FACULTY OF ENGINEERING

IASE Deemed University

Gandhi VidyaMandir

Sardarshahr (Rajasthan) – 331401

INDIA

Teaching and Examination Scheme and Syllabus

For

BACHELOR OF TECHNOLOGY

(Four-Year Full Time Degree Programme)

MECHANICAL ENGINEERING

2ND TO 4TH YEAR

(SEMESTER SCHEME)

Sessions 2015-16, 2016-17, 2017-18

RULES AND GUIDELINES FOR THE STUDENTS

1. **The Bachelor of Technology (Mechanical Engineering) course is a four year (Eight Semester) full time integrated degree programme**.
2. **THE PROGRAMME**

The Bachelor of Technology (mechanical Engineering) is a four year (Eight semesters) full time degree program .The course structure and program administration are as follows.

3. COURSE STRUCTURE

The four year, eight semester teaching consists of Theory (Lectures and Tutorials) and Practicals/Sessionals (Laboratory work, Engineering Graphics, Workshop Practice and Project etc.).Examination will be held at the end of the each semester. Details of these are given in the Teaching & Examination Scheme.

4. PROGRAMME ADMINISTRATION

4.1. Medium of Instruction

English shall be the medium of instruction and examination.

4.2. EVALUATION

(a) Each subject will be evaluated through a theory paper at the end of the semester carrying 80 marks along with continuous evaluation of sessional work, carrying 20 marks. The theory paper shall be of three hour duration. The sessional work will consist of continuous assessment of student's performance by teachers in tutorial classes, and class tests.

(b) Three class tests will be organized in each semester as per the scheme. The higher two out of the marks scored in the three tests will be considered for the sessional marks.

(c) Evaluation of laboratory practical work and Engineering Graphics (Drawing) will be through continuous assessment throughout the semester as well as examination at the end of the semester.

(d) At the end of the sixth semester the student will undergo practical training for a period of at least 45 working days in an industry / research organization related to his / her field of Study. At the end of the training, the student will submit its report to the Head of the Department within three weeks of the start of the seventh semester. The work of the practical training will be evaluated by a board of two teachers appointed by the Head of the Department. The later will counter sign the marks awarded by the board.

(e) Project: The project work will be carried out in the VII & VIII semester. The topic of the project will be approved by the Head of the Department and the entire project work will be carried out under the guidance of a teacher of the department approved as project supervisor by the Head of the Department. The nature of the project work will consist of varying proportions of designing, fabrication, testing and analysis of results. The project topic can also be taken from a live industrial problem. The report of the completed project shall be signed by the guide and submitted to the Head of the Department on or before the last working day of the eighth semester. The evaluation of the project will be done by a board consisting of two examiners.

5. Promotion

5.1 The maximum span period of a program is eight years from the date of registration in the program.

5.2 The minimum marks for passing the examination for each semester shall be 50% in each practical/ sessional, 40% in End Semester Examination of each theory paper, 50% in training and project, and 45% in the aggregate of all the subjects (theory, sessional and project) of the semester.

5.3 A student will be permitted to attend the classes of the fourth/sixth/eighth semesters immediately after the examination of the third/fifth/seventh semester's examination, as the case may be, provided he/she has appeared in the first/third/fifth/seventh semester examination, respectively.

5.4 To be eligible for promotion to the 5th semester of the program a student must have successfully cleared at least half of the total subjectsincluding practicals and sessionals of the third and fourth semesters taken together.

5.5 To be eligible for promotion to the 7th semester of the program a student must have successfully cleared at least half of the total subjects including practicals and sessionals of the fifth and sixth semesters taken together.

5.6 A student promoted to the third/fifth/seventh semesters, without having cleared all the papers, will have to appear and pass the backlog papers of the first/third/seventh semesters along with the regular examination of the first/third/fifth semesters and backlog papers of the second/fourth/sixth semesters along with the regular examination of the second/fourth/sixth semesters.

5.7 A candidate who has secured minimum marks to pass in each paper but has not secured the minimum marks required to pass in the aggregate for the semester concerned may take re-examination in not more than two papers to obtain the aggregate percentage required to pass the semester. The candidate will have to pay the requisite examination fee in order to be eligible for re- examination. In this case the marks secured by the candidate in the earlier examination in the paper concerned will be cancelled.

5.8 (a) Award of Division:

Securing 60% marks and above	- I st division
Securing 50% and above but below 60%	- II nd division
Securing 45% and above but below 50%	- pass

For first B.Tech to 3rdB.Tech the division will be decided based on the marks obtained in the respective class/ year.

(b) For the declaration of Final B.Tech result, marks will be totalled up as follows:

First B.Tech:	50% of the marks secured
Second B.Tech:	75% of the marks secured
Third B.Tech:	100% of the marks secured
Final B.Tech:	100% of the marks secured

(C) Award of Grade:

- **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.
- **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed courses (core, elective courses).
- **Course**: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course

may be designed to comprise lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/seminars/term papers/assignments/presentations/self-study etc. or a combination of some of these.

- **Credit Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.
- **Credit Point**: It is the product of grade point and number of credits for a course.
- **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
- **Cumulative Grade Point Average (CGPA)**: It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.
- **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.
- **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Letter Grade	% Scale	Grade Point
O (Outstanding)	Above 90%	10
A+(Excellent)	Above 75% to 90%	9
A(Very Good)	Above 65% to 75%	8
B+(Good)	Above 55% to 65%	7
B(Above Average)	Above 50% to 55%	6
C(Average)	Above 45% to 50%	5
P (Pass)	Above 40% to 45%	4
F(Fail)	Less than 40%	0
Ab (Absent)	0 %	0

- **Programme**: An educational programme leading to award of a Degree.
- **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.
- **Semester**: Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.
- **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

(d) A student who has secured 75% marks and above shall be declared to have passed in first division with honours. However, for this the student must have cleared successfully all the subjects in single attempt in the final year period of his/her study.

(e) Similarly, to be eligible for a gold medal on account of having secured first position, the student must have cleared all subjects in single attempt and passed them with first division.

5.9 For determining merit position of the candidates at the final year level the marks obtained by them in the second, third and final year as described above shall only be considered.

5.10 If a student (who has successfully completed the programme) wishes to reappear in one or more theory papers of the first, second, third, fourth, fifth, sixth, seventh or eighth semesters for the purpose of improving his/her marks, he/she will be permitted to do so on payment of requisite examination fee along with the regular examinations of that semester; however, the total number of such attempts shall not exceed four theory papers during the span period of the programme. For this his/her previous performance in the paper/papers concerned shall be treated as cancelled. The application for such reappearing/re-examination must be submitted before the next examination of the corresponding semester. However, such candidates shall not be considered for award of gold medal.

5.11 A student to be eligible for award of degree has to clear all papers offered during four-year programme within the span period of eight years.

6. LATERAL ENTRY

Students who have passed 3 year diploma examination from the Board of Technical Education, Rajasthan, or its equivalent with a minimum of 60% marks can be admitted to the Third Semester of the B. E. programme. However, they will be required to pass a course on Special Mathematics (BE300) for Diploma pass students. Students will have to pass this course before they are admitted to the seventh semester. However, the marks obtained in this course will not be counted for deciding the division of the student.

7. Attendance: All students are required to have 75% attendance in each subject and there must be 75% attendance of the student before he/she could be permitted to appear in the examination.

8. RULES FOR CHANGE OF BRANCH FOR THE STUDENTS OF III SEM. B.TECH/ B.E.:

I The faculty, on the basis of applications received from desirous students up to the date and time notified by the Director, will prepare a merit list of the students. The list will be prepared on the basis of overall merit of the I (Semester) result only and the applications for change of branch will be processed as per the merit list.

II Request for change from B.E. to B. Tech. programme or vice versa by any student will be considered only if, the candidate fulfills basic admission criteria for the desired programme and using the guidelines below:

If the candidate is eligible for change from B. Tech. to B.E. & vice-versa is found deficit in the course coverage of first and second semester, he will have to pass the deficit courses before the candidate is admitted to the seventh semester. However, the marks obtained in the deficit courses will not be added for deciding the division of the student.

ELIGIBILITY CRITERIA:

(a) The students must have passed the I Semester B.Tech./B.E Examination in all components in one attempt with at least 60% marks in aggregate. The student with back papers or whose result has not been declared will not be considered for change of branch.

(b) In case any student has applied for re-valuation/ re-totaling of his/her marks of I Semester B.Tech/B.E and the result has not been received till the time of change of branch, such a student will not be entitled for change of branch on the basis of his/her subsequently revised result.

PROCEDURE:

1) Applications in a specified format (developed by the faculty) for change of branch will be invited by the Director/Principal of the faculty on the basis of the result of I (Semester) B. Tech./ B.E in duplicate, upto the date notified by IASE University. One copy of each such application be sent to IASE University by that date.

2) The students would submit a photo copy of I (Semester) Examination mark sheet of that year along with the application. The student may give as many preferences as possible against the vacant seats in respective college.

3) A seat matrix shall be prepared by the faculty, as per the details of the vacant seats (admitted through direct admission) in the previous year.

4) Due to change of branch, the strength of student in any branch should not fall short of 75% of the enrolled students in that branch in that year. And under no circumstances, due to change of branch, the number of seats in a particular branch in a college shall exceed the sanctioned strength approved by the AICTE, for that batch.

