RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

NANDYAL-518501, KURNOOL DIST., A.P., INDIA

MECHANICAL ENGINEERING

ESTD: 1995

B.TECH SYLLABUS
2015

Applicable for students admitted into B.Tech (Regular) from 2015-16

REGULATIONS, COURSE STRUCTURE & DETAILED SYLLABUS

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

(Affiliated to J.N.T.U.A, Anantapuramu)

ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABI

B.Tech. (Regular) from 2015-16 and B.Tech.(Lateral Entry Scheme) from 2016-17

For pursuing four year Bachelor Degree Program (under graduate) of study in Engineering (B.Tech.),Two year Master (post graduate) Degree of study in Engineering (M.Tech.),Two year Master (post graduate) degree of study in Business Administration (MBA), Three year Master (post graduate) Degree of study in Computer Applications (MCA) offered by Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal - 518501 under Autonomous status and herein referred to as RGMCET (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2015-16 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Rajeev Gandhi Memorial College of Engineering and Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation. As and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Rajeev Gandhi Memorial College of Engineering and Technology shall be the Chairman, Academic Council.

The candidate seeking admission into the first year of study of four year B.Tech. degree Program should have:

Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics and Chemistry as optional subjects (or any equivalent examination certified by Board of Intermediate Examinations) or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh (or any equivalent examination certified by State Board of Technical Education) for admission.

i) Secured a rank in the EAMCET examination conducted by AP State Council for Higher Education (APSCHE) for allotment of a seat by the Convener, EAMCET, for admission.

Admission Procedure:

As per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made to the first year of Four year B.Tech. Degree program as follows:-

a) As per the norms of Government of Andhra Pradesh, A-Category (based on the rank obtained in EAMCET) seats will be filled by the Convener, EAMCET.

b) As per the norms of Government of Andhra Pradesh, B-Category seats will be filled by the management.

Admission to the Second year of Four year B.Tech. Degree Program in Engineering:

i) Candidates qualified in ECET and admitted by the Convener, ECET, in such cases for admission, when needed permission from the statutory bodies is to be obtained.

ii) 20% of the sanctioned strength in each program of study (of RGMCET) shall be filled by the Convener, ECET as lateral entry.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

List of Programs offered

1. B.Tech. – Regular (& Lateral Entry)
2. M.Tech. – Regular
3. MBA – Regular
4. MCA – Regular

Academic Regulations for 2015 B. Tech. (Regular)

(Effective for the students admitted into the I year from the Academic Year 2015-2016)

The B.Tech.be conferred by the Jawaharlal Nehru Technological University Anantapur, Anantapuramu students who are admitted to the program and fulfil all the requirements for the award of the Degree as specified below:

1.0 Award of B.Tech. Degree

1.1 The student will be declared eligible for the award of the B. Tech. degree if he fulfils the following academic regulations:

1.2 Pursued a course of study for not less than prescribed course work duration and not more than double the prescribed course work duration.

1.3 Registered for 200 credits and secured a minimum of 194credits with compulsory subjects as listed in Table-1 below.

Table 1: Compulsory Subjects

S. No.	**SUBJECT PARTICULARS**
1	All the first year subjects
2	All practical subjects
3	All Skill Development Courses/ value added courses
4	Mini project
5	Seminar
6	Comprehensive viva – voce
7	Project work
8.	Extra Academic Activities(EAA)

2.0 Forfeit of seat

Students, who fail to fulfil all the academic requirements for the award of the degree within **eight academic years** from the year of their admission, shall forfeit their seat in B.Tech. Course.

3.0 Courses of study

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

1.	Civil Engineering
2.	Computer Science and Engineering
3.	Electrical and Electronics Engineering
4.	Electronics and Communication Engineering
5.	Information Technology
6.	Mechanical Engineering

and any other course as approved by the authorities of the University from time to time.

Table 2: Credits

Subject	Semester			
	Periods/ Week	Credits	Internal Marks	External Marks
Theory	3+1*	03	30	70
Practical/Mini project	03	02	25	50
Drawing	03	03	30	70
Skill Development Courses/Value Added Course	1+2*	01**	30+70 **(30IM+70EM)**	
EAA (Extra Academic Activities)	02	01	00	00
Seminar		01	50	
Comprehensive Viva-voce		02		50
Project		08	50	100

[*Tutorial

****[Skill Development Courses / value Added Course credits will not be considered for the award of division. However all these courses have to be cleared through internal evaluation by scoring minimum of 40%marks.EAA courses will not have any marks. The credits obtained in Skill development courses and EAA will be taken in to account for the award of degree.]**

4.0 Distribution and Weightage of Marks

4.1 The performance of the student in each semester shall be evaluated subject – wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, mini-project, comprehensive viva, seminar shall be evaluated for 50 marks each and the project work shall be evaluated for 150 marks.

4.2 For theory subjects the distribution shall be 30 marks for Internal Evaluation (25 marks for Internal test and 05 marks for assignments or field work/group task) and 70 marks for the End-Examination.

4.3 During the semester there shall be 2 tests for theory subjects. In each Internal test there shall be one compulsory (short answers) question and 3 descriptive questions are to be answered. The duration of internal test will be for 2hours. First test to be conducted in 3 units and second test to be conducted in the remaining 3 units of each subject. For awarding of 25Internal marks the performance of the student in two Internal examinations conducted one in the middle of the semester and the other towards the end of the semester giving a weightage of 0.75 for the better score and 0.25 for the other score will be considered. There shall be two assignments in each subject (problem based/ field work/group task) for award of 05 marks so that internal component (marks) will be 30 marks (25 marks for internal test+05 marks for assignments / field work/group task).

Table 3: Units for Internal Tests

Semester
3 UnitsFirst Internal test.
3 UnitsSecond Internal test.

4.4 In the case of Skill Development Courses,two Internal examinations shall be conducted one in the middle of the semester and the other at the end of the

semester for 30 marks and the marks scored by the student in these exams with a weightage of 0.75 for better score and 0.25 for the other score will be awarded as Internal marks for 30. For the remaining 70 marks an end examination will be conducted along with other theory examinations. However skill development courses/Value added courses, end examination will be evaluated internally.

4.5 No makeup test for internal examination or assignments/group tasks will be conducted in any subject or practical. The student, who is absent for any test shall be deemed to have scored zero in that test.

4.6 Elective subjects will commence from 3rd year second semester onwards. Out of the electives offered in 3-2 semester, one elective will be MOOC / Elective offered by the department. Any student who is interested can opt for the MOOC/ Elective offered by the department and acquires the required credits. Even if the student opts MOOC, he has to write two internal tests besides the end examination conducted by the institute like other subjects. However, he has to obtain the certificate from the organization in which he has registered. Any MOOC selected by the student should be of more than 45 hours duration and also from the reputed organization. Attendance of the student who has opted for MOOC will be taken from the remaining subjects and labs only in that semester while finalizing the attendance for fulfilling the minimum requirements of attendance for promotion to next semester. Attendance will not be recorded for MOOC.

4.7 Gap Year – Concept of student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted with to evaluate the proposal submitted by the student and committee shall decide on permitting the student for having the Gap Year. The committee consists of Principal as Chairman and all HODs as members.

4.8 In the electives offered in 4-1 semester, one elective will be open elective offered by the other department (inter - department). Student has to select one subject among the offered list of open elective subjects. Student has to clear the subject as per norms to get the required credits. At least 40students should register for any open elective; otherwise that open elective will not be offered.

4.9 Out of the electives offered in 4-2 semester again one elective will be based on MOOC/ elective offered by the department and the student has to acquire the required credits to clear the subject as specified in 4.9.

4.10 The institute would like to offer **Minor as optional feature of the B.Tech program aimed at providing additional learning opportunities for academically motivated and bright students. In order to earn a Minor, a student has to earn a minimum of 20 extra credits. For this in addition to the regular subjects, a student has to pursue three compulsory subjects from 3-1 semester and two electives (out of six electives offered from 3-2 Semester onwards). The Minor is indicated by separate CGPA and is reflected in the degree certificate as for example, B.Tech in**

ECE with Minor in Artificial Intelligence. Each department shall offer at least one Minor. The student has to select the subjects which are not studied in their regular course and student should have cleared all the subjects upto and including 2-2 semester with above 60% of marks to become eligible for Minor. The breakup of the credits are 5 subjects which carry 15 credits @3 credits for subject and project work carries 5 credits. The evaluation pattern of subjects and project work will be similar to methods followed in regular course evaluation. No attendance minimum will be considered for Minor. Not more than two subjects are allowed for registration in any semester.

4.11 Extra - Academic Activity (EAA)

Each of the following activities carry one credit and every student is required to register for two activities during second year of study which is mandatory.

- **a)** NSS/NCC
- **b)** Games and Sports
- **c)** Yoga/Meditation
- **d)** Extension Activities
- **e)** Literary/ Cultural Activities

Any other which may be offered in future

The activities shall be carried out in the allotted hours. The activities will be monitored by the respective faculty in charge, senior faculty member of the department and the HOD. Grades will be awarded on the basis of participation, attendance, performance and behavior. Grades shall be entered in the marks statement as GOOD, SATISFACTORY and UNSATISFACTORY and shall not be counted towards CGPA calculation. If any student gets an Unsatisfactory Grade, he/she has to repeat the activity in the immediate subsequent year.

5.0 Question Paper Pattern

5.1 Each Internal Test question paper shall contain 5 questions, of which the First question is compulsory and three questions are to be answered from the remaining four. Compulsory question carries 10 marks (It contains 5 questions of two marks - no choice in first question). The remaining 3 questions carry 5 marks each. Each question shall have a,b,c.... parts.

5.2 The End Examination question paper will have 7 questions and students have to answer5 questions. However, the first question is compulsory and it consists of 7 short answer questions, each carrying 2 marks. The next 4 questions are to be answered from the remaining 6 questions and each carries 14 marks. Each 14 marks question shall have a, b, c ..parts.

5.3 For practical subjects, there shall be a continuous evaluation during the semester for 25 Internal marks and End Examination carries 50 marks. Of the 25 marks for Internal, 20 marks shall be awarded for day-to-day work and 5 marks to be awarded by conducting an internal laboratory test. The End Examination shall be conducted by the teacher concerned and an external Examiner from other institutions.

5.4 For the subject having design and/or drawing, (such as Engineering Graphics, Machine Drawing etc.) and estimation, the distribution shall be 30

marks for Internal evaluation (15marks for day-to-day work and 5 marks for Internal tests and 10 marks for assignments) and 70 marks for End Examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.

5.5 The Engineering drawing, wherever offered is to be treated as a theory subject. Evaluation method adopted for theory subjects shall be followed here as well.

5.6 There shall be mini-Project, in collaboration with an industry(wherever possible) of their specialization, to be taken up during the vacation(data collection, components etc.) after III year II Semester examination and implementation/simulation shall be carried out in IV year first semester during lab classes. Implementation or fabrication/simulation of mini project will be treated as laboratory. However, the mini project and its report shall be evaluated in IV year I Semester. The mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 50 marks. The committee consists of an external Examiner, Head of the Department, the supervisor of mini project and a senior faculty member of the Department. There shall be 25 internal marks for mini project which will be awarded based on the performance and involvement of the student during mini project period.

5.7 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 over the topic, and submit to the Department, which shall be evaluated by the Departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member of the department. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

5.8 There shall be a comprehensive viva voce examination at the end of IV year II semester for 50 marks which shall be conducted by HOD, senior faculty and external Examiner from other institute.

5.9 The project topic should be approved by Internal Department Committee (IDC). Out of total 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination. The evaluation of project work shall be conducted at the end of the IV year II semester. The project viva voce examination will be conducted by the committee consisting of an external Examiner from other institute, Head of the Department and the supervisor of the project. The Internal evaluation for 50 marks shall be on the basis of two seminars given by each student on the topic of the project. The Internal evaluation of the project work for 50 marks shall be conducted by the committee consisting of head of the Department or his nominee, senior faculty member and the supervisor of project.

5.10 For all practical /mini project/main project/comprehensive viva-voce etc the HOD of the concerned dept shall submit a panel of 4 external examiners from different institutes and one will be selected by the Chief Superintendent of the Examination for conducting of end examination.

Table4: Distribution of weightages for examination and evaluation

Sl. No.	Nature of subject	Marks	Type of examination and mode of assessment		Scheme of Examination
1	Theory	70	End Examination Double Evaluation (Internal + External evaluation)		End Examination in theory subjects will be for 70 marks.
		30	25	Internal examinations (Internal evaluation)	These 25 marks are awarded to the students based on the performance in two (semester) Internal examinations with a weightage of 0.75 for better score and 0.25 for the other score.
			05	Assignments/Field work/group task (Internal evaluation)	Average of two assignments/Field work/group task in a semester each evaluated for 05 marks.
2	Practical	50	End lab examination (External evaluation)		This End Examination in practical subjects will be for a maximum of 50 marks.
		25	20	Internal evaluation	Day-to-day performance in lab experiments and record
			05	Internal evaluation	Internal lab examination at the end of year/semester
3	Mini Project	50	End Examination (External evaluation)		This End Examination in miniproject will be for a maximum of 50 marks.
		25	Internal evaluation		Day-to-day performance in executing mini project.
4	Seminar	50	Internal evaluation		Based on the performance in two seminars during semester
5	Comprehen-sive Viva	50	External evaluation		This end viva voce examinations in all the subjects for 50 marks
6	Project work	100	External evaluation		This end viva voce in project work for 100 marks
		50	Internal evaluation		These 50 marks will be based on the performance of the student in the project reviews apart from attendance and regularity
7	Skill Development Courses/ Value Added Course/ Mock interviews and Group Discussion	30	Internal evaluation		These 30 marks are awarded to the students based on the performance of two Internal examinations with a weightage of 0.75 for better score and 0.25 for the other score.
		70	Internal evaluation		Based on the performance in the end examination.
8	EAA	00	Internal evaluation		Based on performance and committee report.

6.0 Attendance Requirements:

6.1 The student shall be eligible to appear for End Examinations of the semester if he acquires a minimum of 75% of attendance in aggregate of all the subjects of that semester.

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

6.3 The student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. They may seek re-admission for that semester when offered next.

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

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

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

6.7 **The attendance in each subject will be recorded in the Marks memo.**

7.0 Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.6.0.

7.1 The student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or drawing subject or Skill Development Coursesor project if he secures not less than 35% of marks in the End Examination and he has to score minimum of 40% marks from Internal and external exam marks put together to clear the subject.

7.2 The student shall be promoted from II to III year only if he fulfils the academic requirement of securing a minimum of 51credits out of 102credits from all the exams conducted upto and including II year II semester regular examinations irrespective of whether the candidate takes the examination or not.

7.3 The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 76 credits out of 152credits from all the exams conducted up to and including III year II semester regular examinations, whether the candidate takes the examinations or not.

Table 5: Promotion rules

Promotion from	Total credits to register	Minimum credits to obtain for promotion
II yr to III yr	102	51
III yr to IV yr	152	76

7.4 The student shall register and put up minimum attendance in all 200 credits and earn a minimum of 194credits.Marks obtained in the best186credits(excluding the credits obtained in Skill Development Courses/VAC/Mock interviews and GD and EAA)shall be considered for the calculation of percentage of marks.

7.5 Students who fail to earn 194 credits as indicated in the course structure including compulsory subjects as indicated in Table-1 within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

8.0 Course pattern:

8.1 The entire course of study is of four academic years. Each academic year consists of two semesters

8.2 The student is eligible to appear for the End Examination in a subject, but absent at it or has failed in the End Examination may appear for that subject at the supplementary examination.

Table: 6: Course pattern

Year	Semester	No. of Subjects		No. of Skill Development Courses	Number of Labs		Total credits	
First year	First	CE/ME/ CSE	ECE/ EEE/ IT	00	CE/ ME/ CSE	ECE/ EEE/ IT	6X3=18 4X2=08	26
		06 {ENG-I, M-I, EP, MEC,CP, CORE-1}	06 {ENG-I M-I, ED, CP, EP, CORE-I}		EC lab, CP lab, EWS, ELCS	EP Lab, CP lab, ITWS, Core1 lab		
	Second	06 {Eng-II M-II, SSP/MP, DS, ED, CORE-II}	06 {Eng-II M-II, SSP, MEC, DS, CORE-II}	00	EP lab, DS Lab, ITWS Core-II lab	EC lab, DS lab, EWS, Core-II Lab	6X3=18 4X2=08	26
Second year	First	06		01	Subjects SDC/VAC Labs		6X3=18 1X1=01 3x2=06	25
	Second	06		01	Subjects SDC/VAC Labs		6X3=18 1X1=01 3X2=06	25
Third year	First	06		01	Subjects SDC/VAC Labs		6X3=18 1X1=01 3X2=06	25
	Second	04 + 01 Elective 01-MOOC/Elective		01	Subjects Elective MOOC/Elective SDC/VAC Labs		4X3=12 1X3=03 1X3=03 1X1=01 3x2=06	25
Fourth year	First	05 + Open Elective		01	Subjects Open Elective Mock Interviews and GD Labs Mini project		5X3=15 1X3=03 1X1=01 2X2=03 1X2=03	25
	Second	01+ Elective + MOOC/Elective		01	Subjects Elective MOOC/Elective SDC/VAC Seminar Comprehensive Viva Project Viva EAA		1X3=03 1X3=03 1X3=03 1X1=01 1X1=01 1X2=02 1X8=08 2X1=02	23
						GRAND TOTAL		200

9.0 Transitory Regulations:

Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone this course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered subject to section 2.0 and they continue to be in the academic regulations in which they were readmitted.

10.0 With-holding of results:

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

11.0 Award of Class:

After the 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:

Table 7: Award of Division

Class Awarded	% of marks to be secured	Division/ Class	CGPA	From the aggregate marks secured for the best 186 Credits (excluding Skill Development Courses, EAA)
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	
First Class	Below 70% but not less than 60%	First Class	6.5 and < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 and < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 and < 5.5	

(The marks in internal evaluation and End Examination shall be shown separately in the marks memorandum)

12.0 Grading:

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

Table 8: Conversion into Grades and Grade points assigned

Range in which the % of marks in the subject fall	Grade	Grade point Assigned	Performance
90 to 100	O	10	Outstanding
80 to 89.9	A^+	09	Excellent
70 to 79.9	A	08	Very Good
60 to 69.9	B^+	07	Good
50 to 59.9	B	06	Above Average
45 to 49.9	C	05	Average
40 to 44.9	P	04	Pass
<40	F	00	Fail
Ab	AB	00	Fail

12.1 Requirement for clearing any subject: The students have to obtain a minimum of 35% in End Examination and they have to score minimum of 40% marks from Internal and external exam marks put together to clear the subject. Otherwise they will be awarded fail grade.

12.2 F is considered as a fail grade indicating that the student has to reappear for the end supplementary examination in that subject and obtain a non fail grade for clearing that subject.

12.3 In case of skill development/ value added course / soft skill subjects, as there is no end exam, all 100 marks are for internal assessment only. Student has to score 40% in these courses to complete the subject which will be evaluated internally. Marks obtained in these courses shall not be considered for award of Division.

12.4 To become eligible for the award of degree the student must obtain a minimum CGPA of 4.0

13.0 Supplementary Examinations:

Apart from the regular End Examinations, the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day. The student is not permitted to improve his performance in any subject in which he has obtained pass grade.

14.0 Grade Point Average (GPA) and Cumulative Grade Point Average(CGPA)

The Grade Point Average (GPA) for each semester and Cumulative Grade Point Average (CGPA) up to any semester are calculated as follows:

i) Semester Grade Point Average will be computed as follows:

$$GPA = \frac{\sum_1^n C_i \times GP_i}{\sum_1^n C_i}$$

Where, n is the number of subjects in that semester. C_i is Credits for the subjects. GP_i is the grade point obtained for the subject and the summation is over all the subjects in that semester.

ii) A Cumulative Grade Point Average (CGPA) will be computed for every student at the end of each semester. The CGPA would give the cumulative performance of the student from the first semester up to the end of the semester to which it refers to and is calculated as follows:

$$CGPA = \frac{\sum_1^m GPA_j \times TC_i}{\sum_1^m TC_j}$$

Where 'm' is the number of semester under consideration. TC_j the total number of credits for a j^{th} semester and GPA_j is the Grade Point Average of the j^{th} semester. Both GPA and CGPA will be rounded off to the second digit after decimal and recorded as such.

While computing the GPA / CGPA, the subjects in which the student is awarded zero grade points will also be included.

15.0 Grade Sheet:

A grade sheet (Memorandum) will be issued to each student indicating his performance in all subjects of that semester in the form of grades and also indicating the GPA and CGPA.

16.0 Transcripts:

After successful completion of prerequisite credits for the award of degree, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

17.0 Rules of Discipline:

17.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of Examination section for undue favours in the exams, and bribing

them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

17.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that subject(s) and grading is done accordingly.

17.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

17.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice, the decision of the Chief Superintendent is final.

18.0 Minimum Instruction Days:

The minimum instruction days for each semester shall be 95 clear instruction days excluding the days allotted for tests/examinations and preparation holidays declared if any.

19.0 Amendment of Regulations:

The college may, from time to time, revise, amend or change the regulations, scheme of examinations and syllabi. However the academic regulations of any student will be same throughout the course of study in which the student has been admitted. However students will continue to be in the academic regulations in which they were readmitted.

20.0 Transfers

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

21.0 General:

21.1 The Academic Regulations should be read as a whole for the purpose of any interpretation.

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

21.3 The Institute 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 Institute.

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

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

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MECHANICAL ENGINEERING

Academic Regulations for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2016-2017 onwards)

1.0 The Students have to acquire a minimum of 142credits out of 148from II to IV year of B.Tech. Program (Regular) for the award of the degree.

2.0 Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3.0 The same attendance regulations are to be adopted as that of B. Tech. (Regular).

4.0 Promotion Rule:

The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 50 credits out of 100credits from all the exams conducted up to and including III year II semester regular examinations, whether the candidate takes the examinations or not.

5.0 Award of Class:

After the 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: The marks obtained in the best 134 credits will be considered for the calculation of percentage and award of class.

Table 1: Award of Division

Class Awarded	**% of marks to be secured**	Division/ Class	CGPA	From the aggregate marks secured for best 134 Credits (i.e. II year to IV year) excluding Skill Development Courses
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	
First Class	Below 70% but not less than 60%	First Class	$6.5 and < 7.5$	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 *and* < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 *and* < 5.5	

(The marks in Internal evaluation and End Examination shall be shown separately in the marks memorandum)

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

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MECHANICAL ENGINEERING

I B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0001151	Professional English –I	3	1	-	3	30	70	100
A0004151	Mathematics-I	3	1	-	3	30	70	100
A0002151	Engineering Physics	3	1	-	3	30	70	100
A0003151	Modern Engineering Chemistry	3	1	-	3	30	70	100
A0501151	C Programming	3	1	-	3	30	70	100
A0302151	Engineering Mechanics-I	3	1	-	3	30	70	100
PRACTICALS								
A0091151	Engineering Chemistry Lab	-	-	3	2	25	50	75
A0591151	C Programming Lab	-	-	3	2	25	50	75
A0391151	Engineering Workshop	-	-	3	2	25	50	75
A0092151	English Language Communication Skills Lab	-	-	3	2	25	50	75
Contact Periods / Week		**18**	**6**	**12**	**26**	**280**	**620**	**900**

I B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0005152	Professional English –II	3	1	-	3	30	70	100
A0006152	Mathematics-II	3	1	-	3	30	70	100
A0007152	Material Physics	3	1	-	3	30	70	100
A0502152	Data Structures Through C	3	1	-	3	30	70	100
A0301152	Engineering Drawing	3	3	-	3	30	70	100
A0303152	Engineering Mechanics-II	3	1	-	3	30	70	100
PRACTICALS								
A0093152	Engineering Physics Lab	-	-	3	2	25	50	75
A0592152	Data Structures through C Lab	-	-	3	2	25	50	75
A1291152	IT Workshop	-	-	3	2	25	50	75
A0392152	Engineering Mechanics Lab	-	-	3	2	25	50	75
Contact Periods / Week		**18**	**8**	**12**	**26**	**280**	**620**	**900**

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

II B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0015153	Mathematical Methods	3	1	-	3	30	70	100
A0201153	Basics Electrical & Electronics Engineering	3	1	-	3	30	70	100
A0304153	Mechanics of Solids	3	1	-	3	30	70	100
A0305153	Material Science & Metallurgy	3	1	-	3	30	70	100
A0306153	Thermodynamics	3	1	-	3	30	70	100
A0307153	Machine Drawing	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0011154	Corporate Management Skills	1	2	-	1	30	70 (Internal Evaluation)	100
PRACTICALS								
A0393153	Mechanics of Solids Lab	-	-	3	2	25	50	75
A0394153	Material Science Lab	-	-	3	2	25	50	75
A0291153	Basic Electrical & Electronics Engineering Lab	-	-	3	2	25	50	75
Contact Periods / Week		**19**	**8**	**9**	**25**	**285**	**640**	**925**

II B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0009153	Environmental Science	3	1	-	3	30	70	100
A0012156	Probability & Statistics	3	1	-	3	30	70	100
A0308154	Kinematics of Machinery	3	1	-	3	30	70	100
A0309154	Internal Combustion Engines	3	1	-	3	30	70	100
A0310154	Fluid Mechanics & Hydraulic Machinery	3	1	-	3	30	70	100
A0311154	Manufacturing Technology	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0010153	Aptitude Arithmetic Reasoning & Comprehension	1	2	-	1	30	70 (Internal Evaluation)	100
PRACTICALS								
A0395154	Manufacturing Technology Lab	-	-	3	2	25	50	75
A0396154	Fluid Mechanics & Hydraulic Machinery Lab	-	-	3	2	25	50	75
A0397154	Internal Combustion Engines Lab	-	-	3	2	25	50	75
Contact Periods / Week		**19**	**8**	**9**	**25**	**285**	**640**	**925**

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

III B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0016155	Engineering Economics & Accountancy	3	1	-	3	30	70	100
A0312155	Design of Machine Elements-I	3	1	-	3	30	70	100
A0313155	Thermal Engineering	3	1	-	3	30	70	100
A0314155	Dynamics of Machinery	3	1	-	3	30	70	100
A0315155	Mechanical Measurements	3	1	-	3	30	70	100
A0316155	Machine Tools	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0317155	Computer Aided Drafting	1	2	-	1	30	70 (Internal Evaluation)	100
PRACTICALS								
A0398155	Thermal Engineering Lab	-	-	3	2	25	50	75
A0399155	Dynamics & Instrumentation Lab	-	-	3	2	25	50	75
A0381155	Computer Aided Drafting Lab	-	-	3	2	25	50	75
Contact Periods / Week		**19**	**8**	**9**	**25**	**285**	**640**	**925**

III B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0344156	Industrial Engineering & Management	3	1	-	3	30	70	100
A0345156	Design of Machine Elements-II	3	1	-	3	30	70	100
A0318156	Heat Transfer	3	1	-	3	30	70	100
A0319156	Engineering Metrology	3	1	-	3	30	70	100
	Department Elective -I	3	1	-	3	30	70	100
	Department Elective: II/ MOOC	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0013156	Professional Ethics and soft skills	1	2	-	1	30	70 (Internal Evaluation)	100
PRACTICALS								
A0382156	Heat Transfer Lab	-	-	3	2	25	50	75
A0383156	Metrology & Machine Tools Lab	-	-	3	2	25	50	75
A0384156	Parametric Modeling-I Lab	-	-	3	2	25	50	75
Contact Periods / Week		**19**	**8**	**9**	**25**	**285**	**640**	**925**

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

IV B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0325157	CAD/CAM	3	1	-	3	30	70	100
A0326157	Operations Research	3	1	-	3	30	70	100
A0327157	Finite Element Methods	3	1	-	3	30	70	100
A0328157	Refrigeration & Air Conditioning	3	1	-	3	30	70	100
	Open Elective-I	3	1	-	3	30	70	100
	Department Elective-III	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0335157	Parametric Modeling-II	1	2	-	1	30	70 (Internal Evaluation)	100
PRACTICALS								
A0385157	CAM Lab	-	-	3	2	25	50	75
A0386157	Parametric Modeling-II Lab	-	-	3	2	25	50	75
A0387157	Mini Project	-	-	3	2	25	50	75
Contact Periods / Week		**19**	**8**	**9**	**25**	**285**	**640**	**925**

IV B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
THEORY								
A0336158	Industrial Automation and Robotics	3	3	-	3	30	70	100
	Department Elective-IV	3	1	-	3	30	70	100
	Department Elective-V/ MOOC	3	1	-	3	30	70	100
SKILL DEVELOPMENT COURSE								
A0343158	Modeling & Analysis	1	2	-	1	30	70 (Internal Evaluation)	100
A0388158	Seminar	-	-	-	8	50	100	150
A0389158	Core Comprehensive Viva Voce	-	-	-	1	50	-	50
A0371158	Project Work	-	-	-	2	-	50	50
	EAA/ECA	-	-	-	2	-	-	-
Contact Periods / Week		**10**	**7**	**-**	**23**	**220**	**430**	**650**

