—Improving your soft skills –Train Yourself
   Top 60 soft skills—Practicing soft skills—Measuring Attitudes

Activity II: Time and Stress Management
4. Introduction—The 80-20 rule—take a good look at the people around you—Examine your work
   Sense of time management –around you—examine your work—sense of time management
   Time is money—features of time—three secrets of time management
5. Time management matrix—analysis of time matrix—effective scheduling
   Grouping of activities—five steps to successful time management
   Difficulties in time management—evils of not planning—interesting facts about time
   Deal say of spending a day—time wasters—time savers—realizing the value of time
   Time circle planner.
   Introduction –Meaning—Effects , Kinds , and Sources of Stress
   Case study—spotting stress—stress management tips

Activity III: Developing Positive Attitude
6. Introduction—meaning –features of attitudes—attitude and human behavior : Passive, Aggressive and Behavior
   Formation of attitudes—change of attitudes—what can you do to change attitude?
   Ways of changing attitude in a person—attitude in a workplace
   Features of a good team player

7. The power of positive attitude—developing positive attitude

   Obstacles in developing positive attitude—staying negative—examples of negative attitude

   Overcoming negative attitude—negative attitude and its results.

Activity IV Body Language

8. Introduction –body talk—Voluntary and involuntary body language

   Forms of body language—parts of body language—origin of body language

   Uses of body language—Body language in building interpersonal relations

9. Body language in building interpersonal relations—reasons to study body language

   Improving your body language –types of body language—gender differences

   Body language—shaking hands

   Interpreting body language

Activity V Practice in Presentation Skills

10 Types of Presentations

   Do's and Don'ts of Presentation Skills

11   Body language in presentation skills

12. Examples—Aspects, etc

TEXTBOOKS:

1. Soft Skills: Know Yourself and Know the World—Dr. K. Alex-S. Chand Publising-2010

REFERENCE BOOKS:

1. Managing Soft skills: K.R. Lakshminarayanan & Murugavel, Scitech Publications-2010

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IV Year - II Semester	3	1-0-0	3

(C423A) AUTOMOBILE ENGINEERING

UNIT – I
Introduction : Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II
Fuel System : S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection.ss
C.I. Engines : Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.
Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

UNIT – III
Ignition System : Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.
Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil Pressure Gauge, Engine Temperature Indicator Etc.

UNIT – IV
Emission from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG,CNG, liquid Fuels and gaseous fuels, electrical-their merits and demerits.
Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – V

Suspension System : Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System : Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System : Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

TEXT BOOKS:
1. Automotive Mechanics Engineering: William Crouse, TM Hill Publishers, 10TH Edition, 2014.
2. A Systems Approach to Automobile Technology: Jack Erjavec, YESSDEE Publishers Pvt Ltd., New Delhi.

REFERENCES:
1. Automotive Engines: Srinivasan, TMH Publishers, 1996.
2. Automobile Engineering : K.K. Ramalingam, Scitech Publications (India) PVT. LTD.
3. Automotive Engineering: Newton Steeds & Garrett.

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IV Year - II Semester **3** **1-0-0** **3**

(C423B) MECHATRONICS
(Elective - IV)

UNIT – I

Introduction: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications:

Signal Conditioning: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , sped channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , High pass , Notch filtering

UNIT – II

Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation

Systems - Hydraulic Actuation Systems - Electrohydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

Electronic Interface Sub systems: TTL, CMOS interfacing - Sensor interfacing - Actuator interfacing – solenoids , motors Isolation schemes- Optocoupling, buffer IC's - Protection schemes–circuit breakers , over current sensing , resettable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT –III

Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servomotors- 4-quadrant servodrives, - Pulse Width Modulation (PWM) – Variable Frequency Drives, Vector Drives - Drive System load calculation.

UNIT – IV

Microcontrollers Overview: Microcontrollers, microprocessor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking , Voltage measurement using ADC).

Programmable Logic Controllers: Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

Unit – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal - S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robot, CNC, FMS, CIM..

TEXT BOOKS:
1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCES:
1. Mechatronics Source Book : Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics : N. Shanmugam, Anuradha Agencies Publisers.
3. Mechatronics System Design: Devdas shetty, Richard, Thomson.

B.Tech. ME	L	T-P-D	C
IV Year - II Semester	3	1-0-0	3

(C423C) MAINTENANCE AND SAFETY ENGINEERING
(Elective - IV)

UNIT-I
Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.
Maintenance Management And Control: Maintenance Manual, Maintenance, FacilityEvaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.

UNIT-II
Types of maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures,PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

UNIT-III
Inventory Control in Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods
Quality and Safety In Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers

UNIT-IV
Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models

UNIT-V
Reliability, Reliability Centered Maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

Maintainability: Maintainability Importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS
1. Reliability, Maintenance and Safety Engineering : Dr. A.K.Guptha, Laxmi Publications, 2013.
2. Industrial Safety Management: L.M. Deshmukh, TMH, 4th Edition, 2006.