5) All students who have applied for the change of branch in-time will be called for counseling by the admission council of the faculty and considered for change of branch as per merit, preference and availability of seat. However, at the time of the counseling, if any student wishes to withdraw his/her application he/she can do so by a written request. In case any student does not present himself/herself for counseling, his/her branch will be changed as per the preference mentioned in the application form, merit and availability of seat.

9. RULES FOR THE AWARD OF GRACE MARKS

A. **UNDER GRADUATE/ POST GRADUATE (MAIN/SUPPLYMENTARY EXAMINATIONS UNDER THE FACULTIES OF ENGINEERING & TECHNOLOGY.**

Grace marks to the extent of 1% of the aggregate marks prescribed for an examination will be awarded to a candidate failing in not more than 25% of the total number of theory papers, practicals, sessionals, dissertation, viva-voce and the aggregate, as the case may be in which minimum pass marks have been prescribed; provided the candidate passes the examination by the award of such Grace marks. For the purpose of determining the number of 25% of the papers, only such theory papers practicals, dissertation, viva-voce etc. would be considered, of which, the examination is conducted by the University.

N.B.:- If 1% of the aggregate marks or 25% of the papers works out in fraction, the same will be raised to the next whole number. For example, if the aggregate marks prescribed for the examination are 450, grace marks to the

extent of 5 will be awarded to the candidate, similarly, if 25% of the total papers is 3.2, the same will be raised to 4 papers which grace marks can be given.

GENERAL:-

- A candidate passes in a paper/ practical or the aggregate by the award of grace marks will be deemed to have obtained the necessary minimum for a pass in that paper/ practical or in the aggregate and shown in the marks sheet to have passed by grace. Grace marks will not be added to the marks obtained by a candidate from the examiners nor will the marks obtained by the candidate be subject to any deduction due to award of grace marks in any other paper/ practical or aggregate.
- If a candidate passes the examination but misses First or Second Division by one mark, his aggregate will be raised by one mark so as to entitle him for the first or second division, as the case may be. This one mark will be added to the paper in which he gets the least marks and also in the aggregate by showing +1 in the tabulation register below the marks actually obtained by the candidate. The marks entered in the marks-sheet will be inclusive of one grace mark and it will not be shown separately.
- Non appearance of a candidate in any paper will make him ineligible for grace marks. The place of a passed candidate in the examination list will, however be determined by the aggregate marks he secures from the examiners, and he will not, by the award of grace marks, become entitled to a higher division.
- Distinction won in any subject at the examination is not to be forfeited on the score that a candidate has secured grace to pass the examination.

Note: - The Grace marks will be awarded only, if candidate appears in all the papers prescribed for the examination.

TEACHING & EXAMINATION SCHEME

FOR B.TECH- FOUR YEAR (8 S EMESTER) FULL TIME DEGREE

B.TECH MECHANICAL ENGINEERING SECOND YEAR

SEMESTER: III

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME301	Mechanics of Solids	3	1	-	4	20	-	80	-	100
ME302	Materials Science & Engineering	3	-	-	3	20	-	80	-	100
ME303/303-P	Engineering Thermodynamics	3	1	2	5	20	30	80	20	150
ME304/304-P	Manufacturing Processes	3	-	3	4.5	20	30	80	20	150
ME305/305-P	Object Oriented Programming in c++	3	-	2	4	20	30	80	20	150
ME306	Advanced Engineering Mathematics	3	1	-	4	20	-	80	-	100
ME307-P	Machine Drawing	-	-	3	1.5	-	60	-	40	100
ME308-P	Material science and testing lab	-	-	2	1	-	60	-	40	100
ME308	Discipline & Extra Curricular Activities									50
	Total	17	3	12	27					1000

SEMESTER: IV

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME401/401-P	Design of Machine Elements-I	2	-	3	3.5	20	30	80	20	150
ME402/402-P	Thermal Engineering – I	3	1	3	5.5	20	30	80	20	150
ME403/403-P	Fluid Mechanics and machines	3	1	2	5	20	30	80	20	150
ME404	Machining & Machine Tools	3	-	-	3	20	-	80	-	100
ME405/405-P	Kinematics of Machines	3	1	2	5	20	30	80	20	150
ME406	Mechanical Measurements & Control	2	-	-	2	20	-	80	-	100
ME407/407-P	Electrical engineering / Electrical engineering & control lab	2	-	2	3	20	30	80	20	150
ME 407	Discipline & Extra Curricular Activity									50
	Total	18	3	12	27					1000

IA- Internal Assessment **T- Tutorial**

L- Lecture **P- Practical**

TEACHING & EXAMINATION SCHEME

FOR B.TECH- FOUR YEAR (8 SEMESTER) FULL TIME DEGREE

B.TECH MECHANICAL ENGINEERING THIRD YEAR

SEMESTER: V

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME501	Advanced Mechanics of Solids	3	1	-	4	20	-	80	-	100
ME502/502-P	Heat Transfer/ Heat Transfer lab	3	1	2	5	20	45	80	30	175
ME503	Fundamentals of Aerodynamics	3	1	-	4	20	-	80	-	100
ME504	Industrial Engg.- I	3	-	-	3	20	-	80	-	100
ME505/505-P	Dynamics of Machines/ Dynamics of Machines lab	3	-	2	4	20	45	80	30	175
ME506/506-P	Principles of Turbo machines/ Turbo machines lab	3	1	2	5	20	45	80	30	175
ME507-P	Matlab & Computer Graphics	-	-	2	1	-	45	-	30	75
ME508-P	Entrepreneurship Development	-	-	2	1	-	30	-	20	50
ME 509	Discipline & Extra Curricular Activity									50
	Total	18	4	10	27					1000

SEMESTER: VI

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME601/601-P	Design of M/c Elements – II/ Design of M/c Elements – II sessional	3	-	2	4	20	30	80	20	150
ME602/ 602-P	I.C. Engines & Diesel Power Plant/ I.C. Engines lab	3	-	2	4	20	30	80	20	150
ME603	Manufacturing Science & Technology	3	1	-	4	20	-	80	-	100
ME604/604-P	Vibration engineering / Vibration engineering lab	3	1	2/2	4.5	20	30	80	20	150
ME605	Fluid Machines & Hydroelectric Power Plant	3	1	-	4	20	-	80	-	100
ME606/606-P	Numerical Methods and Applied Statistics/ Computer Oriented Numerical Methods	3	1	2/2	4.5	20	30	80	20	150
ME607-P	Automobile Engg. Lab.	-	-	2	1	-	45	-	30	75
ME608-P	P.E. Lab.-I	-	-	2	1	-	45	-	30	75
ME 609	Discipline & Extra Curricular Activities									50
	Total	18	4	10	27					1000

IA- Internal Assessment **T- Tutorial**

L- Lecture **P- Practical**

TEACHING & EXAMINATION SCHEME

FOR B.TECH- FOUR YEAR (8 SEMESTER) FULL TIME DEGREE

B.TECH MECHANICAL ENGINEERING FOURTH YEAR

SEMESTER: VII

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME701/ 701-P	Computer Aided Design/ cad lab	3	1	2	5	20	30	80	20	150
ME702/702-P	Refrigeration & Air-conditioning	3	1	3	5.5	20	30	80	20	150
ME703	Operations Research	3	1	-	4	20	-	80	-	100
ME704	Steam Turbines & Steam Power Plant	3	-	-	3	20	-	80	-	100
ME705	Product Development and Launching	3	-	-	3	20	-	80	-	100
ME706.I	Robotics	3	-	-	3	20	-	80	-	100
ME706.II	Maintenance management									
ME706.III	CNC machine and programming									
ME707-P	P.E.Lab.- II	-	-	3	1.5	-	30	-	20	50
ME708-P	Practical Training and Industrial Visit	-	-	2	1	-	60	-	40	100
ME709-P	Project stage-I	-	-	2	1	-	60	-	40	100
ME 710	Discipline & Extra Curricular Activity									50
	Total	18	3	12	27					1000

SEMESTER:VIII

Subject Code	Course Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		T	P	T	P	
ME801	Renewable Energy Technology	3	1	-	4	20	-	80	-	100
ME802	Operations Management	3	1	-	4	20	-	80	-	100
ME803	Gas Turbines & Gas Power Plant	3	1	-	4	20	-	80	-	100
ME804.I	Computational Fluid flow & Heat Transfer	3	1	-	4	20	-	80	-	100
ME804.II	Mechatronics									
ME804.III	Design and manufacturing of plastic products									
ME805-P	CAM and Robotics Lab.	-	-	2	1	-	90	-	60	150
ME806-P	Industrial Engg. Lab	-	-	2	1	-	60	-	40	100
ME807	Seminar	-	-	2	1	-	60	-	40	100
ME808	Project stage-II	-	-	2	1	-	120	-	80	200
ME 809	Discipline & Extra Curricular Activity									50
	Total	12	4	08	20					1000