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MECHANICAL ENGINEERING

ELECTIVES

Subject Code	**ELECTIVES**
III B.TECH, II-SEMESTER	
DEPARTMENT ELECTIVE – I	
A0320156	Advanced Casting and NDT
A0321156	Hydraulic & Pneumatic Control
A0322156	Tool Design
DEPARTMENT ELECTIVE – II/MOOC	
A0323156	Power Plant Engineering
A0018156	Nanotechnology
A0324156	Advanced Welding Technology
IV B.TECH, I-SEMESTER	
OPEN ELECTIVE-I (OFFERED FOR ME & OTHER BRANCHES)	
A0329157	Non Conventional Energy Sources
A0330157	Energy Audit & Management
A0331157	Advanced Optimization Techniques
DEPARTMENT ELECTIVE –III	
A0337158	Gas Turbines
A0338158	Mechanics of Composite Materials
A0339158	Rapid Prototyping
IV B. Tech - II Semester	
DEPARTMENT ELECTIVE-IV	
A0332157	Automobile Engineering
A0333157	Computational Fluid Dynamics
A0334157	Production and Operations Management
DEPARTMENT ELECTIVE-V/MOOC	
A0340158	Cryogenics
A0341158	Modern Manufacturing Methods
A0342158	Mechatronics

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

MINOR ACADEMIC CURRICULUM 2015-16

CIVIL ENGINEERING

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0149153	Strength of Materials-I	3	3+1*	100	70	30
A0109154	Structural Analysis –I	3	3+1*	100	70	30
A0114155	Water Resources Engineering-I	3	3+1*	100	70	30
A0110154	Concrete Technology	3	3+1*	100	70	30
A0112155	Transportation Engineering-I	3	3+1*	100	70	30
A0171158	Minor Project	5	Grade			

ELECTRICAL & ELECTRONICS ENGINEERING
POWER ENGINEERING

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0242152	Principles of Electrical Engineering	3	3+1*	100	70	30
A0208154	Generation & Distribution of Electrical Power	3	3+1*	100	70	30
A0212155	Transmission of Electrical Power	3	3+1*	100	70	30
A0239158	Electrical Distribution Systems	3	3+1*	100	70	30
A0237158	Utilization of Electrical Power7	3	3+1*	100	70	30
A0271158	Minor Project	5	Grade			

ELECTRICAL & ELECTRONICS ENGINEERING
ELECTRICAL MACHINES

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0205153	Circuit Theory	3	3+1*	100	70	30
A0242154	Network Theory	3	3+1*	100	70	30
A0206153	Electrical Machines-I	3	3+1*	100	70	30
A0207154	Electrical Machines-II	3	3+1*	100	70	30
A0210155	Electrical Machines-III	3	3+1*	100	70	30
A0272158	Minor Project	5	Grade			

ELECTRICAL & ELECTRONICS ENGINEERING
POWER ELECTRONICS

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0242152	Principles of Electrical Engineering	3	3+1*	100	70	30
A0402153	Electronic Circuits	3	3+1*	100	70	30
A0211155	Power Electronics-I	3	3+1*	100	70	30
A0214156	Power Electronics-II	3	3+1*	100	70	30
A0226157	Power Semiconductor Drives	3	3+1*	100	70	30
A0273158	Minor Project	5	Grade			

MECHANICAL ENGINEERING

MECHANICAL ENGINEERING
THERMAL ENGINEERING

Subject Code	Course Title	redits	heory	otal arks	xternal	nternal
A0306153	Thermodynamics	3	3+1*	100	70	30
A0309154	Internal Combustion Engines	3	3+1*	100	70	30
A0313155	Thermal Engineering	3	3+1*	100	70	30
A0318156	Heat Transfer	3	3+1*	100	70	30
A0328157	Refrigeration and Air Conditioning	3	3+1*	100	70	30
A0372158	Minor Project	5	Grade			

MECHANICAL ENGINEERING
MECHANICAL DESIGN

Subject Code	Course Title	redits	heory	otal arks	xternal	nternal
A0302151	Engineering Mechanics-I	3	3+1*	100	70	30
A0305153	Material Science & Metallurgy	3	3+1*	100	70	30
A0308154	Kinematics of Machinery	3	3+1*	100	70	30
A0312155	Design of Machine Elements -I	3	3+1*	100	70	30
A0325157	CAD/CAM	3	3+1*	100	70	30
A0373158	Minor Project	5	Grade			

MECHANICAL ENGINEERING
PRODUCTION ENGINEERING

Subject Code	Course Title	redits	heory	otal arks	xternal	nternal
A0311154	Manufacturing Technology	3	3+1*	100	70	30
A0316155	Machine Tools	3	3+1*	100	70	30
A0319156	Engineering Metrology	3	3+1*	100	70	30
A0322156	Tool Design	3	3+1*	100	70	30
A0341158	Modern Manufacturing Methods	3	3+1*	100	70	30
A0374158	Minor Project	5	Grade			

MECHANICAL ENGINEERING

ELECTRONICS & COMUNICATIONS ENGINEERING
SIGNAL PROCESSING

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0409153	Signals and Systems	3	3+1*	100	70	30
A0406157	Digital Signal Processing	3	3+1*	100	70	30
A0436158	Advanced Digital Signal Processing	3	3+1*	100	70	30
A0427157	Digital Image Processing	3	3+1*	100	70	30
A0431157	DSP Architecture and Applications	3	3+1*	100	70	30
A0471158	Minor Project	5	Grade			

ELECTRONICS & COMUNICATIONS ENGINEERING
EMBEDDED SYSTEMS

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0213155	Microprocessors and Microcontrollers	3	3+1*	100	70	30
A0426157	VLSI Design	3	3+1*	100	70	30
A0421156	Embedded System Concepts	3	3+1*	100	70	30
A0418155	Embedded 'C' & Verilog	3	3+1*	100	70	30
A0422156	FPGA Architecture and Applications	3	3+1*	100	70	30
A0473158	Minor Project	5	Grade			

COMPUTER SCIENCE & ENGINEERING
MINOR IN COMPUTER SCIENCE

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0512153	Discrete Mathematics	3	3+1*	100	70	30
A0518154	Design and Analysis of Algorithms	3	3+1*	100	70	30
A0519154	Operating Systems	3	3+1*	100	70	30
A0514153	Database Management Systems	3	3+1*	100	70	30
A0509157	Computer Networks	3	3+1*	100	70	30
A0574158	Minor Project	5	Grade			

COMPUTER SCIENCE & ENGINEERING
MINOR IN WEB PROGRAMMING

Subject Code	Course Title	redits	heory	otal larks	xternal	nternal
A0516154	Core Java Programming	3	3+1*	100	70	30
A0520155	Advanced Java Programming	3	3+1*	100	70	30
A0508156	Web Technologies	3	3+1*	100	70	30
A0510155	C# & .NET Frame Work	3	3+1*	100	70	30
A0540157	PHP Programming	3	3+1*	100	70	30
A0575158	Minor Project	5	Grade			

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

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MECHANICAL ENGINEERING

INFORMATION TECHNOLOGY

MINOR DEGREE IN DATABASE TECHNICS

Subject Code	Course Title	Credits	Theory	Total Marks	External	Internal
A1202153	Foundations of Software Engineering	3	3+1*	100	70	30
A1207154	Relational Database Design and Development	3	3+1*	100	70	30
A1213155	Database Management Concepts	3	3+1*	100	70	30
A1228157	Cloud Infrastructure And Services	3	3+1*	100	70	30
A1217156	Software Testing Methodologies and Tools	3	3+1*	100	70	30
A1271158	Minor Project	5	Grade			

INFORMATION TECHNOLOGY

MINOR DEGREE IN WEB TECHNOLOGY CONCEPTS

Subject Code	Course Title	Credits	Theory	Total Marks	External	Internal
A1203153	Fundamentals of Object-Oriented Design	3	3+1*	100	70	30
A1209154	Java Programming	3	3+1*	100	70	30
A1212155	Web Application Through JAVA & Python	3	3+1*	100	70	30
A1216156	Basics Of Scripting Languages	3	3+1*	100	70	30
A1211155	Data Communications & Networking – 1	3	3+1*	100	70	30
A1272158	Minor Project	5	Grade			

MASTER OF BUSINES ADMINISTRATION

HUMAN RESOURCE MANAGEMENT

SEMESTER – V, VI, VII & VIII (5*3 + 1*5 =20 Credits)

Subject Code	Semester	Course Title	redits	heory	otal larks	xternal	nternal
E0009152	Semester V	Human Resource Management	3	3+1*	100	70	30
E0024153	Semester VI	Training & Development	3	3+1*	100	70	30
E0028153	Semester VI	Performance Management	3	3+1*	100	70	30
E0039154	Semester VII	Organization Development	3	3+1*	100	70	30
E0014152	Semester VIII	Business Research Methods	3	3+1*	100	70	30
E0047154	Semester VIII	Minor Project	5	Grade			

MARKETING MANAGEMENT

SEMESTER – V, VI, VII & VIII (5*3 + 1*5 =20 Credits)

Subject Code	Semester	Course Title	redits	heory	otal larks	xternal	nternal
E0011152	Semester V	Marketing Management	3	3+1*	100	70	30
E0021153	Semester VI	Product & Brand Management	3	3+1*	100	70	30
E0033153	Semester VI	Advertising Management	3	3+1*	100	70	30
E0029153	Semester VII	Sales & Distribution	3	3+1*	100	70	30
E0014152	Semester VIII	Business Research Methods	3	3+1*	100	70	30
E0047154	Semester VIII	Project	5	Grade			

1* - Tutorial

I B.Tech, I-Sem (ME) T 3+1* C 3

(A0001151) PROFESSIONAL ENGLISH - I

(Common to all Branches)

English is the international language of business and opens up many opportunities to engineering professionals. This course introduces the essential learning theories and practices needed for a core professional. The course details the needs of LSRW Skills of the English language and explains how to face variant situations through soft skills. With a clear structure and can-do objectives in every Unit, Professional English Course is a straight forward, student-friendly course. It gradually builds up all the necessary knowledge to help students achieve their learning objectives.

OBJECTIVES:

Students should be able to:

- Acquire basic language skills in order to communicate in English language.
- Develop their awareness of the importance of English as a means of international communication.
- Develop their LSRW skills, namely listening, speaking, reading and writing skills thereby improving their proficiency in oral and written communication in technical English.
- Develop the linguistic competence that enables them to be aware of the cultural, economical and social issues of the society in order to contribute in giving solutions.

OUTCOMES:

Students would be able to:

- Engage in correct usage of grammatical tenses and usage in writing and speaking.
- Produce Technical Writing formats
- Define meaning of vocabulary from conceptual clues.
- Conduct oral presentations with confidence.

UNIT I

Practical English Usage - I

a) Review of Grammar-Parts of Speech-Tenses
b) Introduction to International English Language Testing System (IELTS) Level-1

Practice Tests – IELTS

UNIT II

a) Technical Writing – I: Techniques of Writing-Comparison & Contrast Pattern-Cause & Effect Pattern - Paragraph Writing–Developing An Essay-Letter Formats-Full block Format–Official & Business Letters
b) Soft Skill – *Fish! Philosophy – Attitude is Everything* by Harry Paul

UNIT III

a) Reading Skills - SQR3 Technique–Skimming & Scanning- Reading Comprehension
b) Autobiography – New Horizons – *My Struggle for an Education* by Booker T. Washington

UNIT IV

a) Semantics - Etymology – Synonyms & Antonyms-Phrasal verbs–Idioms
b) Essay – *The Law of Pure Potentiality* by Deepak Chopra

UNIT V

a) Literary Techniques – Allegory – Metaphor - Epithet
b) Short story - New Horizons - *The Happy Prince* by Oscar Wilde
c) Poem – New Horizons - *Where the Mind is without Fear* by Rabindranath Tagore

UNIT VI

a) Movie Analysis – Life of Pi - Plot – Characterization – Techniques
b) Project & Case Studies

***TEXT BOOK PRESCRIBED: NEW HORIZONS, FOR THE JNTUA, PEARSON, 2014.**

SUGGESTED READING:

1. Practical English Usage by Michael Swan, Oxford University Press
2. Murphy's English Grammar by Raymond Murphy, Cambridge University press 2004
3. Technical writing 3rd edition by *Sharon J. Gerson & Steven M. Gerson*, Pearson Education 2001
4. Communication Skills for Engineers(Second Edition) by C. Muralikrishna & Sunita Mishra, Pearson Education Ltd, 2011
5. Top tips for IELTS, British Council, On line edition

I B.Tech, I-Sem (ME) T 3+1* C 3

(A0004151) MATHEMATICS-I

(Common to all Branches)

OBJECTIVES:

- To make aware students about the importance and symbiosis between Mathematics and Engineering. Achieve confidence with mathematical tools which an essential weapon in modern Graduate Engineer's Armory. Balance between the development of understanding and mastering of solution techniques with emphasis being on the development of student's ability to use Mathematics with understanding to solve engineering problems by retaining the philosophy learning by doing.

OUTCOMES:

- By the end of module students will be expected to demonstrate the knowledge of Differential equations, Laplace Transformations, Matrices and their applications in diverse engineering applications.

UNIT – I

Infinite Series: Sequence – Convergence and divergence of sequence. Series – Tests of convergence and divergence – P-Test, Comparison Test, Ratio Test, n-Root Test, logarithmic Test- Alternating Series – Absolute and conditional convergence of series.

UNIT-II

Differential equations of first order and first degree – Exact, linear and Bernoulli equations. Applications to LR & CR circuits, orthogonal trajectories.

UNIT – III

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x), Method of variation of parameters.

UNIT – IV

Rolle's Theorem – Lagrange's Mean Value Theorem – (excluding proof).Simple examples of Taylor's and Maclaurin's Series.

Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrangian method of Multipliers with three variables only. Raidus of Curvature.

UNIT – V

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

UNIT – VI

Differentiation and integration of Laplace transform – Application of Laplace transforms to ordinary differential equations of first and second order.

TEXT BOOKS:

1. Advanced Engineering Mathematics By Erwin Kreyszig.
2. Advanced Engineering Mathematics By R.K. Jain and S.R.K. Iyengar, Narosa Publications.

REFERENCES:

1. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and Others S. Chand & Company.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
3. A Text Book of Engineering Mathematics, Thomson Book Collection.
4. Engineering Mathematics By Srimantha Pal et.al. Oxford University Press.
5. Engineering Mathematics, Sarveswara Rao Koneru, Universities Press.

I B.Tech, I-Sem (ME)

T	C
3+1*	3

(A0002151) ENGINEERING PHYSICS
(Common to ALL Branches)

OBJECTIVES:

The Engineering Physics (Physics-I) for undergraduate program is designed

- To develop students with sufficient depth in both engineering and physics skills to produce engineers who can relate fundamental physics to practical engineering problems.
- To nurture innovative talent in modern applied physics, providing students both solid theoretical grounding and training in practical scientific research skills.
- To prepare students for careers in engineering where physics principles can be applied to the development of technology.

OUTCOMES:

After the completion of the course the student will be able to:

- Understand the concept of signals by studying light behavior.
- Apply the concepts of light in optical fibers, light wave communication systems.
- Understand the use of lasers as light sources for low and high energy applications
- Solve engineering problems using the concepts of wave and particle nature of radiant energy.
- Construct a quantum mechanical model to explain the behavior of a system at the microscopic level.
- Understand the nature and characterization of acoustic design and nuclear accelerators.

UNIT I:

WAVE OPTICS: Interference – Types of Interference - Interference in thin films by reflection - Newton's rings – Applications - Diffraction – Distinction Between Interference and Diffraction - Fraunhofer diffraction at a single slit - Fraunhofer diffraction at a double slit (qualitative) - Diffraction grating – Determination of Wavelength of Light - Polarization – Optic axis - Double Refraction in Calcite Crystal - Nicol Prism – Different types of polarized lights - Quarter and Half wave plates – Applications - problems.

UNIT II:

FIBER OPTICS: Principle – Optical Fiber Cable- Propagation of Light in Optical fibres – Acceptance angle, Numerical aperture and Fractional Index change – Types of rays - Types of optical fibres (index, mode and material based) – Losses in Optical Fiber - Fibre optical communication system (Block diagram) – Merits of Optical Fibers – Applications - problems.

UNIT III:

LASERS: Introduction – Characteristics - Einsteins A and B coefficients - Principle of Spontaneous emission and stimulated emission, Population inversion, pumping. – Important Components of a laser - - Types of lasers – Nd-YAG, He-Ne, CO_2 and Semiconductor lasers (homo junction GaAs) – Hetrojunction laser – Applications - problems.

UNIT IV:

QUANTUM PHYSICS: Matter waves – properties - de-Broglie's hypothesis – Heisenberg's Uncertainity principle – Electron as a wave experiment - Schrödinger's Time independent wave equation – Physical significance of wave function – Particle in a one dimensional box - problems.

UNIT V:

ACOUSTICS AND ULTRASONICS: Introduction to acoustics - Reverberation and reverberation time - growth and decay of energy - Sabine's formula (qualitative) - absorption coefficient and its measurement - factors affecting architectural acoustics - problems.

Introduction to ultrasonics – Production – magnetostriction effect - magnetostriction generator, piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves – Types of Ultrasonic waves - properties – Cavitations - Non Destructive Testing –pulse echo system through transmission and reflection modes - Testing Methods - A, B and C –scan displays - problems.

UNIT VI:

NUCLEAR ENERGY: Nuclear fission – Discovery of fission, binding energy curve, chain reaction (fission of U235), critical size, critical mass, essentials of nuclear reactor - problems.

Nuclear fusion – Thermonuclear reaction - fusion reaction in stars - p-p cycle, C-N cycle, controlled fusion – fusion reactor - problems.

REFERENCES:

1) Arthus Beiser, "Concepts of Modern Physics", Tata Mc Graw Hill Publications, New Delhi.
2) Resnick and Halliday, "Physics Volume – II", Wiley, New Delhi.
3) M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2014.
4) D. K. Bhattacharya and Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.
5) R. K. Gaur and S.C. Gupta, "Engineering Physics", Dhanpat Rai Publications, New Delhi.
6) Rajagopal, "Engineering Physics", PHI, New Delhi.
7) Rajendran, V and Marikani A, "Engineering Physics", Tata Mc Graw Hill Publications Ltd, III Edition, New Delhi.
8) Chitra Shadrach and Sivakumar Vadivelu, "Engineering Physics", Pearson Education, New Delhi.

I B.Tech, I-Sem (ME) T 3+1* C 3

(A0003151) MODERN ENGINEERING CHEMISTRY

(Common to all Branches)

OBJECTIVES:

- To know the importance of water and sustainable utilization of water resources and alternative methods for potable water like Reverse osmosis and the problems raised in the Production of steam by using the boilers are included in Water technology.
- To identify the structure of organic molecules using photo chemistry and chemical spectroscopy.
- To acquaint the student with concepts of important photo physical and Photochemical processes and spectroscopy.
- To make the students conversant with basics of polymer chemistry
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems.
- To Understand and apply the concepts in electrochemistry and corrosion science

OUTCOMES:

- Apply the concepts of organic chemistry for synthesis.
- Understand the synthesis and applications of Polymer science.
- Synthesize polymers.
- Estimate the hardness of water in terms of Calcium and magnesium ions.
- Standardize solutions using titration, conductivity meter and colorimeter.
- The students will come out with fundamentals of spectroscopy like electromagnetic spectrum, UV visible, IR spectroscopy.
- The properties and engineering applications of abrasives and refractories will be useful for the student in the future.

Detailed syllabus:

UNIT I:

WATER TECHNOLOGY: Sources of Water - Types of impurities in Water - Hardness of Water - Temporary and Permanent hardness - Disadvantages of hard water - Estimation of hardness by EDTA Method, Numerical Problems on Hardness.

Boiler troubles (Sludge, Scale, Caustic Embrittlement, Priming and foaming) - Softening of water (Ion exchange, Zeolite Methodes). Desalination - Reverse Osmosis Method.

Analysis of Water - Alkalinity, Dissolved Oxygen.

UNIT II:

SURFACE CHEMISTRY:

Adsorption: Definition - Types - Langumer Adsorption isotherm-Applications.

Phase Rule: Statement - Explanation of Terms involved with examples - one component System - Water & Sulphr Systems - Condensed Phase Rule - Pb-Ag System.

Engineering Materials: Abrasives - Mho,s Scale of Hardness-Natural & Synthetic Abrasives-Engineering Applications.

Refractories: Introduction, Classification & Properties Refractories - Reasons for failure of Refractories.

UNIT III:

ELECTRO CHEMISTRY: Conductance - Specific Conductance - Equivalent Conductance - Molar Conductance - Determination of conductance by Wheat Stone Bridge Method-Effect of dilution On Conductance - Conducto metric Titrations (Acid Base & Precipitative Titration) - Electrode Potential - Reference Electrodes (SHE, Calomel) - Nernst equation - Numerical Problems. Representation of Cell - electro chemical cells - concentration cells.

Ion Selective Electrode - Principle & Applications.

Chemically Modified Electrodes (CMEs): CMEs as Potentiometric and amphereometric sensors.

UNIT IV:

CHEMISTRY OF CORROSSION & ITS PREVENTION: Definition, Mechanism of Dry(oxidation), Wet (Evelution of hydrogen & Absorption of Oxygen) Types of corrosion - Dry Corrosion, and Wet Corrosion, Theories and Mechanism - Galvanic Series - Galvanic Corrosion, Concentration Cell Corrosion, Water line corrosion, Pitting Corrosion. Factors Influencing Corrosion.

Control of Corrosion - Proper designing and material selection - Cathodic Protection - Sacrificial anode and Imprest Current methods. Use of Inhibitors.

Protective coatings: Metalic coatings & applications.

Electro Plating of Chromium & Nickel

UNIT V:

PHOTO CHEMISTRY&SPECTROSCOPY:

Photo Chemistry: Principles - Growthers Droppers law-Stark Einsten law - Lamberts Beers law - Flouroscence - Phosphorescence - Chemiluminiscence - Photosensitization - Quantum efficiency determination - problems

Spectroscopy: Electromagnetic spectrum - absorption of radiation-Electronic, Vibrational and Rotational Transitions.

UV - Visible and IR Spectroscopy Principles, Instrumentation (block diagrams) & applications (Qualitative)

UNIT VI:

POLYMERS AND FUELS:

POLYMER: Basic concepts - Types of Polymerization – Addition and Condensation Polymerization. Mechanism of Addition polymerization.

Plastics: Definition, Thermo & Thermosetting plastics. Preparation, Properties and Engineering Uses of Poly ethylene, Poly vinyl chloride, Teflon, Bakelite & Nylons.

Elastomers: Processing of Natural Rubber, Compounding of Rubber Drawbacks of Raw Rubber, Vulcanization of Rubber. Preparation, Properties & Uses of Buna-S, Buna-N, Silicone Rubber.

FUELS: Definition, Classification of fuels. Characteristics of a good fuel. Calorific Value and its Units. Determination Calorific Value by Bomb Calorimeter.

Solid Fuel: Analysis of Coal (Proximate & Ultimate)

Liquid Fuels: Petroleum, Refining, Knocking, Octane, Cetane Number.

Gasious Fuels: Producer Gas, Water Gas.

Combustion: Principles and Numerical Problems- Flue gas analysis by Orsat's apparatus.

TEXT BOOKS:

1. Text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company,
2. 15th edition New Delhi (2008).
3. Text book of Engineering Chemistry by sashi chawla, Dhanpat Rai Publishing Company, 12th edition New Delhi (2011).

REFERENCE:

1. A text book of Engineering Chemistry by S.S. Dara, S.Chand & Co, New Delhi (2008)
2. Dara S.S Text Book Of Engineering Chemistry, S.Chand & Company Ltd, NewDelhi 2003
3. Chemistry of Engineering Materials by C.V. Agarwal, Tara Publication, Varanasi.2008
4. Physical Chemistry - Glasston & Lewis.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

I B.Tech, I-Sem (ME)

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3+1*	3

(A0501151) C PROGRAMMING

(Common to all Branches)

OBJECTIVES:

- To make students aware about fundamentals of computer programming.
- To provide exposure on C programming language
- To provide exposure on various C programming concepts like arrays, functions, pointers, structures etc.,
- To develop solutions for various problems by using C programming language by students.

OUTCOMES:

By the end of this course, students should be able

- To understand about the various techniques for problem solving**.**
- To understand the fundamental concepts of C language like data types, keywords, operators, Input/Output functions and control statements.
- To understand how to develop C programs to solve various kinds of problems by using different C programming concepts like arrays, functions, pointers.

UNIT I

INTRODUCTION TO COMPUTER PROGRAMMING LANGUAGES: Evolution of Computer Programming languages. Fundamentals of Algorithms and Flowcharts. Simple examples on how to write and trace an effective algorithms and how to draw an effective flow charts. Program control structures – sequence, selection and iteration. Software Development Method.

UNIT II

C LANGUAGE FUNDAMENTALS: General Form of a C Program, Steps to execute C program, Character set of C language, Data Types, Constants and Variables, Identifiers, Keywords, Operators, Precedence of operators, Expressions. Example Programs on the topics covered in this unit

UNIT III

CONTROL STATEMENTS IN C LANGUAGE: Non iterative statements – if statement, if else statement, nested if else statement, if else ladder statement, switch statement, go to statement. Iterative statements – while loop, do while loop and for loop. Example Programs on the topics covered in this unit.

UNIT IV

ARRAYS IN C LANGUAGE: Importance of an array in C language, Definition, Need of arrays while writing C programs. Types of arrays - One dimensional array, Two dimensional array. Declaration of One dimensional array, initialization of one dimensional array, storing and accessing the elements from a one dimensional array. Two-dimensional Arrays and their declaration, initialization, storing & accessing elements from it. Example Programs on the topics mentioned above. **Strings** - Definition, Declaring and initializing strings, Basic Operations on strings, String handling Functions. Example Programs on the topics mentioned above.

UNIT V

FUNCTIONS IN C LANGUAGE: Top down approach of problem solving, Library Functions and User defined functions. Need for user-defined functions. General form of declaring a function, Elements of an user defined functions- Function definition Function call, Function declaration, Function name, return type, parameters, return statements.

Categorization of functions with respect to parameters and return values. Definition of Scope of a variable with suitable examples. Storage Classes - Automatic, External, Static, and Register. Arrays and functions - Passing an entire array as an Argument to a function. Pre-processor Commands. Example Programs on the topics mentioned above.

UNIT VI

POINTERS IN C LANGUAGE: Pointers- Pointer variable and its importance, Pointer variable declaration, initialization of pointer variables, how to access a value from a memory location through it's pointer variable. Arithmetic operations on pointer variables, Scale factor length. Pointers and functions - pointers as function arguments (i.e., call-by-reference), Pointers and Arrays, Pointers and Strings, Array of Pointers, Pointers to Pointers, Generic Pointers, Pointer to Functions. Example Programs on the topics mentioned above.

TEXT BOOKS:

1. Programming in C ,Pradeep Dey, Manas Ghosh,Oxford Heigher Education
2. Computer programming and Data Structures, E.Balaguruswamy, Tata Mc Graw Hill. 2009 revised edition.
3. The C Programming Language, Brian W.Kerninghan, Dennis M.Ritchie
4. Programming in C , Dr. N. Uday Bhaskar, Winger publications

REFERENCES:

1. Let us C – Yeshwanth kanetkar, 8th Edition.BPB Publications
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI, Eighth Edition.
4. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

I B.Tech, I-Sem (ME) T 3+1* C 3

(A0302151) ENGINEERING MECHANICS- I

OBJECTIVES:

- Work comfortably with basic engineering mechanics concepts required for analyzing static
- Structures.
- Model the problem using good free-body diagrams and accurate equilibrium equations.
- Identify and model various types of loading and support conditions that act on structural systems.
- Apply relevant mathematical, physical and engineering mechanical principles to the system to solveand analyze the problem.

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

- Solve for the resultants of any force systems.
- Determine equivalent force systems.
- Determine the internal forces in plane truss and support reactions on a beam.
- Solve the mechanics problems associated with friction forces.
- Obtain the centroid, first moment and second moment of an area.

UNIT-I

BASICS & STATICS OF PARTICLES: Introduction - Units and Dimensions, Laws of Mechanics - Parallelogram and triangular Law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of forces - Lame's theorem, Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

UNIT-II

EQUILIBRIUM OF RIGID BODIES: Moment of a force, Varignon's theorem, moment of a couple, coplanar non-concurrent forces, equilibrium of rigid bodies, principle of virtual work, work done by forces and moments.

UNIT-III

SUPPORT REACTIONS OF BEAMS AND FRAMES: Definition of Beam and Frame, different types of beams, Loads, supports and reactions.

PERFECT FRAMES: Types of frames, free body diagram, degree of indeterminacy, analysis by method of joints and method of sections.

UNIT-IV

FRICTION: Types of friction - laws of Friction - Limiting friction - Cone of friction - body on horizontal/inclined plane, two bodies in contact, Ladder friction, Wedge friction.

UNIT-V

CENTROID & CENTRE OF GRAVITY: Definitions - Determination of Areas and Volumes - First moment of area and the centroid of standard sections - Centroid of areas, volumes and composite sections. Theorems of Pappus - Guldinus, Centre of gravity of rigid bodies.

UNIT-VI

AREA MOMENT OF INERTIA: Area Moment of Inertia - Parallel and perpendicular axis theorems, moment of inertia of standard sections - moment of inertia of composite sections, product of inertia.

MASS MOMENT OF INERTIA: Mass Moment of Inertia, Radius of Gyration, Determination of mass moment of inertia from first principles, Mass moment of inertia of simple solids.

TEXT BOOKS

1. Engineering Mechanics, S. S. Bhavikatti and K. G. Rajashekarappa, New Age International(P) Ltd.
2. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.