REFERENCES:
1. Maintenance Engineering & Management: R.C.Mishra, PHI, 2005.
2. Reliability Engineering: Elsayed, Pearson
3. Engineering Maintenance a modern approach, B.S Dhallon, 2002, C.R.R publishers

B.Tech. ME	L	T-P-D	C
IV Year - II Semester	3	1-0-0	3

(C423D) PRODUCTION PLANNING AND CONTROL
(Elective - IV)

UNIT-I
Introduction: Definitions – objectives of production planning and control- functions of production planning and control-elements of production control- types of production-organization of production planning and control – internal organizations department

UNIT-II
Forecasting – Importance of forecasting – types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III
Inventory management – Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model – Inventory control systems – P- Systems and Q – Systems

Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV
Routing – Definition – routing procedure- Route sheets – Bill of material- factors affecting routing procedure. Schedule – definition – difference with loading.
Scheduling polices – techniques, standard scheduling methods- job shop, flow shop,.

UNIT-V
Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.
Dispatching – Activities of dispatcher- Dispatching procedure - follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planning control.

TEXT BOOKS:
1. Production Planning and Control: M.Mahajan- Dhanpati Rai & Co, 2010.
2. Production Planning and Control: Jain & Jain – Khanna publications, 7th Edition, 2014.

REFRENCE BOOKS :
1. Production Planning and Control: Text & cases, SK Mukhopadhyaya, PHI.
2. Production and operations Management: R.Panneer Selvam, PHI, 3rd Edition, 2014.
3. Operations Management: Chase, PHI

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IV Year - II Semester   **3**   **1-0-0**   **3**

(C423E) RENEWABLE ENERGY SOURCES
(Elective - V)

UNIT – I
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT- II
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Solar Energy Storage and Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT-IV
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V
Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and Joule-Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:
1. Renewable Energy Resources: Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy Sources : G.D. Rai, Khanna Publications, 10th Edition, 2002.

REFERENCES:
1. Renewable Energy Sources: Twidell & Weir, PHI Publishers, 2nd Edition, 2012.
2. Solar Energy: Sukhatme, 2nd Edition, 1997.
3. Solar Power Engineering: B.S Magal Frank Kreith & J.F Kreith.

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IV Year - II Semester   **3**   **1-0-0**   **3**
(C423F) COMPUTATIONAL FLUID DYNAMICS
(Elective - V)

UNIT-I
Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

UNIT - II
Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.
Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT - III
Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - IV
Introduction to first order wave equation; stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.
Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

UNIT - V
Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.
 Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow: Suhas V. Patankar Hema shava Publishers corporation & Mc Graw Hill.
2. Computational Fluid Flow and Heat Transfer: Muralidaran- Narosa Publications

REFERENCES:

1. Computational Fluid Dynamics: Basics with applications : John D. Anderson, Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics: Tapan K. Sengupta, Universities Press

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B.Tech. ME	L	T-P-D	C
IV Year - II Semester	3	1-0-0	3

(C423G) GAS DYNAMICS
(Elective - V)

UNIT- I
Introduction: Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation.

Properties of atmosphere, standard atmosphere, relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT- II
Isentropic flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed. maximum speed, variation of Compressibility with mach number.

UNIT- III
Variable area flow, criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying backpressures.

UNIT-IV
Flow in constant area duct: Adiabatic and isothermal- flow calculation of pressure, temperature, density, Mach number relationships. Limiting length of duct for adiabatic and isothermal flow. Fanno line.

Diabatic flow: Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships. Limiting conditions.Rayleigh line.

UNIT-V
Wave phenomenon: Pressure disturbances in compressible fluid, type of shock waves – normal, shock. Pressure –density-velocity-temperature and Mach number relations for a plane normal shock. Shock intensity- Rayleigh- Pilot and Prandtl- Pitot equation for normal shock. Introduction to oblique shockwaves and hypersonic flow.

TEXT BOOKS
1. S.M. Yahya, "Fundamentals of Compressible Flow", New Age International Publishers, 2nd Edition, 2004.
2. Zoeb Hussain, "Gas dynamics through problems ", Wiley Eastern Ltd.

REFERENCES
1. Gas dynamics: E. Radha Krishnan, P.H.I Publication, 2009.
2. Gas Dynamics : H.W. Lipman and A. Rashkho, John Wiley, 1963.
3. Gas Dynamics: Cambel and Jennings, McGraw Hill, 1958.

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B.Tech. ME   **L**   **T-P-D**   **C**

IV Year - II Semester   **0**   **0-3-0**   **2**

(C4211) SOFT SKILLS LAB- II
(Common to all Branches)

Activity/ Experiment = 12

Group Discussion
1. Dynamics of Group discussion—tips for Group Discussion—Traits tested in GD
2. Non-verbal Communication in GD
3. Body language in GD

Interview Skills
4. Introduction—types of Interview
5. FAQ's in Interview
6. Reasons for rejecting a candidate
7. On the day of interview
8. common mistakes in interview
9. Post interview etiquette
10. Dress code and tips for job seekers at interview
11. Body language in Interview skills

Mock Interview
12. Parameters to evaluate students' performance

TEXTBOOKS:
Soft Skills: Know Yourself and Know the World—Dr. K. Alex-S. Chand Publising-2010

REFERENCE BOOKS:
Managing Soft skills: K.R. Lakshminarayanan & Murugavel, Scitech Publications-2010