IA- Internal Assessment **T- Tutorial**

L- Lecture **P- Practical**

ME301: MECHANICS OF SOLIDS

UNIT	CONTENTS	CONTACT HOURS
I	Stress & strain: Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain relationship, Hooke's law and its applications; Elastic constants and their relations for a isotropic homogenous material, anisotropy & orthotropy, thermal stresses, composite bars; simple elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress-strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies.	8
II	flexural loads: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, Section modulus and transverse shear stress distribution in circular, hollow circular, I, box, T, angle-sections, etc.	8
III	Principal planes, stresses & strains: combined axial, bending & torsional loads, maximum normal and shear stresses; Concept of equivalent bending & equivalent twisting moments: Mohr's circle of stress & strain. Theories of elastic failures: The necessity for a theory, different theories, significance and comparison, applications.	8
IV	Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Stability of equilibrium: Instability & elastic stability. Long and short columns, ideal strut, Euler's formula for crippling load for columns of different end conditions, concept of equivalent length, eccentric loading of columns, Rankine formulae and other empirical relations	8
V	Transverse deflection of beams: Relation between deflection, bending moment, shear force and load,Transverse deflection of beams and shaft under static loading, area moment method, direct integrationmethod: method of superposition and conjugate beam method. Variational approach to determine deflection and stresses in beam.Elastic strain energy: Strain energy due to axial, bending and torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts.Castigliano's theorem. Maxwell's theorem of reciprocal deflections.	8

Text Books:	Reference Books:
• Bansal, R. K., "A Textbook of Strength of Materials Laxmi Publications	• Strength of Materials, Sadhu Singh, Khanna Publishers. • Mechanics of Material, B.C. Punmia, Jain and Jain, Laxmi Publications. • An Introduction to the Mechanics of Solids, Crandall, Dahl and Lardner, Tata McGraw Hill. • Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill. • Strength of Materials, Ryder G.H., Macmillan India.

ME302: MATERIALS SCIENCE AND ENGINEERING

UNIT	CONTENTS	CONTACT HOURS
I	Crystal structure; Space Lattice and constants; Miller Indices; Allotropy, Inter planer spacing Imperfections in crystals: Point defects, Line defects. Grain Boundary and its effect on properties of solids.	**8**
II	Mechanical properties and their measurements; Hardness and impact strength.: Mechanism of plastic deformation, role of dislocation; slip and twinning, slip planes; Elementary treatment of theory of work hardening ;Theories of Recrystlisation and grain growth, Elementary treatment of creep, Fatigue and fracture.	**8**
III	Solidification of metals and some typical alloys; Phase rule and equilibrium diagram of binary systems with insoluble, soluble and partially soluble systems; Relationship with structure and properties; Eutectic system, Iron Carbon alloys, Iron-Carbon equilibrium diagram. Phase transformations in steel; Austenite formation, transformation of austenite in to pearlite or mar tensite, TTT diagram.	**8**
IV	Detailed study of various heat treatment processes-hardening, annealing and tempering, normalizing hardenability; End quench test, surface and case hardening methods; Flame and induction methods, carburizing, nitriding, cyaniding and carbonitriding processes. Heat treatment furnaces, batch and continuous types; Defects in heat treatments, warpage, overheating and burning.	**8**
V	Engineering materials: Effects of alloying elements in steel; Plain carbon steels, Low and high alloy steels, Stainless steels, Tool steels and their heat treatment, Classification of steels, Brasses and bronzes, Aluminum base alloys, Bearing materials, Engineering ceramics, Composite materials and their applications (brief study).	**8**

Text Books:	**Reference Books:**
• Material Science, Raghvan V., Prentice Hall India.	• Material Science and Engineering An Introduction, William D.Callister, John Wiley and Sons. • Engineering Physical Metallurgy, Lakhtin Y., Mir Publisher. • Principles of Material Science and Engineering, William F.Smith, McGraw-Hill Publications. • Heat Treatment – Principles and Techniques, Rajan T.V., Sharma and Sharma, Prentice Hall of India. • The Structure, Properties and Heat treatment of Metals, Davies D.J. and Oelmann L.A., Pitman Books, London.

ME303: ENGINEERING THERMODYNAMICS

UNIT	CONTENTS	CONTACT HOURS
I	Basic Concept of Thermodynamics: Thermodynamic systems, control volume, Properties, state,processes and cycle, equality of temperature, Zeroth Law of thermodynamics, temperature scale, laws of perfect gas, Pure substances, vapour-Liquid –solid-phase equilibrium in pure substances,thermodynamic surface	8
II	Work and heat, Law of conservation of mass and energy, First law of thermodynamics, steady state Processes, Second law of thermodynamics, Heat engine, Carnot cycle, thermodynamic temperature scale, Entropy, change of entropy for different processes, Equivalence of Kelvin plank and Clausius statements, Clausius inequality.	8
III	Work and heat, Law of conservation of mass and energy, First law of thermodynamics, steady state Processes, Second law of thermodynamics, Heat engine, Carnot cycle, thermodynamic temperature scale, Entropy, change of entropy for different processes, Equivalence of Kelvin plank and Clausius statements, Clausius inequality.	8
IV	Air – standard power cycles: Brayton cycle, Otto cycle, diesel cycle, Dual cycle, Stirling cycle, Ericssion cycle and Atkinson cycle, Mean effective pressure and efficiencies, Four stroke petrol and diesel engines Two stroke petrol and diesel engines	8
V	Properties of steam, Phase change process, use of steam table & Molier chart. Rankine cycle, Reheat cycle, Regenerative cycle, cogeneration, vapour compression refrigeration cycle.	8

Text Books:	Reference Books:
• Nag P.K., Engineering Thermodynamics, Tata Mc-Graw Hill	• Engineering Thermodynamics, Chottopadhyay P., Oxford University Press. • Thermal Science & Engineering, Kumar D.S., S.K.Kataria & Sons • Engineering Thermodynamics, Nag P.K., Tata McGraw-Hill, New Delhi • Fundamentals of Classical Thermodynamics, Gordan J Van Wylen, Willey Eastern Ltd. • Engineering Thermodynamics, Cengel & Boles, Tata McGraw-Hill, New Delhi • Thermal Science & Engineering, M.L. mathur and F.S. Mehta,jain brothers, new delhi.

ME303-P ENGINEERING THERMODYNAMICS LAB

1	To study the rise in temperature of liquid due to external work.
2	Effect of reduction in temperature in a steam pressure vessel.
3	To study the expansion process using throttling devices.
4	To study the effect of mixing of two/three fluid streams having different flow rates and temperatures.
5	To study the different thermodynamic working fluid e.g. air, steam.
6	To study a Simple Steam Engine.
7	To study a Compound Steam Engine.
8	Performance and testing of surface steam condenser.
9	Study of Steam Turbines
10	Study of Reciprocating Compressor

ME304 MANUFACUTRING PROCESSES

UNIT	CONTENTS	CONTACT HOURS
I	Importance of manufacturing, economic and technological definition of manufacturing, survey of manufacturing processes. **Foundry Technology:** Patterns practices: Types of patterns, allowances and materials used for patterns, Moulding materials, Moulding sands; properties and sand testing; grain fineness number; moisture content, clay content and permeability test, core materials and core making, core print; core boxes, chaplets, Moulding practices**:** Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding.**Casting practices: S**and casting, Shell-Mould casting, plaster and ceramic moulds, investment casting, vacuum casting, Permanent mould casting, slush casting, pressure casting, die casting, centrifugal casting, continuous casting, squeeze casting, design of castings, Gating system ,elements riser design, use of chills. Melting furnaces-rotary, pit, electric, and cupola furnaces.	**8**
II	**Metal Joining Processes**: Principle of welding, soldering, brazing and adhesive bonding. Survey of welding and allied processes. Arc welding: power sources and consumables. Metal transfer(Elementry treatement only), Gas Metal Arc and Gas Tungsten Arc Welding, Gas welding and cutting; Processes and equipments. Resistance welding: principle and equipments; Spot, projection and seam welding processes. Atomic hydrogen, ultrasonic, plasma and laser beam welding, electron beam welding, friction and explosive welding, welding of C.I. and Al, welding defects. Electrodes and Electrode Coatings,Thermal spraying.	**8**
III	**Forming and Shaping Processes:** Metal working, elastic and plastic deformation, concept of strain hardening, hot and cold working, rolling, principle and operations, roll pass sequence, extrusion, wire and tube drawing processes. Forging: Methods of forging, forging hammerstand presses, principle of forging tool design (Elementary Treatment only), cold working processes- Shearing, drawing, squeezing,blanking, piercing, deep drawing, coining and embossing, metal working defects, cold heading,riveting, thread rolling, bending and forming operations.	**8**
IV	**Powder Metallurgy:** Powder manufacturing, mechanical pulverization, Electrolytic Process,chemical reduction, atomization, Characteristics of metal powders, compacting of powders sintering,Advantages and Engineering applications of Powder Metallurgy. **Rapid Prototyping Operations:** Introduction, subtractive processes, additive processes, Virtual Prototyping and applications	**8**
V	**Plastics Technology:** Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, transfer moulding, injection moulding, extrusion moulding, blow moulding, calendaring, thermoforming, slush moulding, laminating,Welding and Machining of Plastics.	**8**

Text Books:	Reference Books:
• Rao.P.N., Manufacturing Technology, Vol. 1&2 Tata McGraw Hill	• Manufacturing Process; John A. Schey, McGraw Hill Book Co. • A course in Workshop Technology; B. S. Raghuvanshi Dhanpat Rai • Material and Processes in Manufacturing; Degarmo, Black & Kohser Prantice Hall of India • Work shop technologyS.K. Hajra choudhary Vol. 1&2 • Manufacturing Processes; P. C. Sharma, S. Chand • Principles of Manufacturing of Materials & Processes; J. S. Campbell, Mc Graw Hill

ME304-P MANUFACUTRING PROCESSES LAB

	(a)Metal Cutting and Machine Tools
1	Study of lathe machine, lathe tools cutting speed, feed and depth of cut.
2	To perform step turning, knurling and chamfering on lathe machine as per drawing.
3	Taper turning by tailstock offset method as per drawing.
4	To cut metric thread as per drawing.
5	To perform square threading, drilling and taper turning by compound rest as per drawing.
6	To study shaper machine, its mechanism and calculate quick return ratio and preparing a job.
7	Study of Milling Machine and its cutters and preparing a job.
	(b)Foundry
1	To prepare mould of a given pattern requiring core and to cast it in aluminium.
2	Moisture test and clay content test.
3	Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).
4	Permeability Test.
5	A.F.S. Sieve analysis Test.