REFERENCES

1. Engineering Mechanics, Shames and Rao- Pearson Education.
2. Kumar, K. L- Engineering Mechanics, Tata McGraw- Hill, New Delhi.
3. Engineering Mechanics – R.K Bansal, Lakshmi Publications
4. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition,
5. Engineering Mechanics, S. Timoshenko, D. H. Young and J. V. Rao, Tata McGraw-Hill Education Pvt. Ltd., Revised 4th Edition.

I B.Tech, I-Sem (ME) P 3 C 2

(A0091151) ENGINEERING CHEMISTRY LAB
(Common to all Branches)

OBJECTIVES:

- Chemistry is one subject which gives adequate knowledge about the applications involved in the aerospace, mechanical, environmental and other engineering fields. Knowledge of chemistry plays a vital role in engineering profession enabling the potential engineers to understand and to perform successfully while working on multidisciplinary tasks.
- The main objective of the department is to develop the necessary theoretical and practical aspects required for understanding intricacies of the subject and also give adequate exposure to the applied chemistry aspects in different disciplines of engineering. Our faculty educates the engineering students with all necessary concepts related to chemistry and develops a scientific attitude by means of distinguishing, analyzing and solving various engineering problems. We are training the students to develop their experimental skills and important practical knowledge in engineering by providing sophisticated chemistry laboratory.

OUTCOMES:

- Develop procedures and observational skills as data is taken and gain a fundamental understanding of simple and complex apparatus used in the experiment.
- Apply analytical techniques, statistical analysis, graphical analysis, spread sheet data/recording to the experiments.
- Verify the theoretical ideas and concepts covered in lecture by completing a host of experiments.
- Take the time to discuss the procedure, the data, and the results of the experiment with the lab partner.

Detailed Syllabus:

1. Standardization of KMnO4 By using Mohr,s salt.

Complex metric Titrations:

2. Determination of Hardness of water by using EDTA titration method.
3. Estimation of Magnesium ion by using EDTA titration method.
4. Estimation of copper ion by using EDTA titration method.
5. Estimation of dissolved oxygen by Winklers Method.

Dichrometry:

6. Determination of Ferrous ion by using potassium dichromate.

Conductometric titration:

7. Determination of Strength of the given HCl by using conductometric titration.
8. Determination of Strength of the given CH3COOH by using conductometric titration.
9. Determination of Alkalinity Present in a given solution.
10. Verification of Beer,s - Lambert,s Law by KMnO4.
11. Determination of Strength Manganese by Colorometric Method
12. Determination of Calorific Value of Solid/Liquid fule using Bomb Calorimeter.
13. Determination of Viscosity by using Red wood Viscometer-I (or) II
14. Potentiometric Determination of iron using Standard K2Cr2O7 Solution.

Demonstration:

1. Determination of Bulk density.
2. Determination of Refractive index of a given Sollution.
3. Preparation of Ethyl Acetate.
4. Preparation of Bakelite.
5. Determination of pH of Water and various other samples.

REFERENCES:

1. Laboratory Manual on Engineering Chemistry, Sudharani (Dhanpat Rai Publishing Company).
2. Vogel's Textbook of Quantitative chemical analysis, J. Mendham et.al. (Pearson Education). Advanced Inorganic Analysis, Agarwal & Keemtilal, Pragati prakashan.
3. Chemical tables, Dr N. S. Gnanapragasam, (Sultan Chand & sons).

I B.Tech, I-Sem (ME) P 3 C 2

(A0591151) C PROGRAMMING LAB

(Common to all Branches)

OBJECTIVES:

- To make the student to learn how to write programs in **C** language.
- To introduce different constructs of **C** language to the students to solve various kinds of problems.
- To make the students to implement different kinds of sorting algorithms like selection sort, bubble sort, insertion sort, quick sort and merge sort etc.
- To make the students to implement different kinds of searching algorithms like linear search and binary search etc.

OUTCOMES:

By the end of this course, students should be able

- To understand about the fundamentals of Computer programming.
- To understand the fundamental concepts of C language like data types, keywords, operators, Input/Output functions and control statements.
- To understand how to develop C programs to solve various kinds of problems by using different C programming concepts like arrays, functions, pointers.

RECOMMENDED SYSTEMS /SOFTWARE REQUREMENTS:

- Intel based desktop PC with ANSI C Compiler and Supporting Editors

Exercise 1:

Write a C program to demonstrate the various operators used in C language.

Exercise 2:

a) Write a C program to find the roots of a quadratic equation.
b) Write a C program to find both the largest and smallest number in a list of integers.

Exercise 2:

a) Write a C program, which takes two integer operands and one operator from the user, performs the specified operation and then prints the result. (Consider the operators +,- ,*, /, % and use Switch Statement)
b) Write a C Program to find the reverse of a given number.

Exercise 3:

a) Write a C program to find the sum of individual digits of a positive integer.
b) Write a C program to generate the first 'n' terms of the Fibonacci sequence.
[**Note:** A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.]
c) Write a C program to generate all the prime numbers between 1 and n, where 'n' value is given by the user.
[**Note:** Develop each of the above programs by using different loop constructs supported by C language. (i.e., while, do while and for Loops)]

Exercise 4:

a) Write a C Program to mask the most significant digit of the given number.
b) Write a program which Prints the following patterns

```
ABCDEFGFEDCBA
ABCDEF FEDCBA
ABCDE   EDCBA
ABCD     DCBA
ABC       CBA
AB         BA
A           A
```

```
   0
  111
 22222
3333333
444444444
```

Exercise 5:

a) Write a C program to generate Pascal's triangle.
b) Write a C program to construct a pyramid of numbers.

Exercise 6:

a) Write a C program to find all the even numbers in the given one dimensional array.
b) Write a C program to print the elements of an array in reverse order.
c) Write a C program to perform the following operations:
   i) Addition of Two Matrices ii) Multiplication of Two Matrices
   [Note: Use functions to implement the above specified operations]

Exercise 7:

a) Write C programs that use both recursive and non-recursive functions
   i) To find the factorial of a given integer.
   ii) To find the GCD (greatest common divisor) of two given integers.

Exercise 8:

a) Write a C Program to solve the Towers of Hanoi problem by using recursive function.
b) Writea C Program to demonstrate the various storage classes, which are supported by the C language. [i.e., automatic, external, static and register]

Exercise 9:

a) Write a C Program to demonstrate that, how to pass an entire array as an argument to a function with a suitable example.
b) Write a C Program to perform various operations on given two strings using string handling functions.

Exercise 10:

a) Write a C Program to perform various arithmetic operations on pointer variables.
b) Write a C Program to demonstrate the following parameter passing mechanisms:
   i) call-by-value ii) call-by-reference

Exercise 11:

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

Exercise 12:

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

REFERENCE BOOKS

1. Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2. The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
3. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
4. Computer Basics and C Programming, V. Raja Raman, PHI Publications.

I B.Tech, I-Sem (ME) P 3 C 2

(A0391151) ENGINEERING WORKSHOP

(Common to all Branches)

OBJECTIVES:

- The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labor involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

OUTCOMES:

- At the end of the Engineering Work Shop: A Student involved in acquiring manufacturing skills must have balanced knowledge of theory as well as practice. The First students of all engineering branches should know the basic knowledge of various tools and their use in different sections of manufacturing such as fitting, carpentry, tin smithy, welding etc. and basic engineering practices such as plumbing, electrical wiring, electronic circuits, machine shop practice.

Note: At least two exercises to be done from each trade.

1. TRADES FOR EXERCISES:

A] Carpentry	1. T-Lap Joint	2. Cross Lap Joint
	3. Dovetail Joint	4. Mortise and Tennon Joint
B] Fitting	1. Vee Fit	2. Square Fit
	3. Half Round Fit	4. Dovetail Fit
C] House Wiring	1. Parallel / Series Connection of two/three bulbs	
	2. Stair Case wiring	3 Tube Light Wiring
	4. Measurement of Earth Resistance/Go down Wiring	
D] Tin Smithy	1. Rectangular Tray	2. Square Box without lid
	3. Open Scoop	4. Funnel
E] Welding	1. Single V butt joint	2. Lap joint
	3. Double V butt joint	4. T fillet joint.
F] Soldering	1.Soldering & Desoldering Practice	2. Series Circuit
	3. Parallel Circuit	

2. TRADES FOR DEMONSTRATION:

a) Plumbing
b) Machine Shop
c) Bosch Power Tools

REFERENCE BOOKS:

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.
4. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.

I B.Tech, I-Sem (ME) P 3 C 2

(A0092151) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(Common to all Branches)

OBJECTIVES:

- English Language Lab acts as a platform for learning, practicing and producing language skills through interactive lessons and communicative mode of teaching. Communicative method for learning languages combines extensive, high-quality content with flexible and interactive multimedia technology. Learners can act and respond in a variety of ways at their own pace. Through a wide range of activities, a variety of skills are aimed to develop in a learner. A learner needs to communicate: oral and written comprehension, as well as oral and written expression. It also addresses the concepts of grammar, lexicon, phonetics and conjugation.
- To develop language learning through accuracy in grammar
- To enrich the discourse competence, to prepare the learner to be able to produce contextualize written text and speech.
- To achieve good pronunciation patterns and accent.
- To acquire strategic competence to use both spoken & written language to use in a wide range of communication strategies.

OUTCOMES:

Students will be able to

- Participate actively and effectively in cooperative groups
- Use computers and all available technology to enhance their communication skills
- Acquainted with pronunciation patterns and accent
- Deliver a clear, coherent oral presentation using information and diction suitable for subject, purpose, and audience.

UNIT I

Functional English – self Introduction - Greetings – Requests – seeking information Invitations, Ice breaking activities

UNIT II

Multi Media Lab Practice
Introduction to Phonetics I – Speech sounds –Vowels – Diphthongs – Consonants

UNIT III

Multi Media Lab Practice
Phonetics II– Word Accent – Intonation –Rhythm

UNIT IV

Information Transfer – Activity -Description of Technical Objects

UNIT V

Oral Presentations - Activity – JAM

UNIT VI

Group Communication – Activity – GD/Role plays

LICENSED SOFT WARE AVAILABLE IN THE LANGUAGE LAB:

- K-VAN , SOFTX Technologies: English Language and Communication Skills Soft ware IV.0

- Alania Series, English Mastery, Visual & Media Works:Listening Comprehension – Grammar – Vocabulary
- Rosetta Stone Soft ware, Visual & Media Works: LSRW Skills
- EL Client, Globerena Technologies: Phonetics – Job Skills
- K-VAN Solutions: Advanced Communication Skills Lab Soft ware.

REFERENCE BOOKS:

1. Better English Pronunciation by J.D. O' Connor, Cambridge University Press,1980
2. Longman Dictionary of Contemporary English for Advanced Learners, Pearson Education Ltd.
3. Speak with Power and Confidence: Tested Ideas for Becoming a More Powerful Communicator by Patric Collins , 2007
4. Professional Communication Skills ,by Praveen S.R. Bhatia (Author), A.K. Jain (Author), A.M. Sheikh (Author),2006

I B.Tech, II-Sem (ME) T 3+1* C 3

(A0005152) PROFESSIONAL ENGLISH–II

(Common to All Branches)

Professional English II has been prescribed with specific objectives of enlightening the learners in the arena of Language competence. The curriculum has been designed to sharpen the skills of the professional students to meet the job tasks and to sustain the global milieu. This skill based curriculum will mould the young learners as competent engineers.

OBJECTIVES:

- Students will be able to read and explore for enrichment works from various genres (novels, plays, poems, essays).
- Students will be able to engage in formal writing assignments that require utilization of all stages of the writing process.
- Students will be able to evaluate their own language competence according to established criteria and rubrics like IELTS / TOEFL
- Students will be acquainted and be able to assess the LSRW skills.

OUTCOMES:

Students will be able to:

- Read and explore for enrichment works from various genre (Novels, Plays, Poems, Essays).
- Accomplish on line tasks
- Acquaint with soft skills and usage
- Understand and show respect for the diverse cultures, traditions & arts.

UNIT I

Practical English Usage II

a) Review of Advance Grammar– Active & Passive Structures – Reported speech
b) Introduction to International English Language Testing System (IELTS) Level-2 Practice Tests – IELTS

UNIT II

a) **Listening Skills -** Active Listening – ROAR Technique – Note Making
b) **Autobiography** - *A Daughter is born* from **I am Malala** by Malala with Christina Lamb

UNIT III

a) **Technical Writing** –II - Design – Led Documentation - Online writing – E mails – Social Media – Netiquettes- Project Reports
b) **Essay**– *Green Living by* Neil Chambers

UNIT IV

a) **Concept of Communication** – Process - Principles
b) **Prose** – *Immortal Speeches – M.K.Gandhi*

UNIT V

a) **Introduction to Soft Skills** – Hard Skills vs Soft Skills – Team Dynamics
b) **Soft Skill** – *The Art of Time Management* by Ramesh & Ramesh

UNIT VI

a) **Expression through Art** - Fine Arts- Ravi Varma Paintings
b) Project / Case Studies

***Text book Prescribed:** *Falcon: Rise High, RGMCET Publication*

REFERENCE BOOKS

1. The Ace of Soft Skills by Gopala Swamy Ramesh & Mahadevan Ramesh, Pearson Education.
2. The Basics of Communication by Steven Duck, Sage Publication, New Delhi.
3. I am Malala by Malala Yousazai with Christina Lamb, Phoenex, 2014.
4. The Art of Public Speaking by Dale Carneige, Cosimo, Inc., 01-Nov-2007.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME)

T	C
3+1*	3

(A0006152) MATHEMATICS-II

(Common to all Branches)

OBJECTIVES:

- To make aware students about the importance and symbiosis between mathematics and engineering. Achieve confidence with mathematical tools which an essential weapon in modern Graduate Engineer's Armory. Balance between the development of understanding and mastering of solution techniques with emphasis being on the development of student's ability to use Mathematics with understanding to solve engineering problems by retaining the philosophy learning by doing.

OUTCOMES:

- By the end of module students will be expected to demonstrate – knowledge of vector calculus, Fourier series, Fourier Transform , Z-transform and solve problems of engineering using these techniques.

UNIT – I

Multiple integrals: Double and triple integrals – Change of Variables – Change of order of integration.

UNIT – II

Vector Differentiation: Introduction of Vector differentiation -Scalar and vector point functions-Gradient of scalar function– Directional derivatives- Divergence and curl of a vector function- properties of Grad, Div and Curl.

UNIT – III

Vector integration – Line integral - Potential function – Area , Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss's Divergence Theorem (excluding their proof). Verification of Green's – Stoke's and Gauss's Theorems.

UNIT – IV

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

UNIT – V

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

UNIT – VI

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

TEXT BOOKS:

1. Advanced Engineering Mathematics By Erwin Kreyszig.
2. Advanced Engineering Mathematics By R.K. Jain and S.R.K. Iyengar, Narosa Publications.

REFERENCES:

1. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and Others S. Chand & Company.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
3. A Text Book of Engineering Mathematics, Thomson Book Collection.
4. Engineering Mathematics By Srimantha Pal et.al. Oxford University Press.
5. Engineering Mathematics, Sarveswara Rao Koneru, Universities Press.

I B.Tech, II-Sem (ME) T 3+1* C 3

(A0007152) MATERIAL PHYSICS

(Common to CE and ME)

OBJECTIVES:

- The Material Physics is designed to meet the educational needs of each student and to provide the foundation for future career development.
- To provide students with a broad education required to recognize, understand, and further the evolving role that materials science plays in society.
- To prepare students for careers in materials physics and engineering, or in fields that require an understanding of materials, by providing a broad, fundamental view of materials as well as a solid foundation in science and engineering.
- To identify important scientific and engineering problems related to materials, and then design systems and processes as well as perform relevant experiments and interpret data to aid the solution of these problems;
- To understand and appreciate materials research and its application in advancing a wide range of established and emerging technologies.

OUTCOMES:

- After the completion of the course the student will be able to:
- Know engineering material structures using the concepts crystal structures.
- Understand the origin of resistance and band structures with the study of conductors
- Understand the structure and behavior of semiconductor and thermal properties.
- Apply the concepts of magnetism and superconductivity in electrical machines, inductors etc.
- Apply the concepts of dielectric behavior in the fabrication of capacitors.
- Motivate towards new small scale technology where the behavior of the materials is different.

UNIT I

CRYSTAL PHYSICS: Classification of solids - Lattice – Space lattice - Basis- Crystal Structure - Unit cell – Primitive cell – crystal systems - Bravais lattice –Atomic radius – Coordination number – Packing factor for SC, BCC, FCC structures – NaCl, diamond and graphite structures - Lattice planes – Miller indices – inter planar spacing in a cubic lattice – X-Ray Diffraction - Bragg's law – Powder method of crystal structure determination - Lattice defects – Qualitative ideas of point, line, surface and volume defects - problems.

UNIT II

CONDUCTING MATERIALS: Conductors – classical free electron theory of metals – Drift Velocity - Electrical and thermal conductivity – Quantum theory – Fermi energy – Fermi level - Effect of temperature on Fermi Function - Fermi distribution function – Sources of electrical resistivity – Kroning-Penney model (qualitative results-no derivation) – Energy bands – classification of materials - problems.

UNIT III

THERMAL AND SEMICONDUCTING PROPERTIES: Introduction - Specific Heat of Solids – Einstein Model – Debye Model – Lattice Vibrations – Phonons – Thermal Conductivity.
Introduction - Intrinsic semiconductor – extrinsic semiconductors – Drift and diffusion – Einstein relation - Hall effect – Determination of Hall coefficient – Applications - Basic Ideas of Compound Semiconductors (II-VI & III-V).

UNIT IV

MAGNETIC AND SUPERCONDUCTING PROPERTIES: Terms and definitions - Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferromagnetism – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites – applications - problems.

Introduction to superconductors - Properties of a superconductor - Meissner's effect – London penetration depth - Type of superconductors - BCS theory of Super conductivity (Qualitative) - Applications of superconductors - problems.

UNIT V

DIELECTRIC PROPERTIES: Matter polarization and relative permittivity: definition - dipole moment and polarization vector P-polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization - frequency dependence - Lorentz field and Clausius - Mossotti equation - ferroelectricity - $BaTiO_3$ - applications - problems.

UNIT VI

MODERN ENGINEERING MATERIALS: Nanomaterials: Introduction - Properties - synthesis - ball milling - solgel - applications.

Carbon nanotubes: introduction - types of CNTs - synthesis - chemical vapor deposition - properties and applications.

Metallic glasses - shape memory alloys (one way, two way) - applications.

REFERENCES:

1. Charles Kittel “Introduction to Solid State Physics”, John Wiley & sons, 7th edition, Singapore.
2. Ali Omer, “Elementary Solid State physics”, Person Publications 5th Edition, New Delhi.
3. M.N. Avadhanulu and PG Kshirsagar, “A Textbook of Engineering Physics”, S.Chand and company, Ltd., New Delhi, 2014.
4. D. K. Bhattacharya and PoonamTandon, “Engineering Physics”, Oxford University Press, 2015.
5. Srivastava, “Elements of Solid State Physics”, PHI, New Delhi.
6. Charles P. Poole and Frank J. Ownen, “Introduction to Nanotechnology”, Wiley India.
7. S.P.Basavaraju, “Applied Physics”, Subhas Stores, Bangalore.
8. M.Ratner & D. Ratner –“Nanotechnology”, Pearson Ed, New Delhi.

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MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME)

T	C
3+1*	3

(A0502152) DATA STRUCTURES THROUGH C

(Common to all Branches)

OBJECTIVES:

- To make students aware about structures and unions in C language.
- To provide exposure on various searching and sorting techniques.
- To provide exposure on various data structures like stacks, queues, circular queues and linked lists etc.,
- To develop solutions for various problems by using C Programming Language by students.

OUTCOMES:

By the end of this course, students should be able

- To understand how to develop C programs to solve various kinds of problems by using different C programming concepts like structures and unions.
- To develop programs by performing I/O operations through Files.
- To implement different linear data structures like stacks, queues, circular queues and linked lists etc.,
- To implement various searching and sorting techniques.

UNIT I

STRUCTURE AND UNIONS IN C LANGUAGE: Structures - Introduction, Features of Structures. Declaration and Initialization of Structures, Accessing structure members, structure initialization. Nested Structures, Array of Structures, Arrays within structures and Pointers to Structures, Structures and Functions, Bit Fields, Unions, Union of Structures. Example Programs on the topics mentioned above.

UNIT II

FILE INPUT/OUTPUT: Introduction, Types of Files, File I/O Operations- High level I/O functions- Open & Close a file, Read and Write data into a file, Searching data in the file, Error handling during I/O operations on files. Command Line Arguments, Applications of Command Line Arguments. Example Programs on the topics covered in this unit.

UNIT III

INTRODUCTION TO DATA STRUCTURES: classification of data structures, dynamic memory allocation functions in C language.

STACKS: Definition, Various representation methods, operations on stacks and their implementation in C language, applications of stacks.

UNIT IV

QUEUES: Definition, Various representation methods, operations on queues and their implementation in C language, applications of queues. Circular queues- operations on circular queues and their implementation in C language.

UNIT V

LINKED LISTS: Definition, Various representation methods, operations on linked lists and their implementation in C language.

UNIT VI

SEARCHINGAND SORTING TECHNIQUES:

Searching Techniques- Linear search and Binary Search Techniques.

Sorting techniques- Bubble Sort, Selection Sort, Quick Sort, Insertion Sort, and Merge Sort. Implementation of all the above mentioned techniques in C language and trace them by giving different test data.

TEXT BOOKS:

1. Programming in C,Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2. Computer programming and Data Structures, E.Balaguruswamy, Tata McGraw Hill. 2009 revised edition.
3. The C Programming Language, Brian W.Kerninghan, Dennis M.Ritchie
4. Programming in C , Dr. N. UdayBhaskar, Winger publications

REFERENCES:

1. Let us C – Yeshwanthkanetkar, 8thEdition.BPB Publications
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI, Eighth Edition.
4. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

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MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME) T 3+3* C 3

(A0301152) ENGINEERING DRAWING

(Common to all branches)

OBJECTIVES:

- This course is to introduce the basic principles of engineering mechanics with emphasis on analysis and application to practical engineering problems.

OUTCOMES:

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

- Determine the moment of inertia and mass moment of inertia of simple and composite sections.
- Understand the simple machines.
- Analyze the forces causing the motion of a particle.
- Use the equation of motion to describe the accelerated motion of a particle.
- Apply work, energy, impulse and momentum relationships for a particle in motion.
- Study impulse, momentum and impact of rigid bodies

UNIT-I

Polygons-Construction of Regular Polygons using given length of a side; Conic sections-Ellipse- Arcs of Circles and Oblong Methods, Construction of Parabola and Hyperbola by eccentricity method only.

UNIT-II

Introduction to Orthographic Projections- Projections of Points-Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane, inclined to both planes, determination of true lengths, angle of inclinations.

UNIT-III

Projections of Planes- Regular Planes Perpendicular / Parallel to one Reference, Plane and inclined to other Reference Plane.

UNIT-IV

Projections of Solids-Prisms, pyramids, cones and Cylinders with the axis inclined to one Plane.

UNIT-V

Section of solids: Sectioning of prism, pyramid, cone and cylinder– sectional view – true shape. Solids in simple position and cutting plane inclined to one reference plane only.

Development of surface of solids: Development of truncated prism, pyramid, cone and cylinder – frustum of cone and pyramid

UNIT-VI

Conversion of Isometric Views to Orthographic Views/Projections-Conversion of Orthographic Views to Isometric Projections and Views.

TEXT BOOK:

1. Engineering Drawing by N.D. Bhatt, Chariot Publications.
2. Engineering Drawing and Graphics, Venugopal/New age publications.

REFERENCE BOOKS:

1. Engineering Drawing. K.L Narayana, P. Kannaiah, Scitech Publications.
2. Engineering Drawing, B.V.R Gupta, J.K. Publishers.
3. Engineering Drawing by M.B. Shah and B.C. Rana, Pearson Publishers.
4. Engineering Drawing, Johle, Tata Mc Graw - Hill.
5. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai (2006).

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MECHANICAL ENGINEERING

I B.Tech, II-Sem (ME)

T	C
3+1*	3

(A0303152) ENGINEERING MECHANICS- II

COURSE OBJECTIVES:

- This course is to introduce the basic principles of engineering mechanics with emphasis on analysis and application to practical engineering problems.

COURSE OUTCOMES: At theend of the course, the student will be able to:

- Determine the moment of inertia and mass moment of inertia of simple and composite sections.
- Understand the simple machines.
- Analyze the forces causing the motion of a particle
- Use the equation of motion to describe the accelerated motion of a particle
- Apply work, energy, impulse and momentum relationships for a particle in motion
- Study impulse, momentum and impact of rigid bodies.

UNIT-I

LIFTING MACHINES: Introduction, Reversible and irreversible machines, condition for irreversibility of a machine, Law of machine, Friction of a machine expresses in terms of actual effort, friction of a machine expressed in terms of load, Important lifting machines- Simple wheel and axle, Differential wheel and axle, Worm and worm wheel.

UNIT-II

KINEMATICS: Basics of dynamics- rectilinear motion- motion with constant, Acceleration- freely falling bodies - curvilinear motion- motion of a projectile- uniform circular motion, relative motion.

UNIT-III

KINETICS: Kinetics of rectilinear motion, Newton's law of motion, D'Alembert's principle, motion of a lift, motion on an inclined plane, kinetics of circular motion, centrifugal force.

UNIT-IV

WORK ENERGY METHOD: Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V

WORK ENERGY METHOD: Work Energy expression for angular momentum, loss of rotary motion, work Energy equation for rigid bodies, principle of conservation of energy.

IMPULSE AND MOMENTUM: Principle of Impulse and momentum, law of conservation of momentum, impulse momentum equation.

Impact of elastic bodies-impact or collision, line impact, coefficient of restitution.

UNIT VI

MECHANICAL VIBRATIONS: Definitions, basic concepts, Simple harmonic motion - Free Vibrations - Simple, Compound and Torsional Pendulums- Simple problems-Free Vibrations without Damping General Case.

TEXT BOOKS

1. *Engineering Mechanics*, S. S. Bhavikatti and K. G. Rajashekarappa, New Age International (P) Ltd.
2. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.

REFERENCES

1. *Engineering Mechanics*, Shames and Rao- Pearson Education.
2. *Kumar, K. L-* Engineering Mechanics, Tata McGraw- Hill, New Delhi,.
3. *Engineering Mechanics* – R.K Bansal, Lakshmi Publications
4. *Beer,F.P and Johnson Jr.* E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition,
5. *Engineering Mechanics*, S. Timoshenko, D. H. Young and J. V. Rao, Tata McGraw-Hill Education.

I B.Tech, II-Sem (ME) P 3 C 2

(A0093152) ENGINEERING PHYSICS LAB
(Common to all Branches)

OBJECTIVES:

1. Providing an opportunity to develop and hone experimental skills, particularly as they pertain to scientific and technical knowledge
2. Providing a solid grounding in the methods of scientific and research inquiry,
3. Apply the scientific method to experiments in the laboratory.
4. To create curiosity in research methods by the experiments Hall effect, four pobe conductivity, laser diffraction etc.

OUTCOMES:

- Develop procedures and observational skills as data is taken and gain a fundamental understanding of simple and complex apparatus used in the experiment.
- Apply analytical techniques, statistical analysis, graphical analysis, spread sheet data/recording to the experiments.
- Verify the theoretical ideas and concepts covered in lecture by completing a host of experiments.
- Take the time to discuss the procedure, the data, and the results of the experiment with the lab partner.

List of experiments (Any 10 Experiments)

1. Newton's rings
2. Determination of thickness of a thin film
3. Spectrometer – Transmission grating
4. Determination of wavelength of a Sodium light – Normal Incidence
5. Dispersive power of a prism - spectrometer
6. Laser experiment: wavelength determination using grating
7. Laser experiment: particle size determination
8. Determination of numerical aperture of an optical fiber
9. Field along the axis of coil carrying current – Stewart Gee's method
10. Determination of rigidity modulus – Torsional Pendulum
11. Determination of Band gap of Si or Ge – Four probe method
12. Study of B – H Curve.
13. Determination of Charge density and Hall coefficient or magnetic flux density – Hall effect.
14. Study of Solar I-V characteristics
15. Measurement of Dielectric constant

I B.Tech, II-Sem (ME) P 3 C 2

(A0592152) DATA STRUCTURES THROUGH C LAB

(Common to All Branches)

OBJECTIVES:

- To introduce different constructs of C language like structures and unions to the students to solve various kinds of problems.
- To introduce different types of linear data structures like stacks, queues, circular queues and linked lists etc.
- To make the students to implement different kinds of sorting algorithms like selection sort, bubble sort, insertion sort, and quick sort and merge sort etc.
- To make the students to implement different kinds of searching algorithms like linear search and binary search etc.
- To implement various searching and sorting techniques

OUTCOMES:

By the end of this course, students should be able

- To understand how to develop C programs to solve various kinds of problems by using different C programming concepts like structures and unions.
- To develop programs by performing I/O operations through Files.
- To implement different linear data structures like stacks, queues, circular queues and linked lists etc.,
- To implement various searching and sorting techniques.

RECOMMENDED SYSTEMS /SOFTWARE REQUREMENTS:

- Intel based desktop PC with ANSI C Compiler and Supporting Editors

Exercise 1:

a) Write a C Program to copy the contents of one structure variable to another structure variable.

b) Write a C program to implement nested structure to store and display the student information. The structure student contains the field's S.no, name, and date. Date is the nested structure and it contains the fields day, month and year.

Exercise 2:

a) Write a C program to simulate the multiplication of two fractions by passing individual structure members to a function.

b) Write a C program to simulate the multiplication of two fractions by passing the whole structure to a function.

Exercise 3:

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

b) Write a C program to implement Union Concept.

Exercise 4:

a) Write a C program which copies last 'n' characters from one file to another.

b) Write a C program to reverse the first 'n' characters in a file.

c) Write a C program to merge two files into a third file.

Exercise 5:

Write a C program to implement the following operations on Stack using array representation

a) Push b) Pop c) Display

Exercise 6:
Write a C program to implement the following operations on Queue using array representation
a) Insert b) Delete c) Display

Exercise 7:
Write a C program to implement the following operations on Singly Linked list using linked representation
a) Insert b) Delete c) Display d) Search

Exercise 8:
Write a C program that implements the following sorting methods to sort a given list of integers in ascending order.
a) Bubble sort b) Selection sort c) Insertion sort

Exercise 9:
Write a C program that implements the following sorting methods to sort a given list of integers in ascending order.
a) Quick Sort b) Merge sort

Exercise 10:
Write C program to implement the following searching methods to search an element in a given list of integers
a) Linear Search b) Binary Search

REFERENCE BOOKS

1. Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2. Computer programming and Data Structures, E.Balaguruswamy, Tata Mc Graw Hill. 2009 revised edition.
3. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.

I B.Tech, I-Sem (ME) P 3 C 2

(A1291152) IT WORKSHOP
(Common to All Branches)

OBJECTIVES:

- The IT Workshop for engineers is a training lab course.
- The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, Power Point and Publisher. It enables the students to understand and fix the common hardware, software issues & makes the students to install either Windows or UNIX based Operating system in the machines.
- Enable students to understand how computers work, different types of computers, functions of applications, input and data storage devices, different operating systems, ethics, data communications, and systems analysis and design
- It makes the students to understand and use the common office suite tools like word, excel etc effectively in their daily usage.
- To ensure the students to understand the basic networking concepts like IP Address etc

OUTCOMES:

By the end of module students will be expected to demonstrate

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

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on a working PC (PIV or higher)to disassemble and assemble back to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace for usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced.

Productivity tools module would enable the students in crafting professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools

PC HARDWARE

Exercise 1 - Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Exercise 2 - Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video shall be given as part of the course content.

Exercise 3 - Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Exercise 4 - Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Exercise 5 - Task 5: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

Exercise 6 - Task 6: Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

OFFICE TOOLS

WORD

Exercise 7 - Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007,2010/ equivalent tool word: Importance of LaTeX and MS office 2007,2010/ equivalent tool Word as word Processors, Details of the four tasks and features that would be covered in each. Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 1-Task IV: Using Word to create project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

INTRODUCTION TO LATEX

EXCEL

Exercise 8 - Excel Orientation: The mentor needs to tell the importance of MS office 2007,2010/ equivalent tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1-Task IV: Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text, Formulas, Functions

POWER POINT

Exercise 9 - Task1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this Exercise

includes:- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in Power point. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

Exercise 10 - Task 2: Second Exercise helps students in making their presentations interactive. Topic covered during this Exercise includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts

INTERNET & WORLD WIDE WEB 2 EXERCISES

Exercise 11 - Task 1: **Orientation & Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

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

Exercise 12 - Task 2: **Search Engines & Netiquette:** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated by the student to the satisfaction of instructors.

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

REFERENCES:

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

I B.Tech, II-Sem (ME) P 3 C 2

(A0191152) ENGINEERING MECHANICS LAB

OBJECTIVE:

- To know different types of force systems and finding their resultant.
- To understand friction between the two contact surfaces.
- To understand the concept of moments and couple.
- To understand the working of simple machines.

OUTCOMES:

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

- Find the resultant of coplanar concurrent systems.
- Determine the coefficient of friction present between contact surfaces.
- Determine the support reactions for the given beam.
- Determine the moment of inertia of rotary masses.
- Analyze the simple lifting machines.

LIST OF EXPERIMENTS

1. To verify the polygon law of coplanar Forces for a concurrent force system.
2. Verification of Lamis Theorem.
3. To find experimentally the reactions at the supports of a simply supported beam and verify the same with analytical values.
4. Verification of force transmitted by members of given truss.
5. To determine the coefficient of static friction between two surfaces.
6. To determine the Co-efficient of Friction for different materials.
7. To verify the principle of moments using the bell crank lever apparatus.
8. To determine the coefficient of friction between the threads of the screw jack.
9. To find the moment of Inertia of a flywheel.
10. To determine the Mechanical advantage, Velocity ratio and Mechanical efficiency of the simple wheel & Axle.
11. To determine the Mechanical advantage, Velocity ratio and Mechanical efficiency of a worm and worm wheel.
12. To find the moment of inertia of a compound pendulum.

II B.Tech, I-Sem (ME) T 3+1* C 3

(A0015153) MATHEMATICAL METHODS
(Common to CE, ECE, EEE, IT & ME)

OBJECTIVES:

- To make aware students about the importance and symbiosis between mathematics and engineering. Achieve confidence with mathematical tools which an essential weapon in modern Graduate Engineer's Armory. Balance between the development of understanding and mastering of solution techniques with emphasis being on the development of student's ability to use Mathematics with understanding to solve engineering problems by retaining the philosophy learning by doing.

OUTCOMES:

- By the end of module students will be expected to demonstrate understanding of Matrices, Partial Differential Equations and Numerical Methods are used to solve various Engineering Problems.

UNIT – I

Matrices: Elementary row transformations – Rank – Echelon form, Normal form – Solutions of Linear System of Homogenous and Non Homogeneous equations
Eigen Values, Eigen vectors – Properties. Cayley – Hamilton Theorem – Inverse and powers of a matrix by Cayley–Hamilton theorem

UNIT – II

Real matrices – Symmetric, skew – Symmetric, orthogonal matrices.
Complex matrices: Hermitian, Skew-Hermitian and Unitary matrices – Eigen values and Eigen vectors and their properties. Quadratic forms –Linear Transformation – Reduction of quadratic form to canonical form and their nature(Signature and Index).

UNIT – III

Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.
Interpolation: Introduction – Finite differences – Forward Differences – backward Differences –Newton's forward and backward difference formulae for interpolation – Lagrange's Interpolation formula.

UNIT – IV

Curve fitting: Fitting a straight line – Second degree curve – Exponential curve-Power curve by method of least squares.
Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT – V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Method– Milne's Predictor-Corrector Method.

UNIT – VI

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace equation under initial and boundary conditions

TEXT BOOKS:

1. Advanced Engineering Mathematics By Erwin Kreyszig.
2. Advanced Engineering Mathematics By R.K. Jain and S.R.K. Iyengar, Narosa Publications.

REFERENCES:

1. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and Others S. Chand & Company.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
3. A Text Book of Engineering Mathematics, Thomson Book Collection.
4. Engineering Mathematics By Srimantha Pal et.al. Oxford University Press.
5. Engineering Mathematics, Sarveswara Rao Koneru, Universities Press.

II-Year, B.Tech I-Sem (ME) T 3+1* C 3

(A0201153) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to ME & CE)

OBJECTIVE:

- This course introduces the basic concepts in electric circuits and networks
- This course also introduces the working principles of different types of AC and DC motors, Generators and Transformers.
- It also helps to study the operating principles of electrical measuring instruments and their working
- To understand the fundamental principles of basic electronic devices
- To provide theoretical prerequisites necessary to do lab work on DC machines and AC machines

OUTCOMES:

- The student will familiarize the working of DC and AC machines and their performance behavior.
- The student will understand the basic concepts of different measuring instruments and semi conductor devices.

UNIT – I

ELECTRICAL DC CIRCUITS: Basic definitions (electrical conductor, insulator, semiconductor, electrical circuit, electric current, electric potential, EMF and electric potential difference) - Types of elements(active and passive elements)- Ohm's Law and its limitations-electric power-electrical energy- Kirchhoff's Laws- Resistances in series- Resistances in parallel- Star to delta and delta to star transformations –DC super position theorem and thevinin's theorem-simple problems.

UNIT – II

DC MACHINES:

DC-GENERATOR: Working Principle and construction of DC Generator– induced emf equation – types of DC Generators-simple problems regarding EMF.

DC MOTOR: Working Principle of DC Motor-types of DC Motors -back emf -torque equation –speed control of DC Shunt Motor – applications of DC machines -losses in DC machines- Swinburne's test and efficiency calculation –simple problems.

UNIT – III

TRANSFORMERS: Principle of operation of single phase transformers –Constructional features –Theory of an Ideal Transformer- EMF equation –Practical Transformer on no load and load–Equivalent circuit-Impedance Ratio-Shifting of Impedances – losses- regulation - OC & SC test- efficiency –simple problems.

UNIT – IV

ELECTRICAL INSTRUMENTS: Introduction-Types of electrical instruments –Principle of Operation of indicating instruments– Essentials of Indicating Instruments-Defecting Torque-Controlling Torque –Damping Torque-PMMC and Moving Iron Instruments (Operation and Construction only).

UNIT – V

DIODE AND ITS CHARACTERISTICS: Formation of n- type and p-type semiconductor – Construction of P-n junction diode, symbol - V-I Characteristics- Diode Applications- Rectifiers – Half wave-Full wave-mid point and bridge type-simple Problems.

UNIT - VI

TRANSISTORS and CRO: Formation of PNP and NPN transistors – CE configuration of NPN and PNP transistors- applications -Transistor as an amplifier-SCR characteristics and applications- construction and Principle of CRO(operation only)-Applications.

TEXT BOOKS:

1. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.
2. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
3. Principles of Electronics by V.K.Mehta, S.Chand & Co.

REFERENCES:

1. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.
2. Electronics and Devises by salivahan, TMH Publications

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MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0304153] MECHANICS OF SOLIDS

OBJECTIVES:

- To impart basic principles of solid mechanics and their associated laws.
- To understand the behavior of engineering materials for different types of loads
- To understand the behavior of beams under different types of loads
- To analyze the circular solid and hollow shafts under bending and torsional loads
- To understand the nature of stresses developed in material under complex loading system
- To analyze the cylindrical shells under circumferential and radial loading conditions

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

- Determine the simple stresses and strain when members are subjected to axial loads.
- Understand statically determinate and indeterminate problems.
- Evaluate stresses in different cross-sectional members subjected to bending moment.
- Evaluate principal stresses, strains in bi-axial stress systems.
- Analyze and design thin cylindrical shells.

UNIT- I

SIMPLE STRESSES & STRAINS: Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT –II

SHEAR FORCE AND BENDING MOMENT: Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams subjected to point loads, UDL, Uniformly varying loads and combination of these loads- Point of Contra flexure- Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT –III

FLEXURAL STRESSES: Theory of simple bending- Assumptions- Derivation of bending equation (M/I = f/y = E/R) – Neutral axis- Determination of Bending stresses- section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections.

UNIT- IV

BEAM DEFLECTION: Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method.

Columns: End conditions – Equivalent length of a column – Euler's equation – Slenderness ratio – Rankin's formula for columns.

UNIT- V

PRINCIPAL STRESSES & STRAINS: Principal stresses and Principal planes, Method of determining stresses on oblique sections, Mohr's circle.

UNIT -VI

CYLINDERICAL SHELLS: Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal stresses and volumetric strains.

TEXT BOOKS:

1. Strength of materials by Ramamrutham.
2. Strength of Materials by R.K. Bansal, Laxmi publications (P) ltd.

REFERENCES:

1. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co,
2. Strength of materials by Bhavikatti, Lakshmi Publications.
3. Analysis of structures by Vazrani & Ratwani.
4. Engineering Mechanics of Solids by Popov E.P, Prentice-Hall of India, New Delhi.
5. Mechanics of solids by Timo shenko,TMH Publications.
6. Singh D.K “Mechanics of Solids” Pearson Education.
7. Beer F. P. and Johnston R, Mechanics of Materials, McGraw-Hill Book Co, Third Edition.

II B.Tech, I-Sem (ME) T 3+1* C 3

[A0305153] MATERIAL SCIENCE & METALLURGY

OBJECTIVES:

- The student can able to understand the material behaviour and the selection of appropriate material for the given application.
- To instruct the students on the importance of quantification and characterization of properties and phenomena.
- Understanding different bonds in solids, crystal structures, Understanding Phase-Diagrams, cooling curves, Heat treatment. Knowledge about ceramics and composite materials

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

- Understand basic concepts of crystallography, material properties.
- Understand the concept of constructing Phase diagrams.
- Understand the Physical and chemical properties of cast-irons, steels and stainless steels.
- Understand the physical properties of different Non-ferrous metals and their alloys.

UNIT: I

Structure of Metals: Crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size- Mechanical properties of engineering materials.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds.

UNIT: II

Testing of Engineering materials: Mechanism of plastic deformation, Slip and Twinning-Testing of materials under tension, Compression and shear loads, Hardness tests- Brinell, Vicker's and Rockwell, Impact test- Izod and Charpy tests, Fatigue and creep tests.

UNIT: III

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, equilibrium cooling and heating of alloys, Lever rule, coring, eutectic systems, peritectic reaction. Transformations in the solid state –allotropy, eutectoid, peritectoid reactions, phase rule. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, and Fe-Fe_3C.

UNIT: IV

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Hadfield manganese steels-stainless steels, tool and die steels.

Non-Ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT: V

Heat Treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, sub zero treatment of alloys.

UNIT: VI

Powder Metallurgy: Introduction, advantages of Powder Metallurgy, Preparation of metal powders-Mixing, Blending, Compacting, Sintering &Hot-pressing – applications of powder

metallurgy, examples of typical components produced.

TEXT BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Elements of Material science / V. Raghavan

REFERENCES:

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and Engineering / William and collister.
4. Material Science & Metallurgy / Dr.C.D.Yesudian & Dr.Harris Samuel/Scitech Publications.
5. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.
6. An introduction to Material science / W.g.vinas & HL Mancini
7. Engineering materials and metallurgy/R.K.Rajput/ S.Chand.

II B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0306153] THERMODYNAMICS

(Use of Standard Steam Tables, Mollier Diagram are Permitted in End Examinations**)**

OBJECTIVES:

The students completing this course are expected:

- Modern industry requires Mechanical Engineers, who are capable of design & implementing thermal engineering specific tasks. To do this engineer must exercise creative ability, sound judgment and technical knowledge.
- The student should understand the nature and role of the thermodynamics, heat and work transfer.
- The student should recognize and understand the different forms of energy and restrictions imposed by the First Law of Thermodynamics on conversion from one form to the other.
- The student should understand implications of the Second Law of Thermodynamics and limitations placed by the Second Law on the performance of thermodynamic systems.
- The student should be able to know the behavior of Ideal, real and mixture of perfect gasses.
- The student should be able to know the behavior of pure substances in thermal systems.

OUTCOMES:

The *Learning Outcomes* are assessed through graded home work, quizzes, mid-semester, final, GATE and IE Sexams.

At the end of the course the students are capable of solving the problems in

- Engineering thermodynamics, systems and properties.
- Zeroth law, first law and Second law of thermodynamics of thermodynamics.
- Entropy and availability
- Behavior of Ideal, real and mixture of perfect gasses.
- Behavior of pure substances in thermal systems

UNIT–I

BASIC CONCEPTS AND DEFINITIONS: Macroscopic & Microscopic approaches, Thermodynamic system, state, properties, processes and cycle, Thermodynamic Equilibrium, quasi-static process, Zeroth Law of Thermodynamics.

Work and Heat Transfer: path and point functions– Non flow (PdV) or displacement work in various processes, Heat Transfer, comparison of work and heat Transfer.

UNIT–II

FIRST LAW OF THERMODYNAMICS: First law for a closed system under going a cycle and for a process, Joules experiment –specific heat at constant volume and constant pressure, enthalpy, PMM-I.

First Law Applied to Flow Systems: Control volume, steady flow process, applications of steady flow energy equation. Simple problems on steady flow energy equation.

UNIT–III

SECOND LAW OF THERMODYNAMICS: Heat engine, Kelvin-Plank statement, Clausius statement, refrigerator and heat pump, equivalence of Kelvin-plank and clausius statements, reversibility and irreversibility, Carnot Cycle, Carnot's Theorem, corollary of Carnot's theorem, thermodynamic temperature scale ,efficiency of a reversible heat engine, PMM-II - simple problems.

UNIT–IV

ENTROPY: Clausius theorem, Clausius inequality–Definition of entropy, principle of entropy increase, T-Splot, change in entropy in various reversible processes.

Availability:Availableenergy,maximumworkinareversibleprocess,availabilityinnon flow and flow processes.

UNIT–V

IDEAL AND REAL GASES:

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states.

Real gases - Deviations from perfect Gas Model – Vander Waals Equation of State.

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, specific Heats and Entropy of Mixture of perfect Gases and Vapor.

UNIT–VI

PROPERTIES OF PURE SUBSTANCES: Pure substance, phase transformation**,** Study of P-V, T-S diagrams for pure substances–quality and dryness fraction of steam –Use H-S or Mollier Diagram & steam tables - Simple problems on quality and dryness fraction

TEXT BOOKS:

1. P.K. Nag Engineering Thermodynamics, TMH Publishers, New Delhi.
2. G.J.Van Wylen, Sonntag, Fundamentals of Thermodynamics, John Wiley & Sons Publishers, Singapore

REFERENCE BOOKS:

1. B.P Mistra, Engineering Thermodynamics.
2. E. Ratha Krishna, Fundamentals of Engineering Thermodynamics, PHI Publishers, New Delhi.
3. Thermodynamics – Yadav" Central Publishers.
4. Engineering Thermodynamics, K.Rama Krishna, Anuradha Publishers.
5. S.C.Gupta,Engineering Thermodynamics, Pearson Education, New Delhi

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MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0307153] MACHINE DRAWING

OBJECTIVES: At the end of this course

- The student should understand the some fundamental aspects and design concepts and manufacturing of parts of the production machines, including conventional representation of materials, parts-screw joints, welded joints, gears, nuts, bolts, keys, webs, ribs etc. Surface roughness and its indication of mechanical components, symbols used on drawings, detailed/part drawings-Drawing of parts from assembly drawings with indications of size, tolerances, roughness.

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

- Understand the conventional representation of materials, machine parts and screws.
- Draw the machine elements including keys, couplings, cotter, riveted and bolted joints.
- Construct assembly drawing using part drawings of machine components.
- Draw the part drawing of the machine component representing tolerances and surface finish.

UNIT – I

Drawing Conventions: Conventional representation of materials, common Machine elements and parts such as screws, nuts, bolts, keys, gears, web, ribs.

Screwed Fastenings: Various thread profiles, Square and hexagonal bolt sand nuts, Assembly of bolt, nut and washer, Eye bolts. Locking arrangements for nuts, Foundation bolts.

UNIT - II

Keys, Cotters and Pin Joints: Different types of keys in assembly, cotter joint with sleeve, cotter joint with socket and spigot ends, cotter joint with gib, knuckle joint.

Bearings: Solid and bushed journal bearing, Pedestal bearing, Footstep bearing.

UNIT–III

Riveted Joints: Different types of rivet heads, Single riveted lap joint, double riveted chain and zigzag lap and butt joints.

UNIT–IV

Shaft Couplings: Muff couplings, Flanged coupling, Compression coupling, Universal coupling and Oldham coupling.

UNIT - V

Assembly Drawing: Assembly drawings of the following:

Engine Parts: Stuffing box, Steam engine Crosshead, eccentric. Petrol engine Connecting rod. **MACHINE TOOL PARTS AND ACCESSORIES:** Square tool post, Lathe tail stock and Shaper tool post.

UNIT - VI

Miscellaneous Parts: Screw Jack, Swivel bearing, Plummer block and Pipe Vice.

TEXT BOOKS:

1. K.L.Narayana, K.Venkata Reddy, Machine Drawing, NAI Publication, New Delhi.
2. N.Sidheswar, P. Kannaiah ,Machine Drawing, TMH Publishers, New Delhi

REFERENCE BOOKS:

1. K.R.Gopalakrishna, Machine Drawing, Subhash Publication, New Delhi.
2. P.S.Gill, Machine Drawing, Kataria Publication, New Delhi.
3. N.D. Junnarkar, Machine Drawing, Pearson publication, New Delhi.

Note:

- First angle projection to be adopted.
- All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued.
- The End examination will be for **4 hrs** in the following format.
- **Q.No.1** is compulsory, **04** questions are to be answered from **Q.No.2** to **Q.No.7**.
- **Q.No.1-** Questions are from unit-I to VI of the syllabus, **07** out of **07** short questions to be answered with a Weightage of **02** marks each – **14 Marks.**
- **Q.No.2** to **Q.No.5**-Questions are from **unit**-I to **IV** of the syllabus, **04** out of **03** to be answered with a weithtage of **08** Marks each **-24 Marks.**
- **Q.No.6 to Q.No.7**-Questions are from **unit-V** to **VI** of the syllabus, **01** out of **02** to be answered with a weithtage of **32** Marks each **-32 Marks.**

II B.Tech, I-Sem (ME) T 1+2* C 1

(A0011154) COPORATE MANAGEMENT SKILLS

(Common to all Branches)

(Skill Development Course)

OBJECTIVES:

- Provides knowledge & skills on communication (verbal & non verbal)

OUTCOMES:

- Able to perform better way in personnel interviews and presentations.

UNIT-1:

Concept of Communication: Significance-Functions of Communication-Process-Different types of Communication-Essentials of good communication-Channels of communication-Formal and informal communication networks.

UNIT-2:

Types of Communication: Oral Communication-Tips to make oral communication effective-Merits and Demerits of oral communication-Written Communication-Steps in Writing-Merits and Demerits of written communication-Non verbal communication and Different types in it.

UNIT-3:

Barriers to Communication: Types of barriers-Technological, Socio psychological-How to overcome the barriers-Different communication styles and models.

UNIT-4:

Interviews: Resume preparation, Interview Process-Types-Common mistakes in interview-Preparation for interviewer- Preparation for interviewee.

UNIT-5:

Emotional Intelligence: Felt Vs Displayed emotions-Emotional dimensions- External constraints on emotion-Gender and emotion-Importance of emotional intelligence.

UNIT-6:

Personality and Perception: Determinants of personality-Theories of personality-Components of perception-Factors influencing the perception process-Johari Window.

REFERENCE BOOKS:

1. Business communication Meenakshi Raman oxford university prof
2. Business communication Lalitha Ramakrishna
3. Business communication Hudson,5 /E,Jaico publication
4. Effective communication Harward Business school, Harward Business review no 1214
5. Management and organization Behaviour by P.Subbarao

II B.Tech, I-Sem (ME) P C
3 2

(A0291153) BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB
(Common to ME & CE)

OBJECTIVE:

- To experiment and verify the basic electrical and electronic principles.
- To provide practical exposure to test the performance of DC and AC machines, Transformers
- It helps to study the characteristics of basic electronics devices

OUTCOMES:

- The student will get clear understanding over the theoretical concepts through experimentation
- The student will be acquainted with the working of DC and AC machines and their performance.

SECTION – A

Electrical Engineering Lab: **(Any five experiments)**

1. Verification of super position theorem
2. Verification of thevinin's theorem
3. Speed control of D.C. Shunt motor by
   a. Armature Voltage control
   b. Field flux control method
4. Swinburne's test on D.C. Shunt machine
5. Brake test on D.C Shunt Motor
6. OC and SC tests on single phase transformer (Predetermination of efficiency at given power factors)

SECTION – B

Electronics Engineering Lab: (Any five experiments)

1. PN-junction diode characteristics
2. Half wave Rectifier with and without filters
3. Full wave center tapped Rectifier with and without filters
4. Transistor CE Characteristics (Input and Output)
5. CE Amplifiers
6. Study of CRO (Voltage and time measurements)

II B.Tech, I-Sem (ME) P 3 C 2

[A0393153] MECHANICS OF SOLIDS LAB

OBJECTIVES:

- A student can understand the some fundamental aspects and failure modes of engineering materials with the applications of sudden and gradually applied loads. A student able to find out the hardness of the various materials with the help of Brinells & Rockwell hardness testing machines.

OUTCOMES: At the end of the course the student will be able to:

- Conduct tension test on steel.
- Perform compression tests on spring and wood.
- Determine elastic constants using flexural and torsion tests.
- Determine hardness of metals

LIST OF EXPERIMENTS

1. To study the stress-strain characteristics of Mild steel rod using Universal Testing Machine (UTM).
2. To find the compressive strength of a wood
3. Torsion test on mild steel rod.
4. Izod Impact test on metal specimen.
5. Charpy Impact test on metal specimen.
6. Hardness test on metals – using Brinnel hardness testing machine.
7. Hardness test on metals – using Rockwell hardness testing machine.
8. Deflection test on beams.
9. Compressiontest on helical spring.
10. Tension test on helical spring.

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MECHANICAL ENGINEERING

II B.Tech, I-Sem (ME) P 3 C 2

[A0394153] MATERIAL SCIENCE LAB

OBJECTIVES:

- The student should be capable of mount the specimen and able to identify the given metal by observing the micro structure
- To Distinguish the Ferrous and non-Ferrous structures
- To study the effect of heat treatment on microstructures

OUTCOMES:

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

- Use various metallurgical instruments for sample preparation for microscopical examination.
- Understand the micro-structural phases present in the materials ex. Ferrous & Non-Ferrous
- Understand the effect of quenching on hardness of the material.
- Performing non-destructive test to judge the quality of the material.

LIST OF EXPERIMENTS::

1. Preparation of mounted specimen using hydraulic specimen mounting press.
2. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – Carbon steels.
4. Study of the Micro Structures of Cast Irons.
5. Study of Micro Structure of Austenitic- stainless steel.
6. Study of Micro Structure of High-Speed steel.
7. Study of the Micro Structures of Non-Ferrous alloys (Al-alloy, Cu-alloy)
8. Study of the Micro structures of Heat treated steels.
9. Determination of harden ability of steels by Jomny End Quench Test.
10. Determination of the hardness of untreated steels.
11. Magnaflux testing method.

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0009153] ENVIRONMENTAL SCIENCE

[Common to ALL Branches]

OBJECTIVES:

- Creating the awareness about environmental problems among people.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Environmental education should be compulsory, right from the primary up to the post graduate stage.

OUTCOMES:

- Understand environmental problems arising due to developmental activities.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify the natural resources and suitable methods for conservation and sustainable development.
- Identify the environmental pollutants and abatement devices.

UNIT I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL SCIENCE: Environment - Definition, scope and importance, Segments of Environment-Importance, Productivity, Aesthetical& Optional values of nature, need for public awareness.

UNIT II

RESOURCES AND UTILIZATION: Renewable and non-renewable resources.

a) Natural Resources: soil & water sources (salinity intrusion –conflicts of over utilization of water Resources-water logging, Hydro power project-problems), forest & mineral resources – Utilization-problems.
b) Non conventional resources of energy (Solar Energy, wind energy and their applications),
c) Chemical fertilizers and pesticides-problems,
d) Green Revolution-white revolution- blue Revolution,
e) Non equitable distribution of Resources.

UNIT III

a) **CONCEPTS OF ECO-SYSTEM**
Structure and functions of an ecosystem: producers, consumers and decomposers- Interaction between biotic and abiotic factors in an ecosystem- Energy flow and its importance- Trophic levels- food chain- Food web –Ecological Pyramid, Ecological succession
b) **TYPES OF ECOSYSTEM**
Understanding the types of eco-system: (i) terrestrial (forest, grassland and desert) and (ii) aquatic (fresh water and salt water) with an example of each.

UNIT IV

BIODIVERSITY: Introduction – Definition - genetic, species and ecosystem diversity- Bio-geographical classification of India- Value of biodiversity- Hot-sports of biodiversity- Biodiversity at global, National and local levels- Inida as a mega diversity nation - Hot-spots

of biodiversity- Threats to biodiversity- IUCN Red data book. Conservation of bio diversity (IN-SITU and EX-SITU conservation)

UNIT V

ENVIRONMENTAL POLLUTION: Introduction - Cause, effects and control measures of

a) Air pollution
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Thermal pollution
g) Nuclear hazards.

Municipal Solid waste Management: Sources and Disposable methods. Disaster management: floods, earthquake, cyclone.

UNIT VI

HUMAN POPULATION:

a) Population and Environment:- Definition of species, community, population; Population growth rate curves, Sex ratio, From unsustainable to sustainable development, Diseases-HIV, Malaria, Diaharia, Cancer.
b) Human rights, fundamental duties and value education.
c) Women and child welfare & Family welfare programs.

SOCIAL ISSUES:

a) Resettlement and rehabilitation of people,
b) Energy Crisis – urban and rural sectors,
c) Greenhouse effect and global warming.
d) Climatic changes.
e) Acid rain.
f) Ozone layer depletion.
g) Sustainability- water conservation methods- Rain water harvesting.

TEXT BOOKS:

1. Deswal, S and Deswal A, A Basic Course in Environmental Studies, Dhanpat Rai & Co. Delhi.
2. Anubha Kousik and C P Kousik ., New age international publishers.
3. Garg, S.K and Garg, R., Ecological and Environmental Studies, Khanna Publishers, Delhi.
4. Chauhan, A.S., Environmental Studies, Jain Brothers, New Delhi

REFERENCES:

1. Agarwal, K.C., Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,
3. Brunner R.C., , Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

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MECHANICAL ENGINEERING

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0012156] PROBABILITY AND STATISTICS

[Common to CE, CSE, IT & ME]

OBJECTIVES:

- To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, statistical quality control and queuing theory.

OUTCOMES:

- By the end of module students will be expected to demonstrate proper understanding of the concepts of Probability and Statistics and use these to solve the problems in Industry.