ME305 OBJECT ORIENTED PROGRAMMING IN C++

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to Object Oriented Programming: Basic concepts: Class, Object, Method, Message passing, Inheritance, Encapsulation, Abstraction, Polymorphism.	8
II	Basics of C++ Environment: Variables; Operators; Functions; user defined, passing by reference, passing an array to the function, inline function, scope, overloading; Pointers: objects and lvalue, arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions; Strings: String I/O, character functions in ctype.h, string functions in string.h.	8
III	Object oriented concepts using C++: Classes: Member functions, Friend functions, Constructors, Access functions, Private member functions, class destructor, static data and function members; Overloading: inline functions, this operator, overloading various types of operators, conversion operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance, protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes.	8
IV	Templates and Iterators: function and class templates, container classes, subclass templates, iterator classes; Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library.	8
V	Data Structures Using C++: Linked lists – Singly linked list, Doubly linked lists, Circular lists, Stacks and Queues priority Queues, Stacks, Queues.	8

Text Books:	Reference Books:
• Balaguruswamy E.: Object Oriented Programming in C++ , McGraw Hill Education (India)	• A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH, 1997. • S. B. Lippman & J. Lajoie, “C++ Primer”, 3rd Edition, Addison Wesley, 2000. • R. Lafore, “Object Oriented Programming using C++”, Galgotia Publications, 2004. • D . Parasons, “Object Oriented Programming with C++”, BPB Publication. • Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication. • Schildt Herbert, “C++: The Complete Reference”, 4th Ed., Tata McGraw Hill, 1999.

ME305-P OBJECT ORIENTED PROGRAMMING IN C++ LAB

	List of programs in C
1	Program for revising control statements, arrays and functions.
2	Program using string handling and various functions described in string.h, ctype.h.
3	Program using structures and sorting algorithm (Insertion, Selection, Quick, Heap sort) and functions described in math.h.
4	Program using file handling and related functions defined in stdio.h, io.h.
5	Program using pointers, array and pointers, pointers to structures, dynamic memory allocation.
	List of Programs in C++
6	Program using basic I/O and control statements.
7	Program using class, objects, objects as function parameters.
8	Program using functions and passing reference to a function, inline functions. Program using Inheritance and virtual base class.
9	Program using pointers, arrays, dynamic arrays. Program using functions defined in ctype.h and string.h.
10	Program using constructors, destructors. Program using function and operator over loading List of program in C++ implementing Data Structures
11	Creating and managing (add, delete, print, insert) nodes of a Linked list.
12	Creating and managing (create, pop, push etc.) stacks and queues.

ME306 ADVANCED ENGINEERING MATHEMATICS

UNIT	CONTENTS	CONTACT HOURS
I	Fourier series: Fourier series, Half-range series, Harmonic analysis. Integral Transforms: Fourier integral theorem, Fourier transforms, Convolution theorems, Inversion theorem for Fourier and Laplace transforms, Simple applications of these transforms to onedimensional problems.	8
II	Method of separation of variables – applications to the solution of wave equation in one dimension, laplace's equation in two dimensions, Diffusion equation in one dimension. Transform calculus : Laplace transform with its simple properties, applications to the solutions of ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation.	8
III	Complex Variable: Functions of a complex variable; Exponential, trigonometric, hyperbolic and logarithmic functions; Differentiation, Analytic functions, Cauchy-Riemann equations, conjugate functions; Application to two dimensional potential problems; Conformal transformations, Schwartz-Christoffel transformation; Cauchy's Integral theorem. Taylor's and Laurent's expansions; Branch points, zeros, poles and residues; Simple problems on contour integration	8
IV	Boundary Value Problems: Equations for vibrations of strings, heat flow and electrical transmission lines; Laplace's equation in Cartesian, cylindrical polar and spherical polar coordinates; Solution by separation of variables. Solution in Series: Differentiation and integration of infinite series, Series solution of differential equations; Bessel and Legendre equations, their series solution, elementary properties of Bessel functions and Legendre polynomials	8
V	Numerical Methods: Difference operators: forward, backward, central shift and average operators and relations between them. Newton Backward and Interpolation; Lagrange's interpolation and the error formula for interpolation. Numerical differentiation and integration. Trapezoidal rule and Simpson's one-third rule including error formula.	8

Text Books:	Reference Books:
• Y. N.Gaur and C.L. Koul , Advanced Engineering Mathematics, Jaipur	• Higher Engineering Mathematics; B. S. Grewal khana publication. • Numerical Methods;Jain & Iyenger • Integral Transform;Gokhroo & Saini

ME307-P MACHINE DRAWING

1	Review of sectioning, Review of BIS Standard (SP 46), Fasteners – screws, bolts and nuts, riveted joints, pins, locking devices, welded joints, pipe joints, unions and valves. Assemblies involving machine elements like shafts, couplings, bearing, pulleys, gears, belts, brackets. Tool drawings including jigs and fixtures. Engine mechanisms-assembly and disassembly. Production drawings - limits, fits and tolerances, dimensional and geometric tolerances, surface finish symbols. Layout drawings. Schematics, process and instrumentation diagrams, piping drawings. Structural drawings - examples for reading and interpretation. Computer aided design and use of software packages for engineering Drawings
2	**Assembly Drawing with sectioning and bill of materials** Universal Coupling, Forming punch and die, Jigs for inspecting shaft etc.(1 drawing sheet of any assembly) Lathe tail stock, shaper tool head, steam stop valve, feed check-valve, swivel machine vice etc (1 drawing sheet of any assembly)
3	**Detailed part drawings from assembly drawing** indicating fits, tolerances and surface finish symbols by referring BIS codes (1 drawing sheet) Check-valve, Junction Valve etc.
4	**Free Hand Sketches**: Connecting rod, crank shaft, Pipes and Pipe fittings, machine arbor and cutter, universal dividing head, jigs and fixtures, Step less drive, sliding gear box, safety valve, three way stop valve, blow-off cock, Swivel bearing, Turret Tool Post, drill-press vice, screw jack

ME 308-P MATERIAL SCIENCE AND TESTING LAB.

1	(a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids. **(c)** Material identification of, say, 50 common items kept in a box.
2	Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.
3	Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
4	Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
5	Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.
6	To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading
7	To determine Rockwell/ Vickers/Brinell hardness of a given material
8	To perform Impact test on a given material and to determine its resilience.
9	To study and perform Fatigue test on a given material and to determine fatigue strength of the material
10	To perform Bending test and to determine the Young's Modulus of Elasticity via deflection of beam.
11	Creep testing on creep testing machine

ME401 Design of Machine Elements-I sessional

UNIT	CONTENTS	CONTACT HOURS
I	Materials: Properties and IS coding of various materials, Selection of material from properties and economic aspects. Manufacturing aspects in Design: Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing.	8
II	Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of ignorance): Stress concentration. Causes and mitigation. Introduction of various design considerations like strength, stiffness, weight, cost, space, etc. Concept of fatigue failures. Design of machine elements Course Titleed to direct stresses, Pin, cotter and keyed joints, Design ofscrew fastening.	8
III	Design of members in Bending: Beams, levers and laminated springs.	8
IV	Design of members in torsion : Shafts and shaft couplings.	8
V	Design of shafts, brackets under combined stresses, Calculation of transverse and torsional deflections. Screw fasteners Course Titleed to eccentric loading.	8

Text Books:	Reference Books:
• Bhandari, V. B., Introduction to Machine Design, McGraw Hill Education (India)	• Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors. • Machine Design, Sharma and Aggarwal, S.K.Kataria and Sons, Delhi. • Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill. • Design of Machine Elements, Sharma and Purohit, Prentice Hall India. • Machine Design, Kulkarni S. G., Tata McGraw • A Text Book of Machine Design, Karwa A., Laxmi Publications. • Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.