UNIT - I

Basic concept of probability-Random variables-Expectation-Discrete and continuous distributions.

UNIT – II

Distribution functions. Binomial, poison and normal Distributions-Related properties.

UNIT – III

Test of Hypothesis: population and sample – Confidence interval of mean from normal distribution – Statistical Hypothesis – Null and Alternative hypothesis- level of significance. Test of significance – Test based on normal distribution –Z test for means and proportions.

UNIT-IV

Small samples – t- test for one sample and two sample problem and paired t- test, F- test and chi-square test (Testing of goodness of fit and independence).

UNIT – V

Statistical quality control: Concept of quality of a manufactured product –Defects and Defectives – causes of variations – Random and assignable – The principle of Shewhart control chart-Charts for attribute and variable quality characteristics-Constructions and operation of $\bar{X}$-Chart,R-Chart, P-chart and C-chart.

UNIT – VI

Queuing theory: Pure birth and Death process, M/M/1 and M/M/S and their related simple problems.

TEXT BOOKS :

1. Probability and statistics for Engineers by Miller and Freunds, Pearson education.
2. Probability and statistics for Engineers by Dr.J.Ravichandran, wiley-India publishers.

REFERENCES :

1. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
2. Statistical methods by S.P.Gupta,S.Chand Publications.
3. Probability and statistics for science and engineering by G.Shankerrao, universities press.
4. Engineering Mathematics BySrimantha Pal et.al. Oxford University Press.

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0308154] KINEMATICS OF MACHINERY

OBJECTIVES:

- To study about terms used in kinematics of machinery.
- To learn how to analyze the motions of link mechanisms and to analyze forces in machines.
- To analyze the motions of Cam and follower assembly.
- To locate the instantaneous centre for the given planer mechanism.
- To determine the velocity and accelerations of the linkages in a planer mechanism.
- To study about the toothed gears and related terminology.

OUTCOMES:

Upon successful completion of this course, the student will be able to:

- Understand the principles of kinematic pairs, chains and their classification, Degree of freedom, inversions, equivalent chains and planar mechanisms.
- Analyze the planar mechanisms for position, velocity and acceleration.
- Evaluate gear tooth geometry and select appropriate gears for the required applications.
- Design cams and followers for specified motion profiles.

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 – inversions of quadric cycle, chain – single and double slider crank chains.

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, Klein's construction.

UNIT-III

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.

Straight Line Motion Mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott-Rassul – Grasshopper – Watt T. Chebi-cheff 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 three cases.

UNIT – V

TOOTHED GEARING: 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.

UNIT – VI

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.

TEXT BOOKS:

1. Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers
2. Theory of Machines by Thomas Bevan/ CBS.

REFERENCE BOOKS:

1. Theory of Machines / R.K Bansal, Lakshmi Publications.
2. Theory of machines by Jagadishlal.
3. Theory of Machines R.S Khurmi & J.K Gupta.
4. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
5. The theory of Machines /Shiegley/ Oxford.
6. Theory of machines – PL. Balaney/khanna publishers

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0309154] INTERNAL COMBUSTION ENGINES

OBJECTIVES:

- Modern industry requires Mechanical Engineers, who are capable of design & implementing Internal Combustion Engines specific tasks. To do this engineer must exercise creative ability, sound judgment and technical knowledge.
- The student should able to know the power cycles used in Internal Combustion Engines.
- The student should able to know the different systems used in Internal Combustion Engines.
- The student should able to know the combustion processes in CI & SI Engines.
- The student should able to know the knowledge of testing & performance of Engines.

OUTCOMES:

At the end of the course work the student should have knowledge of:

- Various power cycles used in I.C engines.
- Various engines systems used in I.C engines.
- Theory of combustion in SI & CI Engines.
- Conducting the performance test and estimating the performance of an I.C Engines.

UNIT – I

Power Cycles: Carnot cycle, Air standard cycles -Description and representation of Otto cycle, Diesel cycle & Dual cycles on P–V and T-S diagram -Thermal Efficiency – Comparison of Otto, Diesel and Dual cycles. Simple problems on Otto, Diesel and Dual cycles

UNIT-II

I.C. Engines: Energy conversion – basic engine components –Classification of I.C. Engines, Working principle of two stroke and four stroke engines - comparison of two stoke and four stroke, SI and CI engines –Valve and port timing diagrams, application of I.C Engines.

UNIT – III

Engine Systems: Working principle of, Magneto & Battery Ignition System **-** Simple Carburetor - Common rail fuel Injection System - Air & Thermostat cooling system - Petrol & Pressure Lubrication system.

SuperCharging: Introduction,typesofsuperchargers,methodsofsupercharging,advantagesand limitationsofsupercharging.

UNIT - IV

Combustion in S.I. Engines: Homogeneous Mixture - Stages of combustion - Importance of flame speed and factors influencing the flame speed –Abnormal Combustion - Phenomenon of Knocking, Summary of Engine variables affecting the knocking, pre-ignition– Combustion Chambers, requirements, types - Rating of S.I Engine fuels.

UNIT - V

Combustion in C.I. Engines: Heterogeneous Mixture - Stages of combustion – Delay period and its importance – factors affecting the Delay Period – Phenomenon of Knock – Comparison of knock in SI & CI Engines - Combustion chambers (DI & IDI), requirements, types- Rating of C.I Engine fuels.

UNIT – VI

Testing and Performance: Engine Performance Parameters - Determination of brake power, friction power and indicated power – Performance test – Heat balance sheet and

chart- Emissions from Diesel & Petrol Engines, Euro Norms - Simple problems on performance and heat balance sheet.

TEXT BOOKS:

1. I.C. Engines, V. GANESAN- TMH.
2. I.C. Engines / Heywood /McGraw Hill.

REFERENCES:

1. Thermal Engineering / R.K Rajput / Lakshmi Publications.
2. I.C Engines – Mathur & Sharma – Dhanpath Rai & Sons.
3. Engineering fundamentals of I.C Engines – Pulkrabek / Pearson /PHI
4. Thermal Engineering / Rudramoorthy – TMH
5. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
7. IC Engines/ Ramalingam/ Scietech publishers.

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0310154] FLUID MECHANICS & HYDRAULIC MACHINARY

(Common to EEE & ME)

OBJECTIVE:

- To give insight knowledge on fluid statics and fluid dynamics
- To teach different types of fluid flow, and boundary layer phenomena
- To teach operation and working principles of Turbo machinery, pumps and Turbines.

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

- Understanding of fluid mechanics fundamentals, including concepts of mass and momentum conservation.
- Apply the Bernoulli equation to solve problems in fluid mechanics
- Differentiate laminar and Turbulent flow
- Know the concept of boundary layer phenomena and its significance
- To know the working principles of Hydraulic machines and Hydraulic pumps

UNIT I

Fluid Statics: Dimensions and units: Physical properties of fluids-specific gravity, viscosity, vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure - Piezometer, U-tube and differential manometers. Hydrostatic force on a plane area, Buoyancy, centre of Buoyancy, meta-centre, meta-centre height, conditions of equilibrium of a floating and submerged bodies.

UNIT II

Fluid Kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

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: Laminar and turbulent flow through pipes: Reynolds experiment significance of Reynolds's number, formulae for laminar flow through circular pipes, Turbulent flow-Darcy Weisbach equation, chezy's formula, friction factor and Mody's diagram - Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter.

UNIT-IV

Boundary Layer Flow: Introduction, Definitions, Drag force on a flat plate due to Boundary layer, Turbulent Boundary layer on a flat plate, Analysis of Turbulent Boundary layer, Separation of Boundary layer.

UNIT V

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.

UNIT VI

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

Hydraulic Pumps: Working principle of Centrifugal and Reciprocating pump. (No-derivations and No-problems)

TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machinery MODI and SETH, S.Chand & co, New Delhi
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Standard Book House, New Delhi.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by Jagadeesh lal.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Fluid Mechanics and Hydraulic Machines by R. K. Rajput, Lakshmi Publications.
5. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. (Chapter 12 – Fluid Flow Measurements).

II B.Tech, II-Sem (ME) T 3+1* C 3

[A0311154] MANUFACTURING TECHNOLOGY

OBJECTIVES:

- The student should understand the some fundamental aspects and design concepts of casting process,
- To familiarize various fabrication techniques used in engineering.
- To familiarize various types of bulk deformation processes, sheet metal forming processes.
- To familiarize about processing of plastic materials.

OUTCOMES:

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

- Select materials, types and allowances of patterns used in casting and analyze the components of moulds.
- Design core, core print and gating system in metal casting processes
- Understand arc, gas, solid state and resistance welding processes.
- Identify the effect of process variables to manufacture defect free products.

UNIT–I

Casting Process: Casting, casting terms, pattern materials, types of patterns, pattern allowances, color code for patterns, Molding sands, core sands, properties of moldings and its ingredients, different types of molding machines, use of chaplets, chills, riser and gating system.

UNIT–II

Special Casting Process: CO_2 molding, die casting, centrifugal casting, shell molding, investment or lost wax process; Casting defects, causes and remedies. Furnacesusedin foundry–cupola, pit furnace, electric arc furnaces.

UNIT- III

Fabrication Process: Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Laser, Electron beam welding – Friction welding – Diffusion welding – Flame cutting – Weld defects – Brazing and soldering process – Filler materials and fluxes, Design considerations in welding.

UNIT- IV

Bulk Deformation Processes: Hot working –types and cold working of metals-types – Forging processes – Open and close die forging –Types of Forging Machine – Typical forging operations –Rolling of metals – Flat strip rolling – Types of Rolling mills–Forces in rolling and power requirement-Tube piercing – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion –Principle of rod and wire drawing – Equipments used.

UNIT-V

Sheet Metal Processes: 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.

UNIT- VI

Processing of Plastics: Types of plastics, properties, applications and their processing methods & equipments (Blow and injection molding).

TEXT BOOK:

1. P N. Rao,"Manufacturing Technology", Tata McGraw-Hill Publishing Limited,
2. P. Ghosh, A., and Malik, A. K., Manufacturing Science, Affiliated East west Press Pvt. Ltd.

REFERENCE BOOKS:

1. P.C. Sharma, "A text book of production technology", S. Chand and Company,
2. Begman, 'Manufacturing Process", John Wilely & Sons,
3. Production Technology by K.L. Narayana, J.K. International Publications.
4. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications
5. Hajra Choudhury,"Elements of Workshop Technology, Vol. I and II", Media Promoters Pvt. Ltd., Mumbai,
6. Manufacturing Engineering and Technology/ Kalpakjain.S/ Pearson Education.
7. Production Technology by R.K Jain

II B.Tech, II-Sem (ME) T 1+2* C 1

(A0010153) APTITUDE ARITHMETIC REASONING AND COMPREHENSION

(Common to All Branches)

(Skill Development Course)

OBJECTIVES:

- To make the students ready to the recruitment drives.
- To raise the confidence of the students to face the written test of any Company.
- To train the students regarding employability skills.

OUTCOMES:

- Students becomes well trained for recruitment drives.
- Student become well trained to face the written test of any company.
- Students become well trained in employability skills

UNIT I

Numbers, Number Systems Simple Equations, Ratio, Proportion, Variation Quadratic Equations, Progressions Percentages.

UNIT II

Profit, Loss, Partnerships Averages, Mixtures & Allegations, Simple Interest, Compound Interest, Time and Work-Pipes, indices, surds, inequalities ,Cisterns Time and Distance Geometry and Menstruation.

UNIT III

Permutations & Combinations and Probability Data Interpretation & Data Sufficiency.

UNIT IV

Number & Letter Series, Analogies, Coding Decoding, Odd Man Out Blood Relations.

UNIT V

Direction Sense, Symbols and Notations Deductions & Connectives Clocks, Calendars Analytical

UNIT VI

Reasoning (Distribution+ Binary Logic + Puzzles) Cubes, Venn Diagrams Analytical Puzzles (Linear + Circular +Selections + Sequencing + Routes & Networks + Comparisons) and Non Verbal Reasoning

REFERENCES:

1. R.S.Agarwal " Quantitative Techniques" S.Chand Series
2. Shankuntala Devi " Techniques of Reasoning" S.Chand Series

II B.Tech, II-Sem (ME) P 3 C 2

[A0395154] MANUFACTURING TECHNOLOGY LAB

OBJECTIVES:

- The student should understand the some fundamental aspects and design concepts of manufacturing pattern and pattern makings for the casting process,
- To determine the sand Viz., strengths and permeability of a sand materials and moisture percentages of green sand.
- To teach techniques adopted in welding processes like arc, gas, spot, plasma and brazing processes and also deep drawing process for making a small size parts with the help of blanking, piercing operations.
- To extrusion operations, bending and processing of plastics like injection molding and blow molding. The student should be prepared to continue the study and analysis of the production machine parts.

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

- Make sing piece and two-piece pattern as per the pattern allowances.
- Produce casting using single piece pattern.
- Fabricate joints using arc welding, spot welding and brazing etc.
- Test the properties of the molding sand.
- Perform injection molding studies on plastics.

I. Metal Casting lab:

1. Pattern Design and Making : For one Casting
2. Sand Properties Testing : Exercise-Strength and Permeability. (2 Exercises)
3. Casting : 1 Exercise.

II. WELDING LAB

1. Arc Welding : 3 Exercises
   (Lap joint, Butt Joint & T- Joint)
2. Spot welding : 1 Exercises
3. Soldering of thin sheets : 1 Exercises
4. Plasma Welding and Brazing : 2 Exercises
   (Water Plasma Device)

III. MECHANICAL PRESS WORKING

1. Hydraulic Press: Deep Drawing : 1Exercise
2. Pipe Bending. : 1 Exercise

IV. PROCESSING OF PLASTICS

1. Injection Molding : 1 Exercise
2. Blow Molding : 1 Exercise

II B.Tech, II-Sem (ME) P 3 C 2

[A0396154] FLUID MECHANICS & HYDRAULIC MACHINARY LAB

(Common to EEE & ME)

OBJECTIVES:

- This course "Fluid Mechanics and Hydraulic Machines" lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of "Fluid Mechanics and Hydraulic Machines" in the field of engineering. The student should able to develop theoretical / practical capabilities so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problem.

OUTCOMES:

- In order to assess the students progress towards achieving the learning outcomes, lectures to enable the students to:
- Use knowledge of Fluid mechanics and hydraulic machines for practical applications.
- Understand and build their abilities for running of Fluid mechanics and hydraulic machines lab.

LIST OF EXPERIMENTS:

1. Verification of Bernoulli's Equation
2. Calibration of Mouthpiece/orifice
3. Calibration of Triangular/Rectangular Notch
4. Calibration of Venturi meter
5. Calibration of Orifice meter
6. Determination of Friction Factor for a given pipe line
7. Impact of Jet on Vanes
8. Performance Test on Pelton Wheel
9. Performance Test on Francis Turbine
10. Performance Test on Kaplan Turbine
11. Performance Test on Single Stage Centrifugal Pump
12. Performance Test on Reciprocating Pump

II B.Tech, II-Sem (ME) P 3 C 2

[A0397154] INTERNAL COMBUSTION ENGINES LAB

OBJECTIVES:

- Imparting intensive and extensive knowledge of the Lab so that students can understand the role of I.C Engines in the field of Engineering.
- Developing theoretical/practical capabilities of students so that they can characterize, transform and use I.C Engines in Engineering and Apply knowledge gained in solving related Engineering problems.
- The student should able to know the valve and port operating of an I.C engine.
- The student should able to know how to conduct the performance test on I.C Engines.
- The student should able to know the how to draw the HBS & HBC of an I.C engines.
- The student should able to know the how to measure the exhaust gas composition.

OUTCOMES:

At the end of the Lab work the student should have knowledge on/off:

- Applying the practical skills in designing and testing the I.C Engines.
- How the valves and ports of an I.C engine works.
- Conducting and Estimating the performance of an I.C Engine.
- Drawing the HBS & HBC of an I.C engine.
- Various exhaust gas compositions & Emission Norms of an I.C engine.

LIST OF EXPERIMENTS:

1. Draw the Actual Valve Timing Diagrams of a four stroke Diesel Engine.
2. Draw the Actual Port Timing Diagrams of a two stroke petrol Engine.
3. Performance Test on 4-Stroke, Single Cylinder Computerized Diesel Engine test rig.
4. Performance Test on 4-Stroke, Single Cylinder Petrol Engine test rig.
5. Performance Test on 4 -Stroke Multi Cylinder Diesel Engine test rig.
6. Performance Test on 4 –Stroke, Multi Cylinder Maruthi MPFI Computerized Petrol Engine test rig.
7. Performance Test on 4-Stroke, Single Cylinder VCR Computerized Research Engine test rig.
8. Determination of Engine friction Power by Morse test, retardation test & William's line Method.
9. Heat Balance Sheet & Heat Balance Chart for 4 -Stroke Single/Multi Cylinder Diesel Engines.
10. Heat Balance Sheet & Heat Balance Chart for 4 -Stroke Single Cylinder Petrol Engine.
11. Heat Balance Sheet/Chart for 4 -Stroke Multi Cylinder Maruthi MPFI Computerized Petrol Engine test rig.
12. Measurement of I.C Engine Exhaust Gas Emissions from Petrol/Diesel Engines
13. Study of I.C Engine Parts.

III B.Tech, I-Sem (ME) T 3+1* C 3

[A0016155] ENGINEERING ECONOMICS AND ACCOUNTANCY

[Common to CSE, IT & ME]

OBJECTIVES:

- This course will introduce various concepts and methods of economic analysis in engineering, including the time value of the money and its effect on economic decisions, economic equivalence, cash flow analysis and cost accounting.

OUTCOMES:

- The primary outcome is to provide engineering students an understanding of the economic fundamentals and principles of decision making involved in engineering projects. They learn about different types of accounts, time value of money.

UNIT I:

Introduction to managerial economics: Definition, Nature and scope of managerial economics, Demand analysis, Demand determinants, law of demand and its exceptions.

UNIT II:

Elasticity of Demand: Definition, Types, measurement and significance of elasticity of Demand. Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiment, judgmental approach to demand forecasting)

UNIT III:

Break even analysis and pricing strategies: Break even analysis-Determination of breakeven point (simple problems) - managerial significance and limitations of BEA.
Objectives and policies of pricing-methods of pricing: cost plus pricing, sealed bid pricing, going rate pricing, market skimming pricing, penetration pricing, Two part pricing, Block pricing, Bundling pricing, Peak load pricing, cross subsidization.

UNIT IV:

Business and New economic policy: Characteristics of business , features and evaluation of forms of business organization based on ownership, Nature of the economy, structure of the economy, economic policies, new economic policy 1991 ,economic conditions.

UNIT V:

Cost accounting: introduction- classification of costs –methods of costing – techniques of costing – preparation of cost sheet.

UNIT VI

Accountancy: Accounting principles, procedure-Double entry system-journal-ledger, Trail balance –cash book-preparation of trading ,profit and loss account-Balance sheet.

References:

1. AgarwalAN,"Indian Economy "Wiley Eastern Ltd,New Delhi
2. Jain and Narang "Accounting part-1"Kalyani publishers
3. Arora,M.N."Cost Accounting", Vikas publications
4. Ashwatappa. K "Business Environment"
5. Aryasri "MnagerialEconomis and Financial ccounting

III B.Tech, I-Sem (ME) T 3+1* C 3

[A0312155] DESIGN OF MACHINE ELEMENTS- I

(Note: Design Data Books are *not permitted* in the examination**)**

OBJECTIVES:

- To do this engineer must exercise creative ability, sound judgment and technical knowledge.
- To learn the procedure of designing the machine element.
- To design the machine elements for different types of loading.
- To learn various theories related the design of machine elements for different loading
- Conditions.
- To apply these principles to the solution of variety of practical problems and be able to apply their knowledge to solve more complicated problems and study the affect of problem Parameters.

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

- Understand the concepts of principal stresses, theories of failure, stress concentration and fatigue loading.
- Design shafts, keys and couplings.
- Design screws, cotter joints and riveted joints.
- Design and analyze helical and leaf spring.

UNIT-I

INTRODUCTION: The art and science of machine design - Types of design methods - stages in machine design selection of engineering materials based on mechanical properties-Types of loads, Factor of safety.

STRESSES IN MACHINE MEMBERS: Simple stresses - Combined stresses – Torsional and bending Stresses – impact stresses– Various theories of failure – Design for strength and rigidity, eccentric loading.

UNIT-II

STRENGTH OF MACHINE ELEMENTS: Stress concentration–notch sensitivity, Fatigue stress concentration factor – Design for fluctuating stresses – Endurance limit, S-N Curve – Estimation of Endurance strength – Goodman's criteria – Soderberg's criteria.

UNIT-III

RIVETED JOINTS: Types of riveted joints - modes of failure-strength and efficiency of riveted joints, pitch of the rivets, design stresses - boiler joints, - Riveted joints under eccentric loading.

WELDED JOINTS: Types of welded joints, strength of welds, Design of simple welded joints.

UNIT-IV

BOLTED JOINTS – Forms of Screw threads- Stresses in Screw fasteners - Design of bolts with pre-stresses – Design of joints under eccentric loading– Bolts of uniform strength.

Keys, Cotters and Knuckle Joints: Types of Keys, stresses in Keys, design of rectangular and square Keys. Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

UNIT-V

DESIGN OF SHAFTS AND COUPLINGS- Design of solid and hollow shafts for strength and rigidity – Design of Shafts for combined bending and axial loads.

Design of Rigid couplings: Muff, Split muff and Flange couplings.

UNIT-VI

MECHANICAL SPRINGS: Classification of springs-Stress and deflections of helical Springs-Springs for fatigue loading -Energy storage capacity- Leaf springs-Coaxial springs.

TEXT BOOKS:

1. V.B.Bhandari, Design of Machine Elements, TMH Publishers, New Delhi.
2. Machine Design, Kannaiah, Scietech.

REFERENCES:

1. Shigley, J.E., and Mischke, C.R., *Mechanical Engineering Design*, McGraw Hill InternationalEditions
2. Machine design, R.S Khurmi and Jk Gupta.S.Chand & Chand Publications.
3. Machine Design by S.Md. Jalaluddin, Anardha Publishers, Chennai.
4. Design of Machine Elements, M.F. Spotts, PHI.
5. Schaum's series Machine Design, TMH Publishers, New Delhi.
6. Black and Adams, *Machine Design*, McGraw Hill and Co, New Delhi.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

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3+1*	3

[A0313155] THERMAL ENGINEERING

(Note: Thermal Engineering Data Book, Steam Tables & Mollier Chart are permitted in the examinations**)**

OBJECTIVES:

- Modern industry requires Mechanical Engineers, who are capable of design & implementing Thermal Engineering specific tasks. To do this engineer must exercise creative ability, sound judgment and technical knowledge.

The student should able to know the:

- Various thermodynamic vapour cycles used in thermal power plants.
- Various boilers used in thermal power plants.
- Various turbines used in thermal power plants.
- Various air compressors.
- Basics of Refrigeration & Air Conditioning.

OUTCOMES:

At the end of the course work the student should have knowledge on/of:

- Various vapour power cycles used in thermal power plants.
- Various types of nozzles used in thermal power plants.
- Various type of turbines used in power plants.
- Various types of condensers and compressors used in various application of thermal engineering.
- Basics of refrigeration and air conditioning.

UNIT I

Thermodynamic Vapour Cycles: Carnot Cycle with Steam as Working Substance-Rankine Cycle- Methods to improve cycle performance – Regeneration – reheating- cycles.

Boilers: Classification of boilers – Working Principle of Simple vertical, Babcock and Wilcox, Lamont & Benson boilers – Study of boiler Mountings & Accessories. Simple problems on Rankine Cycle.

UNIT II

Steam Nozzles: Introduction - types, Steam Flow through nozzles-Velocity of steam, Mass of steam through Nozzle, condition for maximum discharge (critical pressure ratio) – Diameters of throat and exit for maximum discharge, Nozzle efficiency - Simple problems.

UNIT III

Impulse Turbine (Single Stage Only): Introduction- advantages of steam turbines over reciprocating steam engines- classification of stream turbines-impulse turbine –De Laval impulse turbine-Pressure and velocity of steam -Velocity triangle for moving blade - Condition for maximum efficiency - Simple problems.

UNIT IV

Reaction Turbine (Single Stage Only): Introduction-Parson's reaction turbine-Pressure and velocity in a reaction turbine –comparison between impulse and reaction turbine-velocity triangles for moving blades **-** degree of reaction- Condition for maximum efficiency - Simple problems.

UNIT V

Steam Condensers: Requirements of steam condensing plant– Classification of condensers – working principle of different types.

Air Compressors: Reciprocating – Single, multi stage with intercooling – work done - power required - simple problems. Rotary compressors- types, working principle.

UNIT VI

Gas Turbines: introduction-comparison of gas turbines and steam turbines-comparison of gas turbines and IC engines-classification-closed cycle with intercooling and reheating-open cycle gas turbines-simple problems.

Introduction to Refrigeration & Air Conditioning:

Reversed Carnot &Brayton cycles – Performance Evaluation – Vapour Compression Cycle - performance Evaluation-Psychometric terms & processes – summer & winter air conditioning systems.

TEXT BOOKS:

1. Thermal Engineering, R.K. Rajput, 7/e, Lakshmi Publications,2009
2. Gas Turbines, V. Ganesan, TMH.

REFERENCES:

1. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand.
2. Thermodynamics and Heat Engines, R.Yadav, Central Book Depot.
3. Gas Turbines and Propulsive Systems, P.Khajuria & S.P.Dubey, Dhanpatrai.
4. Thermal Engineering-M.L.Mathur & Mehta, Jain bros.
5. }Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International

III B.Tech, I-Sem (ME) T 3+1* C 3

[A0314155] DYNAMICS OF MACHINERY

OBJECTIVES:

- The study of dynamics of machinery is an applied field of mechanical engineering that is concerned with understanding the relationship between the power and motions of the machine parts.
- The overall objective of this course is to learn how to analyze mechanisms and to design machine/mechanisms.

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

- Understand the physical significance of Gyroscope, Gyroscopic couple etc.
- Understand and design clutches brakes and flywheel.
- Characterize different types of Governors.
- Analyze balancing problems in rotary and reciprocating machines.
- Understand free and forced vibrations of single degree freedom system.

UNIT – I

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

Friction: Introduction, Friction of screw and nuts, screw jack, torque required to lift the load and to lower the load by using screw jack, efficiency of screw jack, over locking and self locking screw, friction of V-threads, friction of pivot and collar bearings, uniform pressure, uniform wear, Friction circle.

UNIT – II

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

Brakes: Introduction, type of brakes, Simple block brakes, internal expanding brake, band and block brake, braking of vehicle.

UNIT – III

Force analysis and fly wheel: Static force analysis of a slider crank mechanism, Inertia force and inertia torque, D-Alembert's Principle, Dynamic analysis of slider crank mechanism. Introduction to flywheel, turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine. Fluctuation of energy, Coefficient of Fluctuation of energy, coefficient of Fluctuation of speed. Energy stored in fly wheels and their design.

UNIT-IV

Governors: Introduction, type of governors, Centrifugal governor, Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronisms and hunting, effort and power of a governor.

UNIT – V

Balancing: Introduction, Static balancing, dynamic balancing, balancing of several masses rotating in the same plane, balancing of several masses rotating in different planes. Balancing of reciprocating masses, partial balancing of locomotives, effects of partial balancing in locomotives, secondary balancing, balancing of inline engines.

UNIT – VI

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping, Vibration isolation & Transmissibility, resonance, critical speeds of shafts.

TEXT BOOKS:

1. Theory of Machines, S.S Ratan, MGH,
2. Theory of Machinery, Ballaney, Dhanpat Ray

REFERENCES:

1. Mechanism and Machine Theory, JS Rao and RV Dukkipati, New Age Publ.
2. Theory of Machines, R.S Khurmi & Gupta, S.Chand publ.
3. Mechanical Vibrations by G.K. Groover.
4. Theory of Machines, Thomas Bevan, CBS Publishers.
5. Theory of Machines, Jagadish Lal & J.M.Shah, Metropolitan

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME) T 3+1* C 3

[A0315155] MECHANICAL MEASUREMENTS

OBJECTIVES:

- The student should able to apply the knowledge to obtain quantitative measurement at various areas like temperature effect on change in physical state, change in chemical state, altered physical dimensions, change in electrical properties
- Student should able to understand applications of transducers in measuring pressure, temperature, fluid flow, level, speed, acceleration etc. Students get the knowledge about closed loop control systems and open loop control system.

OUTCOMES:

- Enriching the student's knowledge in mechanical measurements
- Cognitive skills (thinking and analysis) can be improved
- The students should link the scientific concepts they are learning with real applications by giving live examples where the subject concepts are applied.
- The student shall know the uses of transducers and sensors and their practical importance in industry and its importance in advanced courses

UNIT-I

Definition –Introduction, 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.

Transducers: Introduction, Theory and construction of various transducers to measure displacement - Inductive, capacitance, Piezo electric, resistance, ionization and Photo electric transducers.

UNIT-II

Measurement of temperature: Introduction, Classification - Ranges - Various Principles of measurement – Liquid filled thermometers, Filled system thermometers, Solid Expansion, Electrical Resistance thermometers, Thermistor, Thermocouple, Radiation and optical Pyrometers.

Measurement of pressure: Introduction, Classification - different principles used- Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement - Thermal conductivity gauges - ionization pressure gauges, McLeod pressure gauge.

UNIT - III

Measurement of level: Introduction, Direct method, float type, indirect methods – electrical, capacitative, magnetic, gamma ray liquid level indicators - Bubbler level indicators.

Flow measurement: Introduction, types of flow measuring instruments, Rota meter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

Measurement of speed: Introduction, Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.

UNIT -IV

Measurement of Acceleration and Vibration: Introduction, Different instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Measurement of humidity –Introduction, Moisture content in the gases, sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT - V

Stress & strain measurements: Introduction, Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque.

Measurement of force, torque and power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT - VI

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

TEXT BOOKS:

1. Mechanical Measurements, Beckwith, Thomas (Rearson education Asia).
2. Mechanical Measurements, D.S Kumar.

REFERENCES:

1. Instrumentation, Measurement & Analysis, B.C.Nakra & K.KChoudhary, TMH.
2. Instrumentation and Control Systems, S.Bhaskar, Anuradha Agencies.
3. Mechanical and Industrial Measurements,R.K. Jain, Khanna Publishers.
4. }Industrial Instrumentation, Ragasudha Gurajala, Spectrum Hyd.

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MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME) T C
3+1* 3

[A0316155] MACHINE TOOLS

OBJECTIVES:

- The student should understand the some fundamental aspects of an overview of machine tools & metal cutting theory, including Components of the Engine lathe, Turret and capstan lathes, Grinding machine, Drilling and Boring Machines, Milling machine, shaping slotting and planning machines.
- The student should able to apply the knowledge to solve more complicated problems and study the effect of process parameters and able to describe the construction and working of different types machine tools.

OUTCOMES:

- The students should link the scientific concepts they are learning with real applications by giving live examples where the subject concepts are applied.
- Communication skills (personal and academic) Students gain a lot of information by searching through the internet and references and from local industrial companies in order to design and solve the problems associated with this subject.

UNIT – I

Geometry of single point cutting tool and angles-Mechanism of chip formation in machining ductile and brittle materials- types of chips –Built-up-Edge (BUE) formation and its effects, Use of Chip breaker in machining-principles and methods of chip breaking. Mechanics of Orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut.

UNIT – II

Engine lathe – Principle of working, specifications of lathe – types of lathes – work holders, tool holders – Box Tools, Taper turning, thread turning and attachments for Lathes. Turret and capstan lathes – collect chucks –tool holding devices –tool layout.
Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout.

UNIT – III

Shaping, Slotting and planning machines – their Principles of working – Principal parts – specifications, classification, Operations performed-Machining time calculations. Shaper size, shape mechanism, Crank and slotted link mechanism, Whit worth quick return mechanism, Hydraulic shaper mechanism.

UNIT – IV

Drilling and Boring Machines – Principle of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine-deep hole drilling machine.

UNIT – V

Milling machine – Principle of working – specifications – classifications and principle features of milling machines – machining operations, Types and geometry of milling cutters– methods of indexing –Director Rapid indexing, Plain or simple indexing, Compound indexing, Differential indexing and angular indexing.

UNIT –VI

Introduction to grinding, lapping, honing and broaching machines-classification-comparison of grinding, lapping and honing- Lapping, Honing and Broaching machines-

Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel.

TEXT BOOKS:

1. Elements of Workshop Technology: Vol: II machine tools; By Choudhury, S. K. Hajara, Choudhury, A. K. Hajara & Roy, Nirjhar.
2. Workshop Technology – Vol II, B.S. Raghuvamshi.

REFERENCE BOOKS

1. Manufacturing science by Amitab Ghosh and Ashok Kumr Mallik, Tata-McGraw-Hill Publications
2. Metal cutting by Bhattacharya.

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Autonomous

MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME)

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[A0317155] COMPUTER AIDED DRAFTING
[Skill Development Course]

OBJECTIVES:

- To create the awareness among the students of making use of computers for drafting purpose.
- To train the student to make use of AutoCAD software package.
- To improve the quality of the engineering drawing.

OUTCOMES:

- 2D drawings and 3D drawings can be drawn using AutoCAD Software package.
- Able to create 3D drawings.
- Useful to increase the productivity of an industry

UNIT – I:

Introduction to Auto CAD: The Auto CAD screen - the X-Y co-ordinate system - angular measurement - entering points in Auto CAD - functional keys.

UNIT – II:

Introduction to drawing & modelling – commands – Accurate Input – O snaps – learn about line, circle, offset, undo, erase, print – drawing lines to exact points.

UNIT – III:

Object Properties & selection sets – and dimensioning – know about crossing selection – window selection – crossing polygon – crossing window – fence – quick select – changing the object Properties – colour – line type – line weight.

UNIT – IV:

Inquiry tools & layers – isometric views – measure distances – mass properties – area & information of selected objects – how to lock, hide and freeze the layers.

UNIT – V:

Advanced drawing and modifying commands – isometric views and dimensioning: rectangle – trim – extend – offset – scale – text etc.

UNIT: VI

Modelling and editing of solids – extrude – revolve – sweep – copy faces – offset – loft – imprint etc.,

TEXT BOOKS:

1. Working Auto-CAD, Singh, TMH
2. }Introduction to Auto-CAD 2D & 3D Design, Alf Yarwood

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MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME) P 3 C 2

[A0398155] THERMAL ENGINEERING LAB

OBJECTIVES:

- Imparting intensive and extensive knowledge of the Lab so that students can understand the role of THERMAL ENGINEERING in the field of Engineering.
- Developing theoretical/practical capabilities of students so that they can characterize, transform and use THERMAL ENGINEERING in Engineering and Apply knowledge gained in solving related Engineering problems.
- The student should able to know the use of various air compressors.
- The student should able to know the use of refrigeration systems.
- The student should able to know the use of air conditioning systems.

OUTCOMES:

At the end of the Lab work the student should have knowledge on/off:

- Applying the practical skills in designing and testing the thermal engineering related equipment.
- How to estimate the performance of an air compressor.
- Conducting and Estimating the performance of a refrigerator and air conditioning systems.

List of Exercises:

1. Determination of Volumetric Efficiency of Multi Stage Reciprocating Air Compressor Test Rig.
2. Determination of Isothermal Efficiency of Multi Stage Reciprocating Air Compressor Test Rig.
3. Performance test on Centrifugal/axial flow air compressor test rig.
4. Determination of COP of a Vapor Compression Refrigeration Test Rig.
5. Determination of COP of a Summer Air Conditioning Test Rig.
6. Determination of COP of a Winter Air Conditioning Test Rig.
7. Determination of Calorific Value of a liquid fuels by using Digital Bomb Calorimeter.
8. Determination of Calorific Value of a gaseous fuels by using Digital Junkers gas Calorimeter.
9. Determination of kinematic & dynamic viscosities of liquid fuels by using Redwood viscometer.
10. Determination of kinematic & dynamic viscosities of liquid fuels by using Say bolt viscometer.
11. Determination of flash & fire points of liquid fuels by using Cleveland's apparatus.}
12. Determination of flash & fire points of liquid fuels by using Able's apparatus

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MECHANICAL ENGINEERING

III B.Tech, I-Sem (ME) P 3 C 2

[A0399155] DYNAMICS &MEASUREMENTS LAB

OBJECTIVE:

- A student can realize the working principles of Gyroscope, different modes of vibrations etc,.
- To study and analyze different types of governors.
- To study and analyze different modes of vibrations.
- To demonstrate the principles of strain gauges, pressure gauges.
- To demonstrate the working principle of LVDT.

OUTCOMES:

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

- Understand different types of vibrating systems and finding their natural frequency.
- Determine the mass moment of inertia of machine elements.
- Understand the principle of gyroscope and gyroscopic couple.
- Balance rotary masses.
- Handle different types of instruments used measuring pressure, load, displacement, speed and temperature.
- To know the calibration of instruments used for measuring different physical quantities.

SECTION-A [DYNAMICS LAB]

1. Longitudinal vibrations of a spring-mass system.
2. Determination of Mass moment of inertia using Bi-filer suspension.
3. Determination of Torsional natural frequency of single and two rotor system.
4. Static and Dynamic balancing of rotary masses.
5. Motorized Gyroscope- study of gyroscopic effect and couple.
6. Critical speed or whirling speed of a shaft.
7. Experiments on Governors- Determination of range sensitivity, effort etc., (Watt, Porter, Proell and Hartnel Governors)
8. Cam Jump Analysis: Cam profile drawing and study of jump phenomenon.
9. Determination of holding Toque of an epi-cyclic gear train.

SECTION-B [MEASUREMENTS LAB]

1. Study and calibration of LVDT transducer for displacement measurement.
2. Calibration of Pressure Gauges
3. Calibration of thermistor for temperature measurement.
4. Calibration of strain gauge for strain measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of load cell for load measurement.
10. Study and calibration of McLeod gauge for low pressure.

III B.Tech, I-Sem (ME) P 3 C 2

[A0381155] COMPUTER AIDED DRAFTING LAB

OBJECTIVES:

- To create the awareness among the students about the use of computers for drafting purpose.
- To train the student to make use of AutoCAD software package.
- To improve the quality of the engineering drawing.

OUTCOMES:

- Various drawing entities can be drawn using computers.
- 2D drawings and 3D drawings can be drawn using AutoCAD Software package.
- Useful to increase the productivity of an industry.

LIST OF EXERCISES:

1. Draw a simple entity using absolute co-ordinate method.
2. Draw a simple entity using relative co-ordinate method.
3. Draw a simple entity using direct distance method.
4. Using offset command & draw the given sketch.
5. By using Array command compute the drawing.
6. Draw simple machine element using fillet and chamfer command.
7. Exercise on mirror command.
8. Compute the drawing and specify dimensions.
9. Using copy commands compute the isometric views.
10. Exercise on isometric views.
11. Using revolve command complete the model.
12. Using extrude, sweep & loft command complete the model.

Software Packages Required:

- Auto-CAD 2014.

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) T C
3+1* 3

[A0344156] INDUSTRIAL ENGINEERING & MANAGEMENT

OBJECTIVES:

- This course provides techniques of applying management principles to professional positions held by Engineers and Engineering Technologists.
- The management functions, especially suited to scientist & Professionals in technical and industrial environment are part of the curriculum.
- Students are exposed to the theory and practices of modern management approaches, tools and techniques in complex industrial & Competitive economic environment.

OUTCOMES:

- Use knowledge and comprehension in management tools to apply in technical organizations.
- Understand and build their analytical abilities in the use of Industrial Management.
- Use management techniques to direct the organizations/industries for goal achievement.
- Solve problems associated with the operations management and scheduling of resources in efficiently and effectively.
- The students may be asked use knowledge of management techniques and write a computer program to address and solve more complicated problems and to study the effect of various parameters on the management/organization.

UNIT-I

INTRODUCTION: Concepts of Management and Organization – Functions of Management – Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs, Systems Approach to Management.

UNIT-II

PLANT LOCATION & LAYOUT: Plant location, definition, factors affecting the plant location, comparison of rural and urban sites- methods for selection of plant. Types of production systems, Plant Layout – definition, objectives and types of plant layout.

UNIT-III

WORK STUDY: Introduction, objectives of work study, steps in work study, purpose of method study, procedure of method study, recording techniques. Work measurement-purpose of work measurement, time study procedure-performance rating, standard time calculations (simple problems).

UNIT-IV

MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory control techniques-ABC and VED analysis. Stores Management and Stores Records. Purchase management, duties of purchase of manager, associated forms, purchase procedure, methods of purchasing.
Introduction to production planning and control (PPC) Objectives of PPC, Functions of PPC

UNIT-V

QUALITY CONTROL: Meaning, process control, SQC control charts, single, double and sequential sampling, Introduction to TQM.

UNIT-VI

Job Evaluation and merit rating: introduction-Job evaluation-objectives, benefits and limitations of job evaluation-methods of job evaluation: simple ranking system, grade description method, factor comparison method, point method-merit rating-objectives - methods of merit rating: Ranking method, paired comparison method, checklist method, graphic rating method, rating by result-requirements for success of merit rating system.

TEXT BOOKS:

1. DR. Ravi Shankar: Industrial Engineering and management/Galgotia publications pvt. Ltd.
2. Khanna O.P.: Industrial Engineering

REFERENCE BOOKS:

1. Industrial engineering and operations management by S.K. Sharma and Savita Sharma.
2. T.R. Banga : Industrial Engineering and Management
3. M. Mahajan: Industrial engineering and production management, Dhanpat Rai & Co.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

T	C
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[A0345156] DESIGN OF MACHINE ELEMENTS- II

(**Note:** The use of Design Data book is permitted in the examinations)

OBJECTIVES:

- To analyze mechanical systems and select the proper machine elements (bearings, gears, pulley, belts,) from commercial catalogs for a required application.
- The student should be able to execute original designs of machine elements.
- To learn and implement design procedures to design and complete the projects individually or in a team.
- The student is expected to communicate design ideas by performing production CAD drawings, writing technical reports and making oral presentations.

OUTCOMES:

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

- Design and analyze the; journal bearings and rolling contact bearings,I.C engine parts, belt, rope and chain drives, spur and helical gears for different applications, power screws.

UNIT – I

BEARINGS: Types of Journal bearings – Lubrication – Bearing Modulus–Bearing materials – Journal bearing design – Ball and roller bearings – Static & dynamic load capacity of ball & roller bearings, bearing life.

UNIT – II

DESIGN OFI.CENGINEPARTS: Design connecting rod-stress due to whipping action on Connecting rod –design of trunk type piston for I. C engine – Design of crank and crankshafts-overhang crank shaft, centre crank shaft.

UNIT – III

DESIGN OF CURVED BEAMS: Introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C–clamps**.**

UNIT – IV

POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes- Design procedure for chain drives.

UNIT-V

SPUR & HELICAL GEARS: Classification of gears, design of spur gears, Lewis equation – bending strength, dynamic load and fatigue of gear tooth- Design of Helical gears.

UNIT-VI

DESIGN OF POWER SCREWS: Design of Power screws- Square, ACME, Buttress screws- Efficiency of the screw. Design of nut, compound screw, differential screw, ball screw- possible failures.

TEXT BOOKS

1. V. B. Bhandari, Design of Machine Elements,TMH Publishers, New Delhi.
2. Machine Design, Kannaiah/ Scietech

REFERENCES:

1. Sadhu Singh, Machine Design, Khanna Publishers, New Delhi.
2. Joseph E. Shigely Mechanical Engineering Design, TMH Publishers, New Delhi.
3. M.F. Spotts, Design of Machine Elements, PHI Publishers, New Delhi.
4. Pandya and Shah Machine Design, Charotar Publishers, Anand.
5. Machine Design, S MD Jalaludin, Anuradha Publishers
6. T.V. Sundararaja Moorthy and N. Shanmugam, Anuradha Publishers

DESIGN DATA HAND BOOK:

Mahadevanand Balaveera Reddy, Machine Design Data Hand Book, CBS Publishers

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Autonomous

MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

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[A0318156] HEAT TRANSFER

(Note: The use of Heat transfer data book along with steam tables is permitted in the examinations**)**

OBJECTIVES:

- Modern industry requires Mechanical Engineers, who are capable of design & implementing Heat Transfer specific tasks. To do this engineer must exercise on creative ability, sound judgment and technical knowledge.

The student is able to know the:

- Different modes of heat transfer.
- The knowledge of heat conduction in various solids.
- The knowledge of heat convection in various mediums.
- The knowledge of boiling and condensation processes.
- The knowledge of heat conduction in various solids
- The knowledge of various heat exchangers.
- The knowledge of radiation heat transfer.

COURSE OUTCOMES:

At the end of the course work the student should have the knowledge on/off:

- Various modes of heat transfer.
- How the conduction takes place in various solids.
- How the convection takes place in various mediums.
- How the boiling and condensation takes place.
- How to estimate the performance of heat exchangers.
- How the radiation takes place.

UNIT – I

INTRODUCTION: Modes of heat transfer – Basic laws of heat transfer – General applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical coordinates - Heat conduction through plane walls and composite walls - hollow and composite cylinders - hollow and composite spheres - critical thickness of insulation - heat conduction with internal heat generation for wall and cylinder – Problems.

UNIT II

Heat flow through extended surfaces - infinite long fin – fin insulated at the tip- fin losing heat at the tip - Efficiency and effectiveness of the fin.

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Heat conduction in solids having infinite thermal conductivity (negligible internal resistance) — Significance of Biot and Fourier Numbers - Chart solutions - Problems.

UNIT – III

CONVECTIVE HEAT TRANSFER: Non-dimensional numbers - Significance of non-dimensional numbers -correlations for convective heat transfer.

FORCED CONVECTION: Introduction to hydrodynamic boundary layer - Concepts and definitions- thermal boundary layer - correlations for forced convection – flow over flat plates and walls - flow inside pipes - turbulent flow over flat plate, cylinders - Problems.

UNIT IV

FREE CONVECTION: Bulk mean temperature and mean film temperature – local and average heat transfer coefficients - correlations for free convection – horizontal plates, cylinders – problems.

Heat Transfer with Phase Change: Boiling – Regimes (Theory only),

Condensation: Film wise and drop wise condensation (Theory only).

UNIT: V

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

UNIT VI

RADIATION HEAT TRANSFER:

Introduction - surface emission properties - absorptivity, reflectivity, and transmissivity - concept of black body & grey body - Stefan Boltzmann law - Kirchhoff, Wein & lambert's cosine law - shape factor and silent features of shape factor.

TEXT BOOKS:

1. Heat and Mass Transfer, R.K.Rajput, S.Chand & Company Ltd.
2. Heat and Mass Transfer by JP Holman.TMH Buplications.

REFERENCE BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, 3/e, New Age International
2. Heat Transfer, P.K.Nag, 2/e, TMH, 2010
3. Heat and Mass Transfer, D.S.Kumar.SK Kataria & Sons.
4. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.
5. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

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[A0319156] ENGINEERING METROLOGY

OBJECTIVES:

- The student should understand the some fundamental aspects of system of limits and fits, measurement of linear, angular dimensions, including limit gauges.
- Emphasis is placed on understanding of surface roughness & described mathematically. The screw thread, gear measurement methods are also considered in some detail..
- The student should able to apply the knowledge to solve more complicated problems and study the effect of problem parameters and able to describe the construction and working of different types of metrology machines and also plot the performance curves.
- The student should be prepared to continue the study and analyze the metrology and surface engineering to solve the complicated practical problems.

OUTCOMES:

- Enriching the student's knowledge of metrology and learning the design of such systems.
- Improves cognitive skills (thinking and analysis)
- Practical and subject specific skills (Transferable Skills) can be improved
- The Science of metrology & surface engineering is of practical importance in industry and is of importance also for other advanced courses

UNIT – I

LIMITS, FITS, TOLERANCES AND GAUGES : Introduction, Limits, tolerance, tolerance build-up, compound tolerances, terminology for limits and fits, system of writing tolerance, Unilateral, Bi-lateral systems; Relation between tolerance and cost; types of fits, hole and shaft basis systems, standard limit systems-Indian standard system, interchangeability and selective assembly. Taylor's principle – Design of go and No go gauges, plug, ring, snap, gap, taper, profile and position gauges.

UNIT – II

STANDARDSOFMEASUREMENTS: Line standards, End standards and Wavelength standards.

LINEAR AND ANGULAR MEASUREMENT: Vernier caliper, vernier height gauge, micrometers, telescopic gauge, dial bore gauge, slip gauges, Dial indicators, vernier and optical bevel protractor, optical dividing head, sine principle and sine bars, angle gauges, sprit level, clinometers, rollers and spheres used to determine the tapers.

UNIT –III

COMPARATORS: Introduction; Need of comparators; Basic Principles of Operation, uses, essential characteristics; classification of comparators; Mechanical, optical, mechanical optical, Electrical and Electronic Comparators, pneumatic comparators, fluid displacement comparators, multicheck comparators, Eden-Rolt-Millionth comparator and their uses in mass production.

UNIT – IV

SCREW THREAD MEASUREMENT: Screw thread terminology, errors in threads; pitch errors; measurement of various elements of thread; measurement of major, minor and effective diameter; Tool maker's microscope and its uses, optical projector.

GEAR METROLOGY: Terminology of gear tooth, measurement of tooth thickness-chordal thickness method-constant chord method-base tangent method-measurement over pins or balls Parkinson gear tester.

UNIT – V

SURFACE TEXTURE: Introduction, factors affecting the surface roughness, reasons for controlling surface texture, orders of geometrical irregularities, Elements of surface texture, methods of measuring surface finish, analysis of surface traces.

UNIT – VI

ACCEPTANCE TESTS FOR MACHINE TOOLS: Introduction**;** alignment tests on lathe, milling, drilling shaping, slotting, surface grinder; performance tests, preparation of acceptance charts.

TEXT BOOKS:

1. Engineering Metrology / R.K. Jain / Khanna Publishers.
2. A text book of Metrology / M. Mahajan. / Danpath Rai & Co

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Autonomous

MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) T C
3+1* 3

[A0320156]ADVANCE CASTING AND NON DESTRUCTIVE TESTING

[Department Elective-I]

OBJECTIVES:

This subject provides students with

- An understanding of the casting design, heat transfer between mould and metal, solidification of pure metals and alloys, casting deflects, recent trends in casting and foundry.
- The knowledge to use the non-destructive testing methods, magnetic particle testing & ultra sonic testing and some case studies.
- The knowledge selects appropriate nondestructive testing technique.

OUTCOMES:

- The field of aerospace materials is an important one within aerospace engineering.
- This course makes the student aware of the international standards bodies who maintain standards for the materials and processes involved.

UNIT I

CASTING DESIGN Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and rise ring.

UNIT II

CASTING METALLURGY: Solidification of pure metal and alloys – shrinkage in cast metals – progressive and Directional solidification Degasification of the melt-casting defects – Cast ability of steel, Cast Iron, Al alloys, Babbitt alloy and Cu alloy.

UNIT III

RECENT TRENDS IN CASTING AND FOUNDRY: Shell molding, precision investment casting, CO_2 molding, centrifugal casting, Die Casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

UNIT – IV

Non-Destructive Testing: An Introduction, Visual Inspection & Liquid Penetrate Testing, Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT – V

MAGNETIC PARTICLE TESTING & ULTRASONIC TESTING: Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications. Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C- Scan, Applications

UNIT – VI

CASE STUDIES, COMPARISON AND SELECTION OF NDT METHODS: Case studies on defects in cast, rolled, extruded, welded and heat treated components. Comparison and selection of various NDT techniques. Codes, standards, specification and procedures.

REFERENCES:

1. Baldev Raj, Jeya kumar. T., Thavasimuthu. M., "Practical Non Destructive Testing" Narosa publishing.
2. Krautkramer. J., "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.
3. Peter J. Shull "Non Destructive Evaluation: Theory, Techniques and Application "Marcel Dekker.
4. ASM Handbook, Vol 15, Casting, 2004
5. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill.
6. Jain P.L., Principles of Foundry Technology, Tata McGraw-Hill Publishers

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) T C
3+1* 3

[A0321156] HYDRAULIC & PNEUMATIC CONTROL

[Department Elective-I]

OBJECTIVE:

- To create the awareness among the students about the application of hydraulic and Pneumatic power.

OUTCOMES:

- Hydraulic and pneumatic circuits for different applications can be designed.

UNIT-I:

BASIC PRINCIPLES

Hydraulic Principles - Hydraulic pumps - Characteristics - Pump Selection -Pumping Circuits - Hydraulic Actuators - Linear Rotary - Selection -Characteristics - Hydraulic Valves - Pressure - Flow - Direction Controls - Applications - Hydraulic Fluids-Symbols.

UNIT-II:

CONTROL COMPONENTS IN HYDRAULIC SYSTEMS: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.

UNIT-III

HYDRAULIC CIRCUITS

Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Accumulator circuits - Safety circuits - Industrial circuits - Press - Milling Machine - Planner - Fork Lift, etc.

UNIT-IV

HYDRAULIC ACTUATORS AND MOTORS: Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

UNIT-V

MAINTENANCE OF HYDRAULIC SYSTEMS: Hydraulic oils; Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting.

UNIT - VI

INTRODUCTION TO PNEUMATIC CONTROL: Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod–less cylinders, types, working advantages. Rotary cylinder types construction and application. Design parameters, selection.

TEXT BOOKS:

1. Industrial Hydraulics, Pippenger, Hicks, McGraw Hill, New York
2. Fluid Power with applications**,** Anthony Esposito, Fifth edition Pearson education, Inc.

REFERENCES:

1. Dudleyt, A. Pease and John J. Pippenger, “Basic Fluid Power ", Prentice Hall
3. Andrew Parr, “Hydraulics and Pnematics (HB) ", Jaico Publishing House.
2. Pneumatics and Hydraulics**,** Andrew Parr. Jaico Publishing Co.
3. Oil Hydraulic Systems - Principles and Maintenance**,** S.R. Majumdar, Tata Mc Graw Hill publishing
4. Pneumatic Systems**,** S.R. Majumdar, Tata Mc Graw Hill publishing Co., .
5. Anthony Esposite, “Fluid Power with Applications ", Prentice Hall.
6. }J.Michael, Pinches and John G.Ashby, “Power Hydraulics ", Prentice Hall

III B.Tech, II-Sem (ME)

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3+1*	3

[A0322156] TOOL DESIGN

[Department Elective-I]

OBJECTIVES:

- Able to understand various manufacturing methods and different tools used therein.
- To inculcate basic knowledge of tool design and the student should design cutting tools for various machining processes
- The student should gain the Knowledge of designing jigs and fixtures.

OUTCOMES:

- Designing and assessment of tools for quality improvement.
- Student can be able to design and develop single point and multi point cutting tools.
- Student can be able to design and development of jigs and fixtures for a particular application.

UNIT –I

DESIGN OF SINGLE POINT CUTTING TOOLS: Design of single point cutting tools such as solid tools, tipped tools, coated tipped tools, throw away type tools and diamond tools.

THERMAL ASPECTS IN MACHINING: Sources of heat generation in machining and its effects, temperature measurement techniques in machining, types of cutting fluids, Functions of cutting fluid, Characteristics of cutting fluid, Application of cutting fluids.

UNIT - II

DESIGN OF MULTIPOINT TOOLS: Design of plain milling cutter, gear milling cutters, hobs, gear shaping tools, broaches, drills, reamers, taps & dies for thread cutting, boring tools, flat form tools, circular form tools. Standard tool holders & standard tooling and their design for turrets and automates

UNIT -III

DESIGN OF JIGS AND FIXTURES: Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

UNIT-IV

DESIGN OF SHEET METAL BLANKING AND PIERCING: Fundamentals of die cutting operating, power press types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout, short run tooling for piercing.

UNIT-V

DESIGN OF SHEET METAL BENDING, FORMING AND DRAWINGS DIE: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

UNIT -VI

TOOL LIFE AND TOOL WEAR: theories of tool wear-adhesion, abrasive and diffusion wear mechanisms forms of wear, tool life criteria and Mach inability index, tool wear criterion, measurement of tool wear.

Introduction to Plastic tooling-commonly used plastic tooling materials.

TEXT BOOKS:

1. Tool Design, Donaldson, Lecain and Goold, TMH.
2. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta

REFERENCES:

1. Production Engineering Design (Tool Design), Surendra Kenav and Umesh Chandra, Satyaprakashan, New Delhi .
2. Design of Cutting Tools. Use of Metal Cutting Theory, Amitabh Bhattacharya and Inyong Ham, ASTME publication Michigan USA.
3. Fundamentals of Machining and Machine Tools, RK Singal and Others, I.K. International.
4. Metal Cutting Principles, Shaw, Oxford Univ. Press.
5. Production Technology, P.C Sharma.

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME)

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3+1*	3

[A0323156] POWER PLANT ENGINEERING

[Department Elective-II/MOOC]

OBJECTIVES:

The student is able to know the:

- Different sources of energy.
- Working principles of various steam power plants.
- Working principles of various Hydro power plants.
- Working principles of various gas and Nuclear power plants.
- Knowledge of various power plants economics.

OUTCOMES:

At the end of the course work the student should know the:

- Different sources of energy systems.
- Working and performance of various power plants like, steam, hydro, gas and nuclear power plants.
- Power plants economics, like various tariffs etc.

UNIT – I

Introduction to different Sources of Energy.

STEAM POWER PLANT: Layout of Modern Steam Power Plant, working of different circuits-selection of site- Coal Storage- Classification of coal handling and Ash handling systems.

UNIT II

STEAM POWER PLANT: overfeed and underfeed fuel beds, traveling grate, spreader grate and retort grate stoker firing systems - different types of burners - pulverized fuel burning system and its components - cyclone furnace-Dust collectors-Cooling Towers.

UNIT – III

HYDRO ELECTRIC POWER PLANT: Selection of Site for Hydro Electric Power Plant - Hydrological cycle – Hydrographs - flow duration curve - mass curve – classification of dams, spill ways and surge tanks.

HYDRO PROJECTS AND PLANT: Classification of Hydro Electric Power Plants – Typical layout – plant auxiliaries – plant operation - pumped storage plants.

UNIT – IV

NUCLEAR POWER PLANT: 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 and Gas Cooled Reactor - Radiation hazards and shielding – radioactive waste disposal.

UNIT V

GAS TURBINE POWER PLANT: Introduction – Plant Layout – Classification – Working of Simple Gas Turbine Power Plant– Constant pressure and constant volume Gas Turbine Power Plants –Combination of Gas Turbine Cycles.

UNIT – VI

POWER PLANT ECONOMICS: Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, utilization factor, Plant capacity factor and plant use factor - Types of loads - Load curve and load duration curve - general

arrangement of power distribution –Different types of tariff for Electrical energy - Simple problems .