ME401-P Design of Machine Elements-I Seasonal

1	Selection of material & IS coding
2	Selecting fit & assigning tolerances
3	Examples of Production considerations.
Problems on	
5	Knuckle and Cotter joints
6	Torque : Keyed joints and shaft couplings
7	Design of screw fastening
8	Bending : Beams, Levers etc.
9	Combined stresses : Shafts, brackets, eccentric loading.
10	Design for rigidity (Transverse / Torsional)

ME402 THERMAL ENGINEERING-I

UNIT	CONTENTS	CONTACT HOURS
I	I.C. Engines: Modern carburetors, fuel pump, injector. Study of cooling, lubrication and ignition system in diesel and petrol engines. Engine Performance and Testing: Indicators, Various efficiencies, Morse test and Willans line, torque and mean effective pressure, performance and heat balance sheet, measurement of volumetric efficiency. Effect of atmospheric condition on performance, high altitude problems, supercharging.	8
II	Boilers Testing: Testing of boilers, heat balance sheet Boiler Draught: Natural draught, height of chimney, artificial draught. Condensors: Types, calculations involving efficiency and cooling water requirement. Capacity of air pump with and without air cooling section. Cooling of circulating water; spray pond and cooling tower.	8
III	Steam nozzles: Steam flow through nozzles, type of nozzles, critical pressure, throat and exit areas for optimum discharge, friction effect. Effect of back pressure. Super saturation phenomenon. Steam injectors.	8
IV	Steam Turbines: Types and classification. Construction details of components; nozzles, blades and their attachment methods, Labyrinth packing. Impulse and reaction turbines, methods of reducing rotor speeds. Velocity diagrams, stage and other efficiencies, condition for maximum efficiency of a single stage turbine, reheat factor, regenerative feed heating (bleeding). Principles of speed governing and emergency governor. Introduction to mixed pressure, back pressure turbines and binary vapour cycle.	8
V	Reciprocating Air Compressors: Single stage compressor working, work done, volumetric and isothermal efficiencies. Muti-stage air compressor; condition for maximum efficiency and work done.	8

Text Books:	Reference Books:
• Thermal Science & Engineering, Kumar D.S., S.K.Kataria & Sons • Engineering Thermodynamics, Nag P.K., Tata McGraw-Hill, New Delhi	• Engineering Thermodynamics, Chottopadhyay P., Oxford University Press. • Fundamentals of Classical Thermodynamics, Gordan J Van Wylen, Willey Eastern Ltd. • Engineering Thermodynamics, Cengel & Boles, Tata McGraw-Hill, New Delhi.

ME402-P THERMAL ENGINEERING LAB. – I

1	Disassembling and assembling of major sub-assemblies of multi-cylinder petrol or diesel engines and study of their parts.
2	To disassemble and assemble a 2-stroke petrol engine.
3	Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.
4	Study of a modern carburettor and MPFI system and disassembling and assembling of their Parts.
5	To calculate valve timing of a multi-cylinder petrol engine and valve tappets Adjustment.
6	Disassemble all the parts of a fuel injection pump and study of its.
7	To disassemble the governor and study its various parts.

ME 403 FLUID MECHANICS

UNIT	CONTENTS	CONTACT HOURS
I	Basic Definitions and Fluid Properties ; Definition of Fluid, Incompressible and compressible fluids, Fluid as a continuum, Mass, Density, specific weight, relative density, specific volume, Bulk modulus, velocity of sound Ideal fluid Viscosity. Newtonian and Non - Newtonian fluid, Kinematic viscosity, Effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation. Fluid Statics : General differential equation, Hydrostatics Manometry, Fluid forces on submerged surfaces. Curved surfaces, Aerostatics, Isothermal atmosphere, polytropic atmosphere. The international standard atmosphere, static stability submerged bodies. Floating bodies.	8
II	Kinematics and conservation of Mass : Flow classifications. Fluid velocity and acceleration, streamlines and the stream function. Pathlines and streak lines. Deformation of a fluid element, verticity and circulation. Irrotational and Rotational flow. Flownet, Laplace equation. Conservation of mass and the continuity equation for three dimensions. Fluid Momentum : The Momentum theorem Applications of the momentum theorem Equation of motion, Euler's equation of motion Integration of Euler's equation of motion. Bernoulli's equation. Applications of Bernoulli's Pitot tube, Equation of motion for Viscous fluid, Navier Stoke's equation.	8
III	Orifice discharging free, Jet, vena contracts, coefficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires. Flow Through Pipes : Reynold's experiment Darcy's Weisback equation. Loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of power through pipes.	8
IV	Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plain Poiseuille flow and Coutte flow. Turbulent Flow; Variation of friction factor with Reynolds number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, rough pipes. The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.	8
V	The Boundary Layer: Description of the boundary layer. Boundary Layer thickness, boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients. Approximate momentum analysis laminar boundary, Aerofoils Theory. Flow round a body ; Drag, skin friction drag, pressure drag, combined skin friction and pressure drag (profile drag) wave drag, lift induced drag. Flow past sphere and cylinder.	8

Text Books:	Reference Books:
• Fluid Mechanics and Fluid Power Engineering; D. S. Kumar; S. K. Kataria & Sons.	• Engineering Fluid Mechanics; K. L. Kumar, Eurasia Publishing House, New Delhi • Fluid Mechanics and Heat Transfer; M. L. Mathur & Mehta, Jain Brothers, New Delhi • Yunus A. Cengel and Cimbala, Fluid Mechanics, Tata McGrawHill,

ME 403-P FLUID MECHANICS LAB

1	Determine Metacentric height of a given body.
2	Determine Cd, Cv & Cc for given orifice.
3	Determine flow rate of water by V-notch
4	Determine velocity of water by pitot tube.
5	Verify Bernoulli's theorem.
6	Determine flow rate of air by Venturi meter
7	Determine flow rate of air by orifice meter
8	Determine head loss of given length of pipe.
9	Determine flow rate of air by nozzle meter.
10	Study of Pelton, Kaplan Turbine models.

ME404 MACHINING AND MACHINE TOOLS

UNIT	CONTENTS	CONTACT HOURS
I	Classification of metal removal processes and machines Mechanics of metal cutting: Geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS, NRS and interrelationships. Mechanism of chip formation and types of chips, chip breakers. Orthogonal and oblique cutting, cutting forces, theories of metal cutting. Power requirements Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting.	8
II	Machinability: mechanisms of tool failure, tool life and cutting parameters, machinability, machinability index, factors affecting machinability. Cutting fluids: Types, properties, selection and application methods, General Purpose Machine Tools: Classification and constructional details of lathe, drilling, milling, shaping and planning machines. Tooling, attachments and operations performed selection of cutting parameters, calculation of forces and time for machining. Broaching operation.	8
III	Machine Tools: semi Automatic lathes, capstan and turret lathe. Swiss type automatic, operational planning and tool layout, sequence of operations. Tracer attachment in Machine Tools: mechanical-copying machines; Hydraulic Tracing Devices; Electric Tracing systems; Abrasive machining processes: Abrasives; natural and synthetic, manufacturing, nomenclature. Selection of grinding wheels, wheel mounting and dressing and turning. Surface and cylindrical grinding machine, their constructional feature details and processes. Surface finishing: Honing, lapping, superfinishing, polishing, buffing and Abrasive blasting processes.	8
IV	Thread Manufacturing: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling; thread grinding. Gear Manufacturing Processes: hot rolling; stamping; powder metallurgy and extruding. Geargenerating processes: gear hobbling and gear shaping. Gear finishing processes; shaving, grinding, lapping; Gear testing.	8
V	High Velocity Forming Methods (High-energy rate forming processes): Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming. Industrial Safety: Human factor in machine equipment safety; reducing industrial noise; precautions to be taken by operators for safe working on machine tools.	8

Text Books:	Reference Books:
• Production Engg. Sciences; P. C. Pandey, C. K . Singh	• Manufacturing Science, Amitabh Ghosh & A. K. Malik, Affiliated East West Press, New Delhi • Rao. P.N., Manufacturing Technology, Vol. 1,2 and 3, Tata McGraw Hill • Manufacturing Technology Metal Cutting and M/C Tools, P. N. Rao, Tata Mc. Graw Hill • Production technology, O.P. Khana, dhanpat rai publication, new delhi. • Production technology, R.K. jain, khana publication, new delhi.

ME405 KINEMATICS OF MACHINES

UNIT	CONTENTS	CONTACT HOURS
I	Kinematics: Elements, pairs , mechanisms, four bar chain and its inversions, velocity and acceleration, Klein's construction, coriolis component, instantaneous center method, synthesis of mechanisms, panto - graph, scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms.	8
II	Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hookes joint. Power transmission: Belts and ropes, effect of centrifugal force, creep, chain drive.	8
III	Friction: Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane and screw jack, pivots, bearing, clutches. Theory of film lubrication.	8
IV	Brakes and dynamometers: Band, block and band & block brakes, braking action, absorption and transmission type dynamometers, rope and hydraulic dynamometers, braking system of automobiles.	8
V	Cams: Type of cams, displacement, velocity and acceleration curves for different cam followers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.	8

Text Books:	Reference Books:
• Rattan, S.S., "Theory of Machines", 2nd Ed., Tata McGraw Hill	• Norton Dynamics of Machinery McGraw-Hill, • Theory of Machines, Thomas Bevan, Pearson Education. • Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press. • . Mechanism and Machine Theory, Ambekar A. G., Prentice-hall Of India • Theory of Mechanisms and Machines, Ghosh A., Affiliated East West Press.