TEXT BOOK:

1. A Text Book of Power Plant Engineering, Rajput. R.K., 4/e, Laxmi Publ.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar.

REFERENCES:

1. Power Plant Engineering, P.K.Nag, 2/e, TMH.
2. Power Plant Engineering, Nagpal,
3. Power plant Engineering, Ramalingam, Scietech Publ.
4. Power Plant Engineering, C. Elanchezian and others, I.K. International.

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) T 3+1* C 3

[A0018156] NANOTECHNOLOGY

[Department Elective-II/MOOC]

OBJECTIVES:

- Intended to impart knowledge in multidisciplinary area.

OUTCOMES:

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

- Know nanotechnology principles and industry applications.
- Understand the science of preparation and synthesis of nano particles.
- Identify career paths and requisite knowledge and skills for career change toward Nanotechnology

UNIT-I

GENERAL INTRODUCTION: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

UNIT-II

SILICON CARBIDE: Application of Silicon carbide, Nano materials preparation, Sintering of SiC, X-ray Diffraction data, Electron microscopy sintering of Nano particles.

NANO PARTICLES OF ALUMINA AND ZIRCONIA: Nano materials preparation, Characterization, Wear materials.

UNIT -III

MECHANICAL PROPERTIES: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties.

UNIT-IV

Process of synthesis of nano powders, Electro deposition, important nano materials.

UNIT-V

INVESTIGATING AND MANIPULATING MATERIALS IN THE NANOSCALE: Electron microscopic, scanning probe microscopic, optical microscopic for nano science and technology, X-ray diffraction.

NANOBIOLOGY: Interaction between bimolecules and naoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology.

UNIT-VI

NANO MEDICINES: Developing of Nanomedicens Nanosytems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications.

TEXT BOOKS:

1. T.Pradeep, Nanomaterials - Tata Mc Graw Hill Publishing Company Limited New Delhi.
2. Nano Materials- A.K.Bandyopadhyay / New Age Publishers.

REFERENCE BOOKS:

1. Nano materials by J.Dutta & H.Hofman.
2. Nano structures & Nano materials by Guozhong cao, Imperial college press.
3. Micro manufacturing and Nano Technology by N.P.Mahalik.
4. Nano Technology by Mark Ratner & Danier Ratner, Prentice Hall.
5. Nano materials by A S Edelstein& R C Cammarata, Institute of physics publishing, Bristol and Philadelphia.

III B.Tech, II-Sem (ME) T 3+1* C 3

[A0324156] ADVANCE WELDING TECHNOLOGY

[Department Elective-II/MOOC]

OBJECTIVES:

On successful completion of this course the student will:

- understand the recent developments in welding technology and where these new processes can be used
- understand the physical principles behind the operation of these processes
- understand the physical and engineering principles behind each application and the methods for maximizing process efficiency
- Understand how to select the most appropriate welding system for a particular application and analyze the economic benefits.
- understand Safe Practices in Welding

OUTCOMES:

Upon completion of this course, the student will have

- deeper knowledge of materials technology of welding
- deeper knowledge of different metals and their properties in welded constructions
- knowledge of quality techniques at production by welding
- knowledge of applications of strength of materials on welded constructions
- Knowledge of applications of fracture mechanics on welded constructions, pressure vessels etc.
- ability to perform design calculations on a welded component

UNIT I

Introduction: Importance and application of welding, classification of welding process, Selection of welding process.

Review of Conventional Welding Process: Gas Welding, Arc Welding, MIG, TIG Welding, SAW, Resistance Welding, Electro slag Welding, Friction Welding.

UNIT II

Advanced Welding Techniques – Principle, working and application of advanced welding Techniques such as Plasma Arc Welding, Laser Beam Welding, Electron beam welding, Ultrasonic Welding.

UNIT III

Advanced Welding Techniques – Principle, working and application of advanced welding Techniques such as explosive welding/ cladding, under- water welding, spray welding hard facing.

UNIT IV

Weld Design: Weld defects and distortion and its remedies, Inspection / testing of welds, Macrostructure & microstructure of welds, HAZ Weld Design, Welding of pipelines and pressure vessels, Life prediction. Techniques for welding of specific materials like steel, copper, Titanium.

UNIT V

Thermal and Metallurgical Consideration: Thermal consideration for welding, temperature Distribution. Analytical analysis, Metallurgical consideration of Weld, HAZ and Parent metal, Structure solidification of weld. .

UNIT VI

Welding defects- types, causes, inspection and remedial measures; testing of welded joints by visual inspection, dye-penetration (DP) test, ultrasonics and radiography. Safe Practices in Welding.

TEXT BOOKS:

1. O.P. Khanna, A Text Book of Welding Technology, Dhanpat Rai & Sons.
2. R.S. Parmar, Welding Engineering and Technology, Khanna Publishers.

III B.Tech, II-Sem (ME) T 1+2* C 1

[A0013156] PROFESSIONAL ETHICS & SOFT SKILLS

(Skill Development Course)

[Common to all Branches]

OBJECTIVES:

The recent past decades have witnessed a dilemma of performance on ethical grounds. A professional be able to carry out tasks and achieve success at societal level. The syllabus has been designed keeping in view of the needs and goals of the generation next undergraduates. It comprises essentials of professional ethics embedded with soft skills which in turn mould students as dynamic professionals. The course of Professional ethics and soft skills has been designed with the following objectives.

- To ignite the speaker of professionalism among students with the purpose to acquire success at societal level.
- To enable them to accomplish tasks balancing hard skills and soft skills.
- To develop critical thinking skills and emotions of students through recent research theories.
- The great contribution of this course shall be to shape human skills and students at the global level.

OUTCOMES:

- Be able to acquire professional ethics & Job Etiquettes
- Be able to balance hard skills and soft skills
- Considerable improvement in communicative ability
- Increase in motivational level and professional attitudes
- Be able to possess wide range of relevant knowledge

UNIT I

NATURE AND SCOPE OF ENGINEERING ETHICS: Definition, Nature, Scope – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory- Moral Reasoning and Ethical theories – Theories of Right Action-Self –Utilitarianism interest- Use of ethical Theories- case study.

UNIT II

PROFESSIONAL ETIQUETTES: Professional Etiquettes **–** Mobile Etiquettes – Email Etiquettes -Kinesics – Proxemics - Chronemics – Chromatics – Olfacts - Haptics – Case study.

UNIT III

CORPORATE COMMUNICATION: Communication Models- Types of Communication – Downward and Upward Communication- Business Deliberations – Meetings – Negotiation Skills - Case Study.

UNIT IV

SOFT SKILLS: Interpersonal Communication – Johari Window – Interpersonal conflict resolutions- Daniel Goleman's Emotional Intelligence.

UNIT V

GLOBAL ISSUES: Multinational Corporations – Corporate Governance - Corporate Social Responsibility Environmental Ethics – case study.

UNIT VI

INTRODUCTION TO INTELLECTUAL PROPERTY: Meaning and Types of Intellectual Property – Recent developments of the copy right act –Trademark Protection – Patent Law - Plagiarism.

TEXT BOOKS:

1. Professional Ethics by R.Subramanian, OXFORD
2. Business Communication , P.D. Chaturvedi, Mukesh Chaturvedi

REFERENCES:

1. The ACE of Soft Skills(Attitude, Communication and Etiquette for success) by – Gopalaswamy Ramesh & Mahadevan Ramesh, Pearson.
2. Essentials of Business Communication, Rajendra Pal, JS.Korlahhi, S.Chand
3. Intellectual Property Right , Deborah E. BouchouxS, Cengage.
4. Business Ethics and Professional Values, A.B. Rao, Excel.
5. M.P. Raghavan, Professional Ethics and Human Values, Scitech Publications, Chennai.

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) P 3 C 2

[A0382156] HEAT TRANSFER LAB

(Note: Heat Transfer Data Books are permitted in the Examinations)

OBJECTIVES:

- The student should able to find thermal conductivity of the given metal rod, composite wall, insulating powder, lagged pipe.
- Heat transfer in drop wise and film wise condensation processes
- Find the critical heat flux of the given wire
- Find the heat transfer through the fin by forced and natural convection processes
- Heat transfer through parallel and counter flow heat exchangers
- Find the value of Stefan Boltzmann constant and emissivity of the plate.

OUTCOMES:

- Gain the knowledge in drop wise and film wise condensation processes, heat exchangers and able to identify the heat exchanger for the given application.
- Variation of resistance and heat transfer with temperature for various metals
- Identify the type of fin, thickness and no. of fins required for the given quantity of heat dissipation.

LIST OF EXPERIMENTS:

1. Thermal conductivity of insulating powder through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through Composite Slab Apparatus.
4. Thermal Conductivity of Metal Rod (conductor).
5. Effectiveness of Pin-Fin by Natural Convection Process.
6. Effectiveness of Pin-Fin by forced convection.
7. Heat transfer coefficient in natural convection.
8. Experiment on Parallel and counter flow heat exchanger.
9. Emissivity of a given test plate by Emissivity apparatus.
10. Experiment on Stefan Boltzmann Apparatus.
11. Heat transfer in drop and film wise condensation.
12. Experiment on Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Heat transfer through a Helical Heat Exchanger.

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) P 3 C 2

[A0383156] METROLOGY & MACHINE TOOLS LAB

OBJECTIVES:

- This course "metrology and machine tools" lab imparts intensive and extensive practical knowledge of the lab so that students can understand the importance of concepts of "metrology and machine tools" in the field of engineering.
- The student should able to develop theoretical / practical capabilities so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problem.

OUTCOMES:

- Use knowledge of metrology and machine tools for practical applications.
- Understand and build their abilities for running of metrology and machine tools lab.

LIST OF EXPERIMENTS:

1. Measurements of length, height, depth, diameters by vernier calipers, vernier height gauge and micrometers.
2. Measurement of bores by dial bore gauge.
3. Use of gear teeth vernier caliper and checking the chordal addendum and chordal height of spur gear.
4. Perform Machine tool alignment tests on lathe.
5. Measurement of angle by sine bar and bevel protractor.
6. Measurement of pitch, major diameter, minor diameter, pitch, threads angle, effective diameter and depth of thread of a given threaded component.
7. Perform Step turning and taper turning operation on a cylindrical work piece using lathe machine.
8. Perform Thread cutting and knurling operation on a cylindrical work piece using lathe machine.
9. Perform Drilling and tapping operation on a given work piece using radial drilling machine.
10. Produce maximum size of the square on a given cylindrical work piece using Shaping machine.
11. Machine slots on a given hollow workpiece using slotting machine
12. Machine a slot on a given workpiece using a milling machine

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MECHANICAL ENGINEERING

III B.Tech, II-Sem (ME) P 3 C 2

[A0384156] PARAMETRIC MODELLING-I LAB

OBJECTIVES:

- To train the student to make use of Pro-E software package
- To improve the quality of the Engineering Drawing.

OUTCOMES:

- 2D drawings and 3D drawings can be drawn using Pro-E Software package.
- Able to create 3D assemble drawings.
- Useful to increase the productivity of an industry.

UNIT – I:

Introduction to Pro/E & sketching: What is parametric modeling – setting up working directory – different file extensions in Pro/E – sketch tools – create and edit dimensions – constraints.

UNIT – II:

Part Modeling: Feature creations – protrusion & cut – solid and thin features – shell – dress up features – pattern chamfer – fillet.

UNIT – III:

Assembly: Introduction to top-down & bottom-up assembly – assembly constraints – Skelton model – exploded views.

UNIT – IV:

Drafting: Introduction to drafting with / without templates – placing views – placing dimensions – bill of materials.

UNIT – V:

Surface modeling: Datum curves – points – plans – co-ordinate systems – sketch based features – extrude – trim – offset – merge.

UNIT – VI:

Sheet metal – flat walls – extrude walls – creating walls – punches – notches – forms – dies – bending the sheet.

TEXT BOOKS:

1. Parametric Modeling, Randy H Shih.
2. Pro/Engineer Wildfire,Dr. Zuomin Dong**,** Department of Mechanical Engineering, University of Victoria.

LIST OF EXERCISES:

1. Draw the sketch with given dimensions.
2. Draw the sketch and specify dimensions.
3. Create a part using extrude and revolve features.
4. Create a part using chamfer and filletsfeatures.
5. Create a part using sweep, blend tools & patternfeatures.
6. Complete the part using revolve and rib toolsfeatures.
7. Modify the dimensions and regenerate the existing part.
8. Draw the simple parts and assemble.
9. Draw all parts of machine component and complete the assembly.
10. Generate views for specified part.
11. Create views, dimensions and bill of materials for specified assembly modeling.
12. Draw the surface and convert it into solid.

Soft Ware Package Required: Pro-Engineer.

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MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

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3+1*	3

[A0325157] CAD/CAM

OBJECTIVES:

- To impart the knowledge on current advances in Computer-aided design/Computer-aided manufacturing (CAD/CAM) and also about Numerical control machines and the process planning.

OUTCOMES:

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

- Know the impact of CAD/Cam in modern manufacturing industries.
- Know the concept of modeling.
- Prepare the CNC part programme for any type of geometry given.

UNIT – I

Product cycle, steps involved in Designing a CAD, CAD tools, CAM tools, CPU, input devices, output devices, Memory types, Application of computers for design, benefits of CAD, storage devices.

UNIT – II

Computer Graphics & Drafting: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, Geometric commands, layers, display control commands, editing, dimensioning.

UNIT – III

Geometric modeling: Wire frame models, Wire frame entities, curve representation, parametric representation of synthetic curves, curve manipulations.

UNIT –IV

Numerical control:

Basic components of an NC, Classifications- CNC, DNC, classification of several output devices used in NC systems, feedback devices, NC co ordinate systems, NC motion control systems, application of NC, Machining center, turning center, NC Part Programming, A.P.T-language.

UNIT – V

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

UNIT – VI

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

TEXT BOOKS:

1. CAD/CAM, A Zimmers & P.Groover, PE, PHI.
2. CAD/CAM-Principles and applications, P.N. Rao, TMH.

REFERENCES:

1. Automation, Production systems & Computer integrated Manufacturing, Groover, P.E.
2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age.
3. Principles of Computer Aided Design and Manufacturing , Farid Amirouche, Pearson
4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH
5. Computer Aided Design and Manufacturing, Lalit Narayan, PHI.
6. Computer Aided Manufacturing, T.C. Chang, Pearson.
7. A text book of CAD/CAM, CSP Rao, Hitech Publ.

IV B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0326157] OPERATIONS RESEARCH

OBJECTIVES:

Upon completion of this course, the student should be able to,

- Formulate a real-world problem as a mathematical programming model,
- Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand,
- Understand the relationship between a linear program and its dual, including strong duality and complementary slackness,
- Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change,
- Solve specialized linear programming problems like the transportation and assignment problems,
- Solve network models like the shortest path and scheduling, replacement and queuing problems
- The students should play an effective role in providing model-based support to managers to help them make better decisions at an operational/technical level.

OUTCOMES:

- In order to assess the students progress towards achieving the learning outcomes, assigned readings, lectures and homework to enable the students to:
- Use some of the techniques, methodologies and models used in Operations Research for practical problems.
- Use techniques in the field of Applied Mathematics that uses mathematical methods and computers to make rational decisions in solving a variety of optimization problems.
- To solve large, complex problems in industry, business, science and technology, management, decision support and other areas and discipline with the use of computer software.

UNIT – I

Linear Programming: Introduction-structure of linear programming model- Formulation– Graphical solution – Simplex method, Big-M method, Two phase method (maximization case and minimization case), Special cases-Duality, dual simplex method.

UNIT-II

Transportation: Introduction-methods of finding initial basic feasible solution (North-west corner rule, least cost method and Vogel's Approximation method), optimal solution (Modi Method), variations in transportation problem-maximization.

UNIT-III

Assignment problems: Hungarian method of Assignment problem- variations of the assignment problem-Traveling salesman problem.

Job sequencing: n jobs - two machines, n jobs - three machines, two jobs - n machines.

UNIT-IV

Replacement and maintenance models: Introduction-types of failure-replacement of items whose efficiency deteriorates with time- replacement of items that fail completely-staffing problem.

UNIT-V

Queuing theory: Introduction-characteristics of queuing system-probability distributions in queuing system-single server queuing models, multi server queuing models.

UNIT-VI

Inventory: Introduction-functional role of inventory-reasons for carrying inventory-inventory control models without shortages and with shortages-EOQ models with quantity discounts-instantaneous probabilistic demand without set-up cost, P-system and Q-system.

TEXT BOOKS:

1. Operations Research- theory and applications, second edition, J.K. Sharma/MacMillian publications.
2. Introduction to operations research, Hamdy A. Taha/PHI publications.

IV B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0327157] FINITE ELEMENT METHODS

OBJECTIVES:

- To equip the students with the Finite Element Analysis fundamentals.
- To enable the students to formulate the design problems into FEA.
- To introduce basic aspects of finite element technology, including domain discretization.
- Polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.

OUTCOMES:

At the end of the course, the students will be able to:

- Identify mathematical model for solution of common engineering problems.
- Formulate simple problems into finite elements.
- Solve structural, thermal, fluid flow problems.
- Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.

UNIT-I

Fundamental concepts in finite element methods, advantages and applications of FEM, steps followed in FEM- Stress and Equilibrium. Strain - Displacement relations. Stress - strain relations. Plane stress, plane strain conditions, Variational and weighted residual methods- the Rayleigh Ritz method, Galerkin's method.

UNIT-II

Finite element technique: Finite element modeling, coordinates-Local and Global coordinates and shapes functions- Principle of minimum Potential Energy- Assembly of Global stiffness matrix and load vector, Finite element equations, Convergence requirements, Treatment of boundary conditions, Quadratic shape functions.

UNIT-III

Analysis of Bar And Truss Structures: One-dimensional Bar element- derivation of element stiffness matrix, simple problems on bar element, Thermal stresses in 1-D bar element- Two-dimensional truss element, stiffness matrix for two-dimensional truss, simple problems on two-dimensional truss structures.

UNIT-IV

Analysis of Beam Structures: Beam elements, stiffness matrix for beam element, simple problems on beam structures – stresses and deflection of beams – cantilever and simply supported beams.

UNIT-V

Two Dimensional Stress Analyses: Finite element modeling for two-dimensional stress analysis, element stiffness matrix for constant strain triangle (CST) and treatment of boundary conditions, formulation of axi-symmetric problems.

UNIT-VI

Steady State Heat Transfer Analysis: Derivation of basic differential equation, One-dimensional heat transfer through a fin and composite wall.

TEXT BOOKS

1. Tirupati Chandrapatla and Bellagundu Introduction to Finite Element in Engineering, PearsonEducation, New Delhi.
2. Reddy J.N. - A Introduction to Finite Element Method, McGraw Hill, International Edition,

REFERENCES

1. C.S. Krishna Moorthy, Finite Element Analysis, TMH Publishers, New Delhi.
2. S.S.Rao Finite Element Methods, Pergamom Press, New York
3. S.Md. Jalaluddin Introduction of finite element Analysis, Anuradha Publishers, Chennai.
4. David V. Hutton Fundamentals of Finite Element Analysis, TMH Publishers, New Delhi
5. Desai and Abel, Introduction to the Finite Element Methods, CBS Publishers, New Delhi.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME) T 3+1* C 3

[A0328157] REFRIGERATION AND AIR CONDITIONING

(Note: The use of Refrigeration and Air Conditioning Data Book along with Steam Tables is Permitted in the Examinassions**)**

OBJECTIVES:

- Familiarize the student with the technology associated with refrigeration and air-conditioning
- To cover the basic principles of psychrometry and applied psychrometrics
- Familiarize the student with system analysis and mathematical modeling
- Familiarize the student with load calculations and elementary duct design.
- Familiarize the student with refrigerants; vapour compression refrigeration and multistage vapour compression systems.
- Understand the components of vapour compression systems and other types of cooling systems.

OUTCOMES:

On completion of the course, it is expected that the student will:

- Familiarize the student with the technology associated with refrigeration & air conditioning.
- Be able to apply the basic principles of psychrometry and applied psychrometrics.
- Be able to undertake system analysis and mathematical modeling.
- Be able to perform load calculations and elementary duct design.
- Be familiar with refrigerants: vapour compression refrigeration systems.
- Understand the components of vapour compression systems and other types of cooling systems.

UNIT – I

INTRODUCTION TO REFRIGERATION: Refrigerants – Desirable properties of idle refrigerant – classification of refrigerants – Nomenclature – secondary refrigerants. Unit of refrigeration – COP-Air refrigerator working on reversed Carnot cycle& Bell Coleman cycle - Boot Strap Air Evaporative Cooling System –Regenerative Air Cooling System. Simple Problems.

UNIT – II

VAPOUR COMPRESSION REFRIGERATION: introduction –advantages and limitations - Basic cycle (p-h chart) – working principle and essential components of the system –types of vapor compression cycles – effect of sub cooling and super heating – Actual cycle- effect of suction pressure and discharge pressure- Improvements in simple saturation cycle – Problems.

UNIT III

VAPOR ABSORPTION REFRIGERATION SYSTEM – simple vapor absorption system-practical vapor absorption system - advantages and disadvantages of VAR over VCR - COP of idle VAR system –domestic Electrolux system – Lithium bromide absorption system.

UNIT IV

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components – Principle and operation of: (i) Thermo-Electric Refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – V

INTRODUCTION TO AIR CONDITIONING: Introduction to Psychometry –psychometric terms –psychometric chart- Daltons Law of partial pressures-psychometric Processes- Need for Ventilation – Infiltrated air – Heat Load concepts - RSHF, GSHF-Problems.

Air Conditioning equipment: Fans and blowers- types.

UNIT – VI

COMFORT AIR CONDITIONING: Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning – summer, winter & year round air conditioning – Simple Problems.

Heat Pump – Heat sources – different heat pump circuits.

TEXT BOOKS:

1. Refrigeration and Air Conditioning, CP Arora, 3/e, TMH,
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpatrai

REFERENCES:

1. Refrigeration and Air Conditioning, Manohar Prasad, 2/e, New Age.
2. A text book of Refrigeration and Air Conditioning, R.S.Khurmi & J.K.Gupta, S.Chand & Co.
3. Principles of Refrigeration, Dossat, 4/e, Pearson Edu.
4. Refrigeration and Air Conditioning, P.L.Ballaney, Khanna Publ.
5. Refrigeration and Air Conditioning, R.C.Arora, PHI.
6. Basic Refrigeration and Air-Conditioning – Ananthanarayanan, TMH

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MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME) T 3+1* C 3

[A0329157] NON-CONVENTIONAL SOURCES OF ENERGY

[Open Elective – I]

OBJECTIVE:

- To study various types of Renewable sources of energy.

OUTCOME:

- Understanding different types of renewable energy sources and their utilization.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Introduction - solar constant - Role and potential of new and renewable source, Environmental impact of solar power, physics of the sun, extra terrestrial and terrestrial solar radiation, instruments for measuring solar radiation .

UNIT-II

SOLAR ENERGY COLLECTORS: Introduction – type - Flat plate and concentrating (Parabolic) collectors - Merits & Demerits of Flat plate and Concentrating (Parabolic) Collectors.

UNIT - III

SOLAR ENERGY STORAGE AND APPLICATIONS: Introduction - Different methods - Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion- photovoltaic Cells.

UNIT-IV

WIND ENERGY: Introduction – Potential in India - Basic Principle of wind energy conversion - Basic components **–** classification – Horizontal & Vertical Axis wind mill **–** Merit & demerits.

UNIT-V

GEOTHERMAL ENERGY: Introduction – nature of geothermal fields – geothermal sources – hybrid systems –merits and demerits- applications - potential in India

OCEAN ENERGY: Introduction – OTEC (open, closed & hybrid cycle) – Energy from Tides – components – Operating methods – Ocean waves – wave energy conversion devices.

UNIT-VI

BIO-MASS: Principles of Bio-Conversion – Bio gas generation-Anaerobic/Aerobic Digestion – Factors affecting Biogas generation-classification of biomass gasifiers -thermal gasification of Bio mass- up draught, down draught & cross draught gasifies- advantages and disadvantages- utilization for cooking and IC Engine operation.

TEXT BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy Sources /G.D. Rai.

REFERENCE BOOKS:

1. Solar Energy /Sukhame.
2. Renewable Energy Sources /Twidell & Weir.
3. Solar Power Engineering / B.S Magal Frank Kreith & J.F Kreith.
4. Principles of Solar Energy / Frank Krieth & John F Kreider.
5. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
6. Non-Conventional Energy Systems / K Mittal /Wheeler
7. Renewable Energy Technologies /Ramesh & Kumar /Narosa.

IV B.Tech, I-Sem (ME) T 3+1* C 3

[A0330157] ENERGY AUDIT & MANAGEMENT

[Open Elective-I]

OBJECTIVE:

- The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect.

OUTCOME:

- The outcome of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the organization and to minimize energy costs / waste without affecting production & quality.

UNIT I

General Aspects of Energy Management: Current energy scenario-India and World. Current energy consumption pattern in global and Indian industry, Energy Conservation Act 2001. Principles of Energy management, Energy policy, Energy action planning, Energy security and reliability, Energy and environment, Need of Renewable energy sources and energy efficiency.

UNIT II

Energy Auditing: Need of Energy Audit, Types of energy audit, Components of energy audit, Energy audit methodology, Instruments, equipment used in energy audit, Analysis and recommendations of energy audit.

Energy conservation opportunities (House–keeping measures) in Boiler and steam system, Furnaces, DG sets, HVAC system, pumping system, Cooling towers and Compressed air system.

UNIT III

Energy Economics: Financial Analysis Techniques - Simple payback, Time value of money, Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR), Risk and Sensitivity analysis.

UNIT IV

Energy Efficiency in Steam System: Energy performance assessment and efficiency improvement of Boilers. Excess air control. Steam distribution. Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system.

UNIT V

Energy Efficiency in Thermal Utilities: Energy performance assessment and efficiency improvement of Pumps, Fans and blowers, Compressors and HVAC systems.

UNIT VI

Cogeneration and Waste Heat Recovery: Cogeneration- Need, applications, advantages, classification, the cogeneration design process. Waste heat recovery- Classification and application, Potential for waste-heat recovery in Industry, Commercial WHR devices, saving potential.

TEXT BOOKS:

1. Energy Management: W. R. Murphy, G. McKay (Butterworth).
2. Fundamentals of Energy Engineering: Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.

REFERENCE BOOKS:

1. Handbook of Energy Audit, Albert Thumann P.E. CEM, William J. Younger CEM, The Fairmont Press Inc., 7th Edition.
2. Energy management Handbook, Wayne C. Turner, The Fairmont Press Inc., 5th Edition, Georgia.
3. Handbook on Energy Audit and Environment Management, Abbi Y. A., Jain Shashank, TERI, Press,. Energy Performance assessment for equipment and Utility Systems, Vol. 2, 3, 4, BEE, Govt. of India
4. Boiler Operator's Guide Fourth Edition, Anthony L Kohan, McGraw Hill
5. Energy Hand book, Second edition, Von Nostrand Reinhold Company - Robert L. Loftness.
8. Energy Management Principles: C. B. Smith (Pergamon Press)
9. Efficient Use of Energy: I. G. C. Dryden (Butterworth Scientific)
10. Energy Economics: A. V. Desai (Wiley Eastern)
11. Best Practice Manual in Energy Audit of Steam System – Generation, Distribution and Utilization, TERI, 1998.
12. www.energymanagertraining.com
13. www.bee-india.nic.in

IV B.Tech, I-Sem (ME) T 3+1* C 3

[A0331157] ADVANCED OPTIMIZATION TECHNIQUES

[Open Elective – I]

OBJECTIVES:

Many real-world problems require advanced techniques to formulate and to solve, and sometimes new optimization algorithms and procedures need to be designed. The objective of this class is to help students become optimizers, who have solid understanding of basic theory to model and solve real-world problems. Students will learn

- A deeper understanding of the key concepts, theory, and algorithms of linear optimization, multi objective optimization and some modern convex optimization
- more advanced modeling techniques,
- ways of solving optimization problems that are too hard, too large for direction solution,
- ways of solving optimization problems faster when speed is essential,
- Ways to assess the quality of sub-optimal solutions.

OUTCOMES:

At the end of this course, students will be able to:

- Understand the basic theory and some advanced topics in linear optimization, integer optimization, and convex optimization.
- Identify the proper optimization technique(s) to attempt when problems are too large or too complicated to solve in a straightforward way.
- Use optimization software and implement solution algorithms involving large-scale optimization techniques.
- Handle large data sets that accompany real-world optimization problems.

UNIT - I

INTRODUCTION TO OPTIMIZATION: Development- Engineering application-statement of an optimization problem- classification of optimization problems-optimization techniques. Classical optimization techniques - Introduction- single variable and multivariable with no constraints and equality constraints – Lagrange model-optimization with inequality constraints, Kuhn-Tucker conditions.

UNIT - II

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Linear programming: Two-phase simplex method, Big-M method, duality, interpretation, applications.

UNIT-IV

Goal programming: Introduction, Linear programming versus Goal programming, concept of Goal programming, Goal programming model formulation, graphical method of Goal programming, modified simplex method of Goal programming, applications of Goal programming.

UNIT - V

Genetic algorithm (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination

criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA.

UNIT – VI

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems.

TEXT BOOKS:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers.
2. Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers.
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Operations research for management-M.P. Gupta and J. K.Sharma, National publishers
4. Genetic Programming- Koza.
5. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers.

IV B.Tech, I-Sem (ME)

T	C
3+1*	3

[A0337158] GAS TURBINES

[Thermal Engineering Data is permitted in the end examinations]
(Department Elective-III)

OBJECTIVE:

- Student gets acquitted with Principle of operation of a gas turbine.

OUTCOMES:

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

- Understand the power cycles used in aero planes, rockets etc,
- Capable of analyzing compressors, turbines etc.

UNIT I

Introduction: Prime Movers-Simple Gas Turbine – Review of basic principles: Definitions and laws –Energy equation- basic fluid dynamics definition-stream tube area –velocity reaction- normal shock waves- equations of motion for a normal shock wave

UNIT-II

Ideal cycles and their analysis: Assumptions in Ideal cycle analysis- simple gas turbine cycle- heat exchange cycle- reheat cycle- reheat and heat exchange cycle- intercooled cycle-intercooled cycle with heat exchanger- inter cooled and reheat cycle- Simple problems.

UNIT-III

Centrifugal compressors: Essential parts of a centrifugal compressor- principle of operation- ideal energy transfer- blade shapes and velocity triangles- analysis of flow through the compressor- compressor characteristics-surging and choking-Simple problems.

UNIT-IV

Combustion systems: Combustion theory applied to gas turbine combustor- factors affecting combustion chamber design- factors affecting combustion chamber performance-requirements of combustion chamber –process of combustion in a gas turbine- combustion chamber geometry- mixing and dilution- combustion chamber arrangements.

UNIT-V

Gas turbines: Axial flow gas turbines- impulse and reaction turbines, single impulse stage, single reaction stage

UNIT-VI

Jet propulsion: Introduction- thrust, propulsive power and propulsive efficiency, classification of gas turbine engines – turbo jet engine, turbo prop engine, ram jet engine, pulse jet engine, comparison of various propulsive devices.

TEXT BOOKS:

1. Gas turbines, V.Ganesan, TMH
2. Gas turbines and propulsive systems, P.Khajuria and S.P.Dubey, Dhanapath rai publications

REFERENCES:

1. Gas turbine and jet rocket propulsion, V.M.Domkundwar, Dhanapath rai &Co
2. Gas turbine theory, Saravanmuttoo, H.I.H.,Rogers,G.F.C. and Cohen H., 6/e Pearson prentice Education, 2008.

IV B.Tech, I-Sem (ME) T 3+1* C 3

[A0338158] MECHANICS OF COMPOSITE MATERIALS

(Department Elective-III)

OBJECTIVE:

- This course provides students a background in modern lightweight composite materials which are being used in an ever-increasing range of applications and industries. Basic knowledge of composites will allow engineers to understand the issues associated with using these materials, as well as gain insight into how their usage differs from metals, and ultimately be able to use composites to their fullest potential.

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

- Know the fundamental concepts of composite materials.
- Understand various manufacturing methods of composites.
- Learn macro and micro-mechanical analysis of a lamina.
- Understand failure theories, and to determine the strength of a lamina.

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.

UNIT-II

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

UNIT-III

Manufacturing Processes: Hand lay-up, Spray lay-up, Vacuum bagging, Pultrusion, Resin Transfer Molding (RTM), Filament winding.

UNIT-IV

Macro-Mechanical Analysis of a Lamina: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials – Anisotropic material, monoclinic material and orthotropic material, 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, Angle Lamina.

UNIT-V

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 theories of an angle lamina- Maximum stress Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu Failure Theory.

UNIT-VI

Micro-Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli – Longitudinal young's modulus, Transverse young's modulus, Major Poisson's ratio and In-plane shear modulus by Strength of Materials Approach, Semi Empirical Models, Ultimate Strengths of a Unidirectional Lamina- Longitudinal tensile strength, Transverse tensile strength, Longitudinal compressive strength, Transverse compressive strength. In-Plane shear

strength.

TEXT BOOKS:

1. Mechanics of Composite Materials- Autar K. Kaw, 2/e, CRC Pubi.
2. Analysis and performance of fibre Composites, B. D. Agarwal and L.J. Broutman Wiley- Inter science,

REFERENCE BOOKS:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford Univ. Press.
2. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York.
3. Composite Materials Science and Engineering, Kishan K. Chawla, Springer.
4. Analysis of Laminated Composite Structures, L.R. Calcote, Van Nostrand Rainfold, New York,
5. Machanics of Composite Materials and Structures, madhujit Mukhpadhyay, New York.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

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3+1*	3

[A0339158] RAPID PROTOTYPING

(Department Elective-III)

OBJECTIVES:

This subject provides students with

- An understanding of the various rapid prototyping, rapid tooling, and reverse engineering technologies;
- The knowledge to select appropriate technologies for product development purposes.

OUTCOMES:

Upon completion of the subject, students will be able to

- Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications.
- Apply the basic principles of rapid prototyping (RP), rapid tooling (RT), and reverse engineering (RE) technologies to product development;
- Explain direct metal laser sintering, LOM and fusion deposition modeling processes
- Demonstrate solid ground curing principle and process
- decipher the limitations of RP, RT, and RE technologies for product development; realise the application of RP, RT, and RE technologies for product development.
- Discuss LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components

UNIT-I

INTRODUCTION: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. **STEREO LITHOGRAPHY SYSTEMS**: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

UNIT-II

SELECTIVE LASER SINTERING: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications.

FUSION DEPOSITION MODELLING: Principle, Process parameter, Path generation, Applications.

UNIT-III

SOLID GROUND CURING: Principle of operation, Machine details, Applications. Laminated Object Manufacturing-Principle of operation, LOM materials. Process details, application.

UNIT-IV

CONCEPTS MODELERS: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

UNIT-IV

RAPID TOOLING: Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast Kirk site, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM.

Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

UNIT-VI

SOFTWARE FOR RP: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

RAPID MANUFACTURING PROCESS OPTIMIZATION: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

TEXT BOOKS:

1. Stereo Lithography and other RP & M Technologies, Paul F. Jacobs: SME, NY.
2. Rapid Manufacturing, Flham D.T & Dinjoy S.S Verlog London.

REFERENCES

1. Rapid Prototyping, Terry Wohlers Wohler's Report "Wohler's Association.
2. Rapid Prototyping Materials**,** Gurumurthi, IISc Bangalore.
3. Rapid Automated, Lament wood. Indus press New York.

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MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME)

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1+2*	1

[A0335157] PARAMETRICMODELLING -II

[Skill Development Course]

OBJECTIVES:

- Use of computers for drafting purpose.
- To train the student to make use of CATIA software package
- To improve the quality of the engineering drawing

OUTCOMES:

- 2D drawings and 3D drawings can be drawn using Pro-E Software package.
- Able to create 3D assemble drawings.
- Useful to increase the productivity of an industry.
- To meet the modern industry demand

UNIT – I:

Drawing the sketches in sketcher: Introduction to CATIA – understanding the sketch terms – using sketch tools – editing and modifying sketches – applying constraints and dimensions.

UNIT – II:

Modeling in CATIA: Transformation features – generating solid – combine – protrusion – creating and removing – multi section solid – creating fillets – chamfers – shell.

UNIT – III:

Assembly modeling: Creating bottom-up and top-down assembly – applying constraints – moving components

UNIT – IV:

Working with drafting: Types of views – generating drawing views – exploded views – modifying the views – insertion of frame and title block – generating dimensions – applying symbols – bill of materials.

UNIT –V:

Working with wireframe and surface design: Need of surface modeling – creating wireframe elements – creating surfaces – cylindrical surfaces – offset surfaces – spherical surfaces – fill option – editing and modifying surfaces.

UNIT – VI:

Working with sheet metal: Setting sheet metal parameters – sheet metal walls – swept walls – creating bend – folding – unfolding sheet metal parts – different types of stampings.

TEXT BOOKS:

1. CATIA for Designers, Sham Tickoo, CAD/ CIM Technologies.

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MECHANICAL ENGINEERING

IV B.Tech, I-Sem (ME) P 3 C 2

[A0385157] CAM LAB

OBJECTIVES:

- To create awareness among the students about the use of computer technology in manufacturing
- Imparting programming skills to write a part program for CNC –Turn and CNC- Mill machines.

OUTCOMES:

- Improves the accuracy and quality of the product.
- Learning different G and M codes.
- Grain the knowledge of writing part program for different configurations.

LIST OF EXERCISES:

- Introduction to CNC and NC Machines
- Introduction to CNC part-programming, and Preparatory codes (G-codes) and Miscellaneous codes (M-codes)

I. EXERCISES ON CNC LATHE:

- Plane Turning operation
- Step Turning operation
- Taper Turning operation
- Thread Cutting operation

II. EXERCISES ON CNC MILL:

- Profile milling (2 exercises)
- Circular pocketing.

III. EXERCISE ON ROBOT:

- Programming the Robot for pick and place operation.

IV. Developing a CNC code for a given job using- Edge CAM software.

IV B.Tech, I-Sem (ME) P 3 C 2

[A0386157] PARAMETRIC MODELING –II LAB

OBJECTIVES:

- Use of computers for drafting purpose.
- To train the student to make use of CATIA software package
- To improve the quality of the engineering drawing

OUTCOMES:

- 2D drawings and 3D drawings can be drawn using Pro-E Software package.
- Able to create 3D assemble drawings.
- Useful to increase the productivity of an industry.
- To meet the modern industry demand.

LIST OF EXERCISES:

1. Draw the sketch with given dimensions.
2. Draw the sketch and specify dimensions.
3. Create a part using extrude and revolve features.
4. Create a part using chamfer and filletsfeatures.
5. Create a part using sweep, blend tools & patternfeatures.
6. Complete the part using revolve and rib toolsfeatures.
7. Modify the dimensions and regenerate the existing part.
8. Draw the simple parts and assemble.
9. Draw all parts of machine component and complete the assembly.
10. Generate views for specified part.
11. Create views, dimensions and bill of materials for specified assembly modeling.
12. Draw the surface and convert it into solid.

Software Required: CATIA soft ware Package.

IV B.Tech, I-Sem (ME) P 3 C 2

[A0387157] MINI PROJECT

There shall be mini-Project, in collaboration with an industry (wherever possible) of their specialization, to be taken up during the vacation(data collection, components etc) after III year II Semester examination and implementation/simulation shall be carried out in IV year first semester during lab classes. Implementation or development of mini project will be treated as laboratory. However, the mini project and its report shall be evaluated in IV year I Semester. The mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 50 marks. The committee consists of an external Examiner, Head of the Department, the supervisor of mini project and a senior faculty member of the Department. There shall be 25 Internal marks for mini project which will be awarded based on the performance and involvement of the student during mini project period.

IV B.Tech, II-Sem (ME) T 3+1* C 3

[A0336158] INDUSTRIAL AUTOMATION AND ROBOTICS

OBJECTIVE:

- In the present scenario all the manufacturing industries are automated to improve the productivity as well as the quality of the product.

OUTCOMES:

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

- The student should understand the some fundamental aspects and an overview of robotics& automation, including Components of the Industrial Robotics, arms, architecture, end effectors, feedback components etc.
- Emphasis is placed on understanding motion analysis described mathematically.
- The Manipulator Kinematics, D-H notation joint coordinates and world coordinates, forward and inverse kinematics are also considered in some detail.

UNIT – I

INTRODUCTION TO AUTOMATION: Automation - need-types, Basic elements of an automated system, levels of automation- computer process control, Forms of computer process control, sensors, actuators, input/output devices for discrete data, overview of material handling equipment

UNIT – II

NUMERICAL CONTROL: Introduction-NC Procedure, NC Coordinate systems, elements of NC Systems, classification of NC Systems, Advantages and dis-advantages of NC Systems, Applications of NC, NC Manual Part programming, APT Language.

UNIT – III

MANUAL ASSEMBLY LINES AND TRANSFER LINES: Fundamentals of Manual Assembly lines and automated production lines, Alternative assembly systems, Design for Assembly, Applications of Automated production lines, Analysis of Transfer lines with NO Internal storage, Analysis of Transfer lines with storage Buffers.

UNIT – IV

INTRODUCTION TO INDUSTRIAL ROBOTS: Robotics Definition - robot configurations, Work volume, Robot Anatomy, Robot Drive systems, Precision of Movement, End effectors, Robotic sensors and actuators, Grippers.

UNIT – V

MANIPULATOR KINEMATICS: Homogeneous transformations as applicable to rotation and translation - (D-H) notation, Forward and inverse kinematics.

Manipulator Dynamics: differential transformation, Jacobians, Lagrange – Euler and Newton Euler formations.

UNIT – VI

ROBOT ACTUATORS AND FEED BACK COMPONENTS: Actuators- pneumatic-hydraulic actuators, Electric & stepper motors, comparison, Position sensors – potentiometers-resolvers- encoders – velocity sensors-tactile sensors-proximity sensors, Robot applications in Manufacturing.

TEXT BOOKS:

1. Mikell P. Groover, Automation, Production Systems and CIM, Prentice-Hall of India Pvt. Ltd.
2. M.P. Groover, Industrial Robotics, TMH.

REFERENCE BOOKS:

1. K.S.Fu., R.C.Gonzalez, C.S.G. Lee, Robotics: Control Sensing, Vision and Intelligence International Edition, McGraw Hill Book Co.
2. P. Coiffet and M.Chaironze, An Introduction to Robot Technology, Kogam Page Ltd. London.
3. Richard. D.Klafter, Robotics Engineering, Prentice Hall
4. Ashitave Ghosal, Robotics, Fundamental Concepts and analysis, Oxford Press
5. Mittal R.K & Nagrath IJ, Robotics and Control, TMH.
6. John. J. Craig, Introduction to Robotics, Pearson.

IV B.Tech, II-Sem (ME) T 3+1* C 3

[A0332157] AUTOMOBILE ENGINEERING

[Department Elective –IV]

OBJECTIVES:

- The student should get the knowledge about components of automobile fuel supply system cooling systems ignition system and power transmission systems
- The student should understand the some fundamental aspects of an internal combustion engines, including important mechanisms used in automobile braking systems, steering system and also clutch mechanism. Emphasis is placed on understanding how the combustion take place inside the engine cylinder. Supply of air fuel mixture to the engine considered in some detail.
- The student should able to apply the knowledge to solve the trouble shootings at various areas like steering mechanisms, fuel supply pumps and lubricating oil supply pumps etc.

OUTCOMES:

- Enriching the student's knowledge in the subject of automobile engineering.
- Develops cognitive skills (thinking and analysis)
- The students should link the scientific concepts they are learning with real applications by giving live examples where the subject concepts are applied.
- Develops communication skills (personal and academic)
- Students gain a lot of information by searching through the internet and references and from local industrial companies

UNIT – I

Introduction : Components of an automobile – chassis and body – power unit – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, oil filters, oil pumps – crank case ventilation-Fuel gauge – oil pressure gauge, Engine température indicator.

UNIT – II

Fuel Supply Systems: S.I. Engine: Types of Fuel Supply system, Mechanical and electrical fuel pump – filters– Carburetors (Simple & Zenith) – air filters – petrol injection systems-types, Mechanical, MPFI and electronic injection system.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, CRDE, fuel pumps, testing of fuel pumps.

UNIT – III

Cooling System: Cooling Requirements, Air Cooling, Thermostat Liquid cooling, Radiators – Types, Cooling Fan, water pump, thermostat, antifreeze solutions.

Ignition System: Function of an ignition system, Principle of Electronic Ignition System, Distributer less Electronic Ignition System.

UNIT – IV

Emission Control: Introduction, Emission Norms - Pollution standards – types of emissions-Reduction of formation of pollutants, closed crankcase ventilation, fuel tank and carburetor ventilation, redesigning the combustion chamber, changes in fuel supply system, modifications in ignition system, treating the exhaust gasses to reduce pollutants – use of alternative fuel.

Starting system: Introduction, Starting Motor, Starting drives, Bendix drive mechanism-starting motor switches - Accessories, Horn, Speedometer, Wind screen wiper.

UNIT – V

Transmission System: Clutches - Principle- types, single plate, multi plate, and centrifugal clutches – gear box – types, constant mesh, synchromesh, epi-cyclic, over drive, torque converter- Propeller shaft – Hotch Kiss drive, Torque tube drive, universal joint, differential, rear axles.

UNIT – VI

Steering System: Introduction, Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, Steering geometry – camber, castor, king pin rake, combined angle toe-in, toe-out- - Steering gears – types, steering linkages.

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

Braking System: Introduction, Classification, Mechanical brake system, Hydraulic brake system, air and vacuum brake systems.

TEXT BOOKS:-

1. Automobile Engineering, – Vol.1 & Vol.2, Kirpal Singh.
2. Automotive Mechanics, William Crouse. Hanna Publishers.

REFERENCE BOOKS:

1. Automobile Engineering, G.B.S.Narang khanna publishers.
2. Automobile Engineering, R.B.Gupta.
3. Automobile Engineering, T.R.Banga khanna publishers.
4. Automobile Engineering, K.K. Jain TMH.
5. Automobile Engineering, K.K.Ramalingam, Scitech Publishers.

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MECHANICAL ENGINEERING

IV B.Tech, II-Sem (ME)

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3+1*	3

[A0333157] COMPUTATIONAL FLUID DYNAMICS

[Department Elective –IV]

OBJECTIVE:

- To study fluid flow over an object.

OUTCOME:

- A student can apply the concepts to practical Engineering applications.

UNIT- I

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momemtum and Energy equations – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD.

UNIT-II

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method. Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNIT-III

Heat conduction - Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems.

UNIT-IV

Convection and Diffusion -Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

UNIT - V

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-VI

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function- Vorticity formulation, Boundary-layer theory, Buoyancy – Driven Convection and stability.

TEXT BOOK:

1. Computational fluid dynamics, Basics with applications, John. D. Anderson, Mc Graw Hill.
2. Introduction to computational fluid dynamics, P.Niyogi, S.K. Chakrabartty, M.K. laha, PEARSON Education Publications.

REFERENCE BOOKS:

1. Suhas V, Patankar Hema Numerical Heat Transfer and Fluid Flow, Shava Publishers and Mc Graw Hill, New Delhi.
2. Muralidharan Computational Fluid Flow and Heat Transfer, Nasora Publications, New Delhi
3. Tapan K. Sengupta Fundamentals of Computational Fluid Dynamics, Universities Press, New Delhi.
4. Patankar, S.V., “Numerical Heat Transfer and Fluid Flow”, McGraw-Hill,

IV B.Tech, II-Sem (ME) T 3+1* C 3

[A0334157] PRODUCTION & OPERATIONS MANAGEMENT

[Department Elective –IV]

OBJECTIVE:

- The objective of production operation management is to produce the quality product at the right time and the right manufacturing cost.

OUTCOME:

- Quality products can be produced with minimum coast.

UNIT – I

Forecasting – Importance of forecasting – Types of forecasting, their uses – Demand patterns-methods of forecasting: qualitative methods and quantitive methods (simple moving average, weighted moving average, Exponential smoothing, adjusted exponential smoothing, linear trend line, seasonal and adjustments)-Forecast accuracy and control (mean absolute deviation, cumulative error, mean sum of squares, bias and tracking signal).

UNIT – II

Introduction to Materials requirement Planning [MRP] - terms used in materials requirement planning[MRP] -dependent and independent, continuous and lumpy demand-lead time-structure of MRP system-working principle of MRP-benefits and drawbacks of MRP-LOB (Line of Balance), JIT inventory: JIT philosophy-push pull and KANBAN systems, contrasts between MRP and JIT-Benefits and evaluation of JIT.

UNIT – III

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading.

Scheduling: introduction- scheduling rules for 'n' jobs on one machine – Types of scheduling (forward and backward).

UNIT –IV

Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques-Critical Path-probability of completing the project, deterministic model, critical path method (CPM)-critical path calculation-crashing of simple of networks.

UNIT-V

Line Balancing: Introduction-terminology in line balancing-methods of line balancing (Ranked positional weight method).

Aggregate planning: concept of aggregate planning-kinds of costs involved in aggregate planning-)-strategies of aggregate planning-methods to handle aggregate planning (graphical and Linear programming method).

UNIT – VI

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up, applications of computer in production planning and control.

TEXT BOOKS:

1. Industrial Engineering and Management by DR. Ravi Shankar/Galgotia publications pvt. Ltd.
2. Industrial Engineering and Operations management by S.K. Sharma and Savita Sharma/ Kataria & sons.

REFERENCES:

1. Operations management by Russel/Taylar
2. Operations Management – S.N. Chary.
3. Production and operations management by Panner Selvam, PHI.
4. Elements of Production Planning and Control / Samuel Eilon.
5. Modern Production/ operation managements / Baffa & Rakesh Sarin
6. Production Control A Quantitative Approach / John E. Biegel.
7. Production Control / Moore.
8. }Operations Management / Joseph Monks

IV B.Tech, II-Sem (ME)

T	C
3+1*	3

[A0340158] CRYOGENICS

[Department Elective –V/MOOC]

OBJECTIVE:

- To give insight knowledge to the students about low temperature Science

OUTCOME:

After learning the course the students should be able to:

- Properties of material at low temperature. Pressure, temperature, flow, fluid quality and liquid level measurement at low temperature. Different types of cryogenic insulations. Different cryogenic applications. Low temperature hazards

UNIT-I

Introduction: Definition and Engineering Applications of Cryogenics, Properties of solids for cryogenic systems.

UNIT-II

Refrigeration and Liquefaction: Simple Linde cycle, Pre-cooled Joule-Thomson cycle, dual-pressure cycle, Simon helium liquefier, classical cascade cycle, mixed-refrigerant cascade cycle

UNIT-III

Ultra-low-temperature refrigerators: Definition and Fundamentals regarding ultra-low-temperature refrigerators, Equipment associated with low-temperature systems, Various Advantages and Disadvantages

UNIT-IV

Storage and Handling of Cryogenic Refrigerants: Storage and Transfer systems, Insulation, Various Types of Insulation typically employed, Poly Urethane Foams (PUFs) and Polystyrene Foams (PSFs), Vacuum Insulation, and so on

UNIT-V

Applications: Broad Applications of Cryogenic Refrigerants in various engineering systems

UNIT-VI

Vacuum Technology: Fundamental principles. Production of high vacuum, Mechanical vacuum pumps, Diffusion pumps, Cryo-pumping, Measurement of high vacuum level. Cryogenic Insulation: Heat transfer due to conduction, Evacuated porous insulation Powder & Fibers Opacified powder insulation, Gas filled powders & Fibrous materials Multilayer super-insulation, Composite insulation.

TEXT BOOKS:

1. Traugott H.K. Frederking and S.W.K. Yuan, Cryogenics - Low Temperature Engineering and Applied Sciences, Yutopian Enterprises, 2005.
2. A. R. Jha, Cryogenic Technology and Applications, Butterworth-Heinemann,

REFERENCE BOOKS:

1. Arora, C.P., Refrigeration and Air-conditioning, Tata-McGraw Hill, 2008.
2. Advance cryogenic –bailey, plenum press

IV B.Tech, II-Sem (ME) T 3+1* C 3

[A0341158] MODERN MANUFACTURING METHODS

[Department Elective –V/MOOC]

OBJECTIVES:

- To familiarize the students with the principles and applications of different modern manufacturing processes.
- To familiarize the students with the modern machining processes used to remove the material from different types of metals and for different purposes.

OUTCOMES:

- Familiarize the students with the principles and applications of different modern manufacturing processes.
- Familiarize the students with the modern machining processes used to remove the material from different types of metals and for different purposes.

UNIT I

Need for non-traditional machining Processes -Classification of modern machining processes. 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.

UNIT – III

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tools, Surface finish and accuracy economic aspects of ECM.

UNIT – IV

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, Process parameters, selection of tool electrode and dielectric fluids, methods of surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes.

Laser Beam Machining: General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT-VI

Plasma Machining: Principle, metal removal mechanism, process parameters, accuracy and surface finish, applications.

Chemical Machining: Fundamentals of chemical machining- Principle- maskants – etchants- advantages and applications.

TEXT BOOKS:

1. Advanced Machining Processes, VK Jain, Allied publishers.

REFERENCES:

1. Modern Machining Process, Pandey, P.C. and Shah H.S., TMH.
2. New Technology, Bhattacharya A, the Institution of Engineers, India 1984.
3. Manufacturing Technology, Kalpakzian, Pearson.
4. Fundamentals of Machining & Machine Tools, D G Booth Roy & WA

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IV B.Tech, II-Sem (ME)

T	C
3+1*	3

[A0342158] MECHATRONICS

[Department Elective –V/MOOC]

OBJECTIVES:

Upon completion of the subject, the student will:

- Have a strong foundation in science and focus in mechanical, electronics, control, software, newest technologies.
- Be able to design, analyze, and test "intelligent" products and processes that incorporate appropriate computing tools, sensors, and actuators.
- Be able to work efficiently in multidisciplinary teams.
- Practice professional and ethical responsibility, and, be aware of the impact of their designs on human-kind and the environment.

OUTCOMES:

Upon completion of the course the student will be able to:

- Employ the knowledge of mathematics, science, and engineering.
- Design and conduct experiments to evaluate the performance of a mechatronics system or component with respect to specifications, as well as to analyze and interpret data.
- Design mechatronics component, system or process to meet desired needs.
- Define and solve engineering problems.
- Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice.

UNIT-I

Introduction: Overview of the course, Examination and Evaluation patterns, History of Mechatronics, Scope and Significance of Mechatronics systems, elements of mechatronic systems, needs and benefits of mechatronics in manufacturing

UNIT-II

Sensors: classification of sensors basic working principles, Displacement Sensor - Linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders. Strain gauges. Force/Torque – Load cells. Temperature – Thermocouple, Bimetallic Strips, Thermistor, RTD

Accelerometers, Velocity sensors – Tachometers, Proximity and Range sensors – Eddy current sensor, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors – Photodiodes, phototransistors, Flow sensors – Ultrasonic sensor, laser Doppler anemometer tactile sensors – PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor

UNIT-III

Actuators: Electrical Actuators : Solenoids, relays, diodes, thyristors, triacs, BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Hydraulic & Pneumatic devices – Power supplies, valves, cylinder sequencing. Design of Hydraulic & Pneumatic circuits. Piezoelectric actuators, Shape memory alloys.

Basic System Models & Analysis: Modeling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems, Block diagram representations for these systems. Dynamic **Responses of System:** Transfer function, Modeling Dynamic systems, first order systems, second order systems.

UNIT-IV

Digital Electronics: Number systems, BCD codes and arithmetic, Gray codes, self-complimenting codes, Error detection and correction principles. Boolean functions using Karnaugh map, Design of combinational circuits, Design of arithmetic circuits. Design of Code converters, Encoders and decoders.

UNIT-V

Signal Conditioning: Operational amplifiers, inverting amplifier, differential amplifier, Protection, comparator, filters, Multiplexer, Pulse width Modulation Counters, decoders. Data acquisition – Quantizing theory, Analog to digital conversion, digital to analog conversion.

Controllers: Classification of control systems, Feedback, closed loop and open loop systems, Continuous and discrete processes, control modes, Two step Proportional, Derivative, Integral, PID controllers.

UNIT-VI

PLC Programming: PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming. Ladder Programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output. Application on real time industrial automation systems.

Case studies of Mechatronics systems: Pick and place robot, Bar code, Engine Management system, Washing machine etc.

TEXT BOOKS:

1. W. Bolton, “Mechatronics, 5 th edition, Addison Wesley Longman Ltd, 2010
2. Alciatore David G & Histand Michael B, “Introduction to Mechatronics and Measurement systems”, 4th edition, Tata McGraw Hill, 2006.

REFERENCE BOOKS/VIDEO:

1. Devdas Shetty & Richard Kolk “Mechatronics System Design”, 3rd edition. PWS Publishing, 2009.
2. http://video_demos.colostate.edu/mechatronics
3. http:// mechatronics.me.wisc.edu

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MECHANICAL ENGINEERING

IV B.Tech, II-Sem (ME)

T	C
1+2*	1

[A0343158] MODELLING & ANALYSIS

[Skill Development Course]

OBJECTIVE:

- To train the student to make use of ANSYS software package.

OUTCOME:

- Structural, thermal, Model and Dynamic analysis can be done using ANSYS software package

UNIT – I

FEA and ANSYS: What is FEA? Introduction about ANSYS – ANSYS basics & environment.

UNIT – II

General analysis procedure: Overview – preprocessing – applying element type – material properties – solution – applying loads – boundary conditions.

UNIT – III

Introduction to modeling in ANSYS: Direct generation – solid modeling – creating nodes – elements – fill between nodes – setting element attributes.

UNIT - IV

Advanced solid modeling: Using key points – lines – splines – arcs – using areas and volumes – concepts of line fillets – and area fillets – Boolean option.

UNIT –V

Meshing in ANSYS: Introduction to elements – 1D, 2D & 3D, quadrilateral elements – brick elements –tetrahedral elements – introduction to meshing – mapped and free mesh – control the mesh size.

UNIT – VI

Post processing – results – graphs – deflection – deformation – animation.

TEXT BOOKS:

1. Finite Element Analysis, SDC Publications.

LIST OF EXERCISES TO BE CARRIED OUT USING ANSYS SOFTWARE PACKAGE:

1. Uniform cross section bar subjected to axial load.
2. Variable cross section bar subjected to axial load.
3. Exercise on 2D truss – configuration 1.
4. Exercise on 2D truss – configuration 2.
5. Exercise on 2D truss – configuration 3.
6. Analysis of simply supported beam.
7. Analysis of cantilever beam.
8. One dimensional heat transfer through slab.
9. Heat transfer of hallow pipe with internal heat generation.
10. Analysis of composite wall.
11. Problems on model analysis.
12. Problems on buckling analysis.