ME405-P KINEMATICS OF MACHINES LAB

1	To study inversion of four bar chain
2	Coupling Rod
3	Beam Engine
4	Steering Mechanism (a) Study of quick return mechanism.(crank and Slotted lever mechanism.) (b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism.
5	Study of inversion of Double slider chain Oldhum Coupling Scotch Yoke Elliptical Trammel
6	To plot displacement v/s curve for various
7	Study of various cam- follower arrangements.
8	To determine coefficient of friction.
9	Study of various types of dynamometers, Brakes and Clutches.
10	To determine moment of inertia of the given object using Trifler suspension.

ME406 MECHANICAL MEASURMENTS & CONTROL

UNIT	CONTENTS	CONTACT HOURS
I	Configuration, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response. Strain Measurement : Electric Strain Gauges - Types ; Selection and Installation, Strain gauge circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts, Load Cells, Mechanical and Optical Strain Gauges.	8
II	Various Mechanical, Electro- Mechanical & Photoelectric Sensors for sensing of Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range, flow, level of fluid , pressure, angular speed, voltage, frequency and current.	8
III	Introduction to Multi-Channel Data-Acquisition System, Measurement Pods, Interface Hardware, Data Analysis Software, Interfacing. Concepts and examples of automatic control systems, Representation systems by differential equations, transfer function, open loop and feed back control systems, signal flow graphs and, block diagram reduction techniques. Control System components, error sensing devices and servo motors.	8
IV	Control for mechanical systems & processes ; speed control system for steam/gas turbines. Aconstant tension ;reeling system, Electro-mechanical systems. Thermal systems, Pneumatic systems; Mathematical Models of physical systems, Feed back characteristics of Control Systems.	8
V	Time response analysis; transient response analysis, time response specifications, steady state-error. Concepts of stability, Routh-Hurwiz stability criterion, relative stability. Root locus technique. Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logrithmic plots. Nyquist stability criterion.	8

Text Books:	Reference Books:
• Control System, Gopal M., Tata McGraw Hill New Delhi.	• Mechanical Measurement, Beckwith, Pearson Education. • Experimental Methods for Engineers, Holman, McGraw Hill Publication. • Mechanical Engineering Measurement, Sahwney A.R., Dhanpat Rai and Sons. • Modern Control Engineering, Ogata, Pearson Education India. • Control System, Gopal M., Tata McGraw Hill New Delhi. • Mechanical Measurement and Instrumentation, Rajput R.K., S.K.Kataria and Sons.

ME407 ELECTRICAL ENGINEERING

UNIT	CONTENTS	CONTACT HOURS
I	**DC Generators:** Introduction, construction, types, emf equation, lap and wave windings, armature reaction, commutation. Demagnetizing and cross magnetizing ampere turns, various characteristics of shunt, series and compound generators, voltage build up, losses and efficiency, condition for maximum efficiency.	**8**
II	**DC Motors:** Introduction, principals, back-emf, torque of motor, types, characteristics of shunt, series and compound motors, speed control (field and armature control methods), basic idea of solid state devices in controlling of DC motors. Starting of DC motors, three point and four point starters, losses and efficiency, Applications.	**8**
III	**Single Phase Induction Motor:** Introduction, construction, principal, double revolving field theory, equivalent circuit, performance calculations, starting methods, and their types, torque slip characteristics of various types.	**8**
IV	**Polyphase Induction Motor**: Introduction. Construction, cage and wound rotors, principal, starting and running torque, condition for maximum torque, equivalent circuits, no load and block rotor test. Torque-slip characteristics, losses and efficiency, circle diagram, starting of cage and wound motors, speed control, cogging and crawling, double cage rotor, induction generator, application.	**8**
V	**Synchronous Motors:** Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics,Applications	**8**

Text Books:	Reference Books:
• A. E. Fitzgerald, C. Kingsley Jr and Umans, Electric Machinery, 6th Edition McGraw Hill, International Student Edition. 2002 • Kothari &Nagrath, Electric Machines, 3/e, TMH 2004	• M. G. Say, The Performance and Design of AC machines, Pit man & Sons. 2003 • Guru, Electric Machinery, 3e, Oxford 2000 • R. K. Srivastava, Electrical Machines, Cengage Learning. 2013 • P. S. Bimbhra, Electrical Machinery, Khanna Pub. 1995 • Stephen J Chapman, Electric Machinery Fundamentals, McGraw-Hill 2001 • Husain Ashfaq, Electrical Machines, DhanpatRai& Sons 2013

ME407-P ELECTRICAL ENGINEERING

1	Speed control of D.C. shunt motor by Field current control method & plot the curve for speed verses field current.
2	Speed control of D.C. shunt motor by Armature voltage control method & plot the curve for speed verses armature voltage.
3	To plot the O.C.C. &S.C.C. of an alternator and to determine its Zs, Xdandregulation by synchronous impedance method.
4	To plot the V-curve for a synchronous motor for different values of loads.
5	To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of its equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv)p.f. (v) Efficiency.
6	To Plot V-Curve and inverted V-Curve of synchronous motor.

ME 501 ADVANCED MECHANICS OF SOLIDS

UNIT	CONTENTS	CONTACT HOURS
I	Analysis of stress in 3-Dimensions: Body force, surface force and stress vectors, state of stress at a point, normal shear stress components, stress component on arbitrary plane, principal stresses in 3-Dimentions, stress invariants, decomposition of stress matrix into hydrostatic and pure shear states, Lame's stress ellipsoid, differential equations of equilibrium.	**8**
II	Analysis of strain in 3-Dimensions: introduction, deformation in neighbourhood of a point, change of length of linear element, state of strain at a point, principal axes of strain and principal strains, compatibility conditions.	**8**
III	Stress strain relations for linearity elastic bodies, generalized Hooke's law, stress-strain relations for anisotropic, orthotropic and isotropic materials.	**8**
IV	Bending of curved beams (Winkler-Bach formula); unsymmetrical bending of beams, shear centre.	**8**
V	Stresses in thick cylinders, shrink fit stresses, stresses in rotating discs.	**8**

Text Books:	**Reference Books:**
• Solid Mechanics, Kazimi S.M.A., Tata McGraw Hill • Introduction to Solid Mechanics, Shames and Pitarresi, Prentice Hall India.	• Advance Mechanics of Solids, Srinath L.S., Tata McGraw Hill. • Theory of Elasticity, Timoshenko and Goodier, McGraw Hill. • Mechanics of Solid, Singh A.K., Prentice Hall India

ME 502 HEAT TRANSFER

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. **Conduction :** General 3-Dimensoinal conduction equation in Cartesian , cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential ; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.	**8**
II	Heat transfer from finned surfaces; fin efficiency and effectiveness, two dimensional steady state heat conduction using analytical and numerical methods, periodic heat conduction. Convection: review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.	**8**
III	**Natural convection:** Dimensional analysis, Granhoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations. **Heat transfer with change of phase** : nature of vaporization phenomena; different regimes of boiling heat transfer; correlations fo r saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.	**8**
IV	**Heat exchanger:** Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.	**8**
V	**Thermal Radiation:** Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.	**8**

Text Books:	Reference Books:
• Heat Transfer, Holman J.P., Tata McGraw-Hill, New Delhi. • Heat and Mass Transfer, Kumar D.S., Kataria and Sons.	• Heat and Mass Transfer, Cengel, Tata McGraw-Hill, New Delhi. • Heat Transfer, Sharma and Lal, Vardhan Publisher Jaipur. • Heat and Mass Transfer, Nag P.K., Tata McGraw-Hill, New Delhi. • Fundamental of Heat and Mass Transfer, Thirumaleshwar M., Pearson Education. • Heat Transfer, Rajput R.K., S. Chand Publication

ME 502-P HEAT TRANSFER LAB

	EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1	To Determine Thermal Conductivity of Insulating Powders.
2	To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3	To Measure the thermal Conductivity of Liquid.
4	To determine the transfer Rate & Temperature Distribution for a Pin Fin.
5	To Measure the Emmissivity of the Test plate Surface.
6	To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
7	To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection
8	Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
9	To Determine Critical Heat Flux in Saturated Pool Boiling.
10	To Study Performance of Simple Heat Pipes.
11	To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
12	To Find the Heat transfer Coefficient in Forced Convection in a tube.
13	To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
14	To find out the thermal conductivity of given slab material.
15	To determine the individual thermal conductivity of different lagging in a lagged pipe.
16	To study the rates of heat transfer for different materials and geometries
17	To understand the importance and validity of engineering assumptions through the lumped heat capacity method.
18	Testing and performance of different heat insulators.

ME 503 FUNDAMENTALS OF AERODYNAMICS

UNIT	CONTENTS	CONTACT HOURS
I	Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an aerofoil, nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta condition, Kelvin's circulation theorem.	8
II	Blade theory; Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift and drag, cascade nomenclature, turbine cascade nomenclature, cascade lift and drag coefficient.	8
III	Isentroic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge; choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.	8
IV	Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow ; Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.	8
V	Normal Shock: Plane stationary normal shock; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.	8

Text Books:	Reference Books:
• Fundamentals of Aerodynamics, Anderson, McGraw Hill Publication • Fundamentals of Aerodynamics, Sharma and Lal, Vardhan Publisher	• Aerodynamics for Engineers, John J. Bertin, Prentice Hall of India • Theory of Wing Section, Abbott and Doenhoff, Dover Publication. • Fundamental of Compressible Flow, Yaha S.M., New Age International. • Gas Dynamics, John and Keith, Prentice Hall of India. • Applied Gas Dynamic, Radhakrishnan E., John Willey and Sons.

ME 504 INDUSTRIAL ENGINEERING

UNIT	CONTENTS	CONTACT HOURS
I	Management Theory and Functions: Evolution of management, scientific management, Contribution to scientific management: Reactions and criticisms of Taylor, Fayol, Mayo, Levels of 'Management Administration and Management, functions of management. Decision-making	8
II	Business Forms and Organization: Forms of Business:(i)Single proprietorship (ii) Partnership (iii) Joint stock company (iv) Private Ltd- Companies and public limited companies Forming Joint Stock Companies (a) Registration (b) issue of Prospectus (c) Commencement Certificate (iv) co-operative Society choice of Business forms (v) State undertaking. Organization meaning. Types of organization; (i) Line organization (ii) Functional Organization (iii) Line Staff organization (iv) Line Staff Committee organization, span of control.	8
III	Finance & Financial Statements: Introduction, Needs of Finance, Kinds of Capital Sources of fixed capital, Shares - (i) Ordinary Shares (ii) Preference Shares. Borrow capital. Surplus profits. Sources of Working capital. Management of working capital. Financial Institutions. Profit & Loss Statement, Balance Sheet, Financial ratio: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio.	8
IV	Interest and Depreciation: interest meaning, Compound interest. Annuities capital Annuity present worth annuity sinking funds annuity compound Amount Annuity Nominal andeffective rate of interest. Depreciation Meaning and causes. Need of Depreciation calculation, Methods of Depreciation. Straight line Methods. Sinking funds methods. Declining Balance Method, sum of years digits method (Syd Method)	8
V	Labour relations and legislation: Profit sharing, fringe benefits etc.Trade Unions. Methods of setting disputes (i) Collective bargaining (ii) Conciliation (iii) Mediation (iv) Arbitration industrial disputes in India, Machinery for setting disputes. Trade Disputes Acts. The factory Act 1944, payment of wages act. Workman's compensation act.	8

Text Books:	Reference Books:
• Dexter S. Kimball, Principles of Industrial Organization, Read Books.	• Introduction to Work Study, George Kanawaty, ILO. • Prasad, L.M., Principles and practice of Management, Sultan Chand & Sons. • Sushil Kumar Basu, K. C. Sahu, N. K. Datta, Works Organisation & Management, Oxford & IBH. • Leon Pratt Alford, Henry Russell Beatty, Principles of Industrial Management, Revised Edition, Ronald Press Co. • Essentials of Industrial Management, McGraw-Hill • Industrial organization and management series, Lawrence L. Bethel, McGraw-Hill. • Riggs, J.L., Bedworth, D.J., Randhawa, S.U., Engineering Economics, Tata McGraw-Hill.

ME 505 DYNAMICS OF MACHINES

UNIT	CONTENTS	CONTACT HOURS
I	Governors: Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects.	8
II	Gyroscope: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels. Inertia force analysis: Velocity andacceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel.	8
III	Gears: Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears.	8
IV	Gear trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.	8
V	Balancing: Balancing of rotating masses, balancing of reciprocating masses, locomotives, IC engines, balancing machines.	8

Text Books:	Reference Books:
• Theory of Machines, Abdulla Shariff, Dhanpat Rai Publications.	• Theory of Machines, Thomas Bevan, Pearson Education. • Mechanism And Machine Theory, Ambekar A. G., Prentice-hall Of India • Theory of Mechanisms and Machines, Sharma and Purohit, Prentice-hall Of India • Theory of Mechanisms and Machines, Ghosh A., Affiliated East West Press. • Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press. • Rattan, S.S., "Theory of Machines", 2nd Ed., Tata McGraw Hill

ME 505-P DYNAMICS OF MACHINES LAB

1	To verify the relation T=I for gyroscope. p
2	To plot force vs. radius and lift vs. speed curves for governors.
3	To plot pressure distribution curves on a journal bearing.
4	To perform wheel balancing.
5	To perform static and dynamic balancing on balancing set up
6	To determine mass moment of inertia of a flywheel.
7	Study of a lathe gear box.
8	Study of a sliding mesh automobile gear box.
9	Study of a planetary gear box.

ME 506 PRINCIPLES OF TURBOMACHINES

UNIT	CONTENTS	CONTACT HOURS
I	Basic concepts of turbomachines: Definition of Turbomachine, classification; Basic laws and governing equations; continuity equation, steady flow energy equation (1 law of thermodynamics), 2nd law of thermodynamics applied to turbomachines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation, dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed; Range of 'specific speeds for various turbomachines. Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate parameter and speed parameter.	8
II	Centrifugal pumps: Main parts, work done and velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting speed, net positive suction head, performance curve.	8
III	Axial flow pumps; Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation	8
IV	Centrifugal compressors and fans: Components and description, velocity diagrams, slip , energy transfer, power input factor, stage pressure rise and loading coefficient, pressurecoefficient, degree of reaction. Centrifugal compressor characteristic, surging, rotating Stall and Choking.	8
V	Axial flow compressors and fans: Basic constructional features; turbine v/s compressor blades; Advantages of axial flow compressors, working principle, velocity triangle,elementarytheory; stage work, work done factor, stage loading, degree of reaction; vortex theory; simple design calculations; introduction to blade design; cascade test; compressibility effects; operating characteristics.	8

Text Books:	Reference Books:
• Principle of Turbo Machinery, Turton R.K., Springer Publication.	• Gas Turbine Theory, Cohen and Roger, Pearson Education. • Turbo Machinery Basic Theory and Application, Logan E.J. • Principles of Turbo Machinery, Shepherd Dennis G., Mac Millan Publisher, New York. • TurboMachines, A Valan Arasu, Vikas Publishing House Pvt. Ltd. • Fundamentals of Turbo Machinery, William W., John Wiley and Sons.

ME 506-P TURBOMACHINERY LAB

1	Determination of Mechanical and volumetric efficiency of Reciprocating Air Compressor.
2	Testing of Reciprocating Air Compressor.
3	Determination of efficiency and Pressure distribution of Axial Flow Compressor.
4	Performance testing of Axial Flow Compressor.
5	Study and Performance of Simple Steam Turbine
6	Performance characteristics of Pelton wheel turbine.
7	Performance characteristics of Francis turbine.
8	Performance characteristics of Kaplan turbine.
9	Performance characteristics of variable speed centrifugal pump
10	Performance characteristics of rated speed centrifugal pump.
11	Performance characteristics of multistage centrifugal pump.

ME 507-P MATLAB AND COMPUTER GRAPHICS

(A)	MATLAB: Use of MATLAB and its application to Mechanical Engineering problems
(B)	Turbo C Graphics: To make C programs to animate different mechanisms and system: Such as Slider Crank Mechanism, Quick Return Mechanism, Cam Follower, Solar system, ball motion in billiard, Rolling of wheel from inclined plane, Seesaw motion, Projectile motion of a wheel, etc.

ME 508-P ENTREPRENEURSHIP DEVELOPMENT

1.	Definition of entrepreneur, qualities of a successful entrepreneur, Charms of being an entrepreneur, achievement- motivation, leadership and entrepreneurial competencies.
2.	Decision-making, procedures and formalities for starting own business, financial support system.
3.	Identification and selection of business opportunities and market survey, business plan. Implementation and customer satisfaction.
4.	Business crises, problem-solving attitude, communication skill. Government policies for entrepreneurs.
5.	Knowledge based enterprises, Scope of entrepreneur in present context, area of future entrepreneurship.
6.	Marketing & Sales Promotion, Techno-Economic Feasibility Assessment by Preparation of Preliminary & Detailed project report.

ME 601 DESIGN OF MACHINE ELEMENTS- II

UNIT	CONTENTS	CONTACT HOURS
I	Fatigue Considerations in Design: Variable load, loading pattern, Endurance stresses, influence of size, surface finish, notch sensitivity & stress concentration. Goodman line, Soderberg, Design of machine members Course Titleed to combined, steady and alternating stresses. Design for finite life. Design of Shafts under Variable Stresses	8
II	Pre loading of bolts; effect of initial tension & applied loads, Bolts Course Titleed to variable stresses. Design of members which are curved like crane hook, body of C-clamp, machine frame etc. Power screws like lead screw, screw jack.	8
III	Design of helical compression, tension, torsional springs. Springs under variable stresses. Design of belt, rope and pulley drive system, selection of chain & sprocket drive systems.	8
IV	Design of gear teeth, Lewis and Buckingham equations; wear and dynamic load considerations, Design and force analysis of spur, helical, bevel and worm gears. Bearingreactions due to gear tooth forces.	8
V	Design of sliding & journal bearing; method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-frictionbearings for different loads and load cycles. Mounting of the bearings. Method of lubrication, selection of oil seals.	8

Text Books:	Reference Books:
• Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi. • Machine Design, Kulkarni S. G., Tata McGraw Hill	• Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors. • Machine Design, Sharma and Aggarwal, Kataria and Sons, Delhi. • Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill • PSG Design Data Book, P.S.G. College of Technology, Coimbatore. • A Text Book of Machine Design, Karwa A., Laxmi Publication. • Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.

ME 601-P DESIGN OF MACHINE ELEMENTS- II SESSIONAL

	Problems on
1	Fatigue loading
2	Helical compression, tension and torsional springs design
3	Curved Beams
4	Preloaded bolts and bolts Course Titleed to variable stresses
5	Belt, Rope and Chain drive system
6	Gear Design
7	Sliding contact bearing design
8	Anti-friction bearing selection

ME 602 INTERNAL COMBUSTION ENGINES AND DIESEL POWER PLANT

UNIT	CONTENTS	CONTACT HOURS
I	Introduction : Historical & Modern Development, Nomenclature, Classification & Comparison : SI & CI, 4 stroke – 2 stroke, First Law analysis, Energy Balance.Testing & Performance : Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Numerical problems, India & International standards of Testing, Emission.	8
II	Fuel & Combustion Combustion in CI & SI engines : Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, Abnormal combustion in CI & SI engines, Detonation & knocking, , Theories of detonation, Control of abnormal combustion, Combustion chamber Design principles, Types of combustion chamber. Fuel:- Conventional : Petroleum, structure, Refusing Fuels for SI & CI engines, Knock rating, Additives, Fuels for Turbine & Jet Propulsion. Alternative : Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.	8
III	Engine Systems & Components Fuel Systems : SI Engine : Combustion & Injection, process & parameters properties of A/F mixture, Requirements of A/F per different operating conditions, Carburetion & Carburetors, types, Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations, Numerical problems. CI engine : Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors. Ignition system : Conventional & Modern ignitionsystems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark galvanic, centrifugal, vacuum Firing order, spark plugs.	8
IV	Engine Friction & Lubrication : Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling : Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components. Supercharging : Objectives, Thermodynamic cycle & performance of super charged SI & CI engines Methods of super charging, Limitations Two stroke engines : Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.	8
V	Dual & Multi fuel engines : Principle, fuels, Combustion, performance Advantages, Modification in fuel system.Working principles of . Rotary, Stratified charge, Free piston, Variable compression ratio engines. Diesel Power plant: Requirements, capacity, operation, safety, Engine Generator Coupling, Electrical load, Switching	8

Text Books:	Reference Books:
• Fundamentals of Internal Combustion Engines, Gupta H.N., Prentice Hall of India. • Internal Combustion Engines, Mathur and Sharma, Dhanpat Rai publications.	• Ganeshan, V., Internal Combustion Engine, Tata Mc Graw Hill. • Internal Combustion Engines, F.Edward Obert, Harper and Raw Publisher. • Internal Combustion Engines Fundamentals, John B. Heyword, McGraw Hill. • Internal Combustion Engines, Lichty, McGraw Hill. • R. Yadav, I.C Engine, Central Publishing House, Allahabad

ME 602-P I. C. Engine Lab

1	Study of complete carburetor (Solex carburetor)
2	Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.
3	Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication)
4	Study of advance cooling systems for Engines.
5	To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed
6	To determine friction power of diesel engine by Willan's line or fuel rate extrapolation method.
7	To conduct a performance test on the variable compression ratio engine and to draw the heat balance sheet for given compression ratio, speed and load and plot the performance curves.
8	To conduct a performance test on a four cylinder four stroke petrol engine and to draw the heat balance sheet and performance curves.
9	To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.
10	To draw the valve timing diagram of a Four stroke S.I. or C.I. Engine using experimental setup.
11	Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

ME 603 MANUFACTURING SCIENCE AND TECHNOLOGY

UNIT	CONTENTS	CONTACT HOURS
I	**JIGS AND FIXTURES:-** Introduction, definitions and comparison; usefulness of jigs and fixtures; materials used; principles and methods of location; clamping elements; jig bushes; drilling jigs; fixtures for milling, turning, boring and welding; assembly fixtures; indexing devices; economics of jigs and fixtures; design of a jig and a fixtures;	8
II	**NON-CONVENTIONAL MACHINING METHODS:** Survey of N.C. machining methods; electric discharge machining (E.D.M.), electrochemical machining, ultrasonic machining (U.S.M.) ; Electron beam machining (E.B.M.) laser beam Machining (L.B.M.); abrasive jet machining (A.J.M.) ; plasma arc machining (PAM).	8
III	**Precision Measurement :** Manufacturing error and tolerance, Standards of linear measurements; linear and angular measurements; screw thread measurement; measurement of effective diameter, pitch and thread angles; Gear measurement, measurement of tooth profile, tooth thickness and pitch, Measurement of surface roughness. Quantitative methods of roughness measurements, Stylus and profilograph methods. IS system of limits and fits, design of limit gauges. **Precision Measuring Instruments:** Comparators types; working principles applications and limitations of various comparators; mechanical and electrical optical, flatness measurement, autocollimator, use of optical flats: principle and method.	8
IV	**DESIGN OF SINGLE POINT CUTTING TOOLS:** Introduction to milling cutters; functions of various tool angles; design of single point turning too]; parting tool; empirical determination of force components; optimum value of tool angles. **DESIGN OF Multipoint Cutting tool:** Introduction; angle of contact; force analysis; approach through dimensional analysis; force and power consumption; tooth form and elements of design of milling cutters.	8
V	**Design of Machine Tool Element** Design of Lathe bed, Material and construction, selection speed and feed range for machine tools, feature, various bed sections, designing for torsional rigidity, use of reinforcing stiffener in lathe bed. Theoretical aspect of design of guide ways, Antifriction guide ways.	8

Text Books:	Reference Books:
• Engineering Metrology, Jain R.K., Khanna Publisher • Production technology, p.c Sharma, s.chand publication.	• Manufacturing Science, Ghosh and Mallik, Tata McGraw-Hill • Manufacturing Technology II, Rao P.N., Tata McGraw-Hill • Production Technology, Jain R.K., Khanna Publisher. • Production Technology, HMT Banglore, Tata McGraw-Hill . • Metal Cutting Principles, Shaw M.C., Oxford • Modern Machining Process, Pandey and Shan, Tata McGraw Hill • Non-Conventional Machining Process, Mishra P.K., Narosa Publishing House

ME 604 Vibration engineering

UNIT	CONTENTS	CONTACT HOURS
I	Sound level and Course Titleive response to sound; Frequency dependent human response to sound, Sound pressure dependent human response. Decibel scale; Decibel addition, subtraction and averaging. Relationship among sound power, sound intensity and sound pressure level. Sound spectra. Octave band analysis. Loudness. Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India. Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver.	**8**
II	Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation, complex number representation, addition. Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy. Compound pendulum and centre of percussion. Damped vibrations ofsingle degree of freedom systems. Viscous damping; undamped, critically damped andoverdamped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped and Hysteretic damped systems.	**8**
III	Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. Steady state and transient parts. Frequency response curves and phase angle plot. Forced vibration due to excitation of support. Vibration Isolation and transmissibility; Force transmissibility, Motion transmissibility. Forced vibration with rotating and reciprocating unbalance. Materials used in vibration isolation.	**8**
IV	System with two degrees of freedom; principle mode of vibration, Mode shapes. Undamped forced vibrations of two degrees of freedom system with harmonic excitation. Vibration Absorber; Undamped dynamic vibration absorber and centrifugal pendulum absorber. Many degrees of freedom systems: exact analysis.	**8**
V	Many degrees of freedom systems: approximate methods; Rayleigh's, Dunkerley's, Stodola's and Holzer's methods. Vibrations of continuous systems; Transverse vibration of astring, Longitudinal vibration of a `bar, Torsional vibration of a shaft.	**8**

Text Books:	**Reference Books:**
• Mechanical Vibrations, Rao S.S., Pearson Education. • Principles of Vibration, Benson H.Tongue, Oxford Publcation.	• Mechanical Vibrations and Noise Engineering, Ambekar A.G., Prentice Hall India. • Mechanical Vibrations, Grover G.K., Nem Chand and Brothers. • Theory of Vibrations with Applicaion, Thomson and Dahleh, Pearson Education.

ME 604-P Vibration engineering Lab.

1	To verify relation T = 2p / (l/g) for a simple pendulum.
2	To determine radius of gyration of compound pendulum.
3	To determine the radius of gyration of given bar by using bifilar suspension.
4	To determine natural frequency of a spring mass system.
5	Equivalent spring mass system.
6	To determine natural frequency of free torsional vibrations of single rotor system. (a) Horizontal rotor (b) Vertical rotor
7	To verify the Dunkerley's rule.
8	Study of free damped torsional vibration to performing the experiment to find out damping co-efficient.
9	To conduct experiment of trifler suspension.
10	Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.

ME 605 HYDRAULIC MACHINES AND HYDRO ELECTRIC POWER PLANT

UNIT	CONTENTS	CONTACT HOURS
I	**Review of fundamentals** Euler's turbine equation, principles of similarity applied to hydraulic machines, non-dimensional specific speed. Classification of turbines on the basis ofnon-dimensional specific speed. Unit and specific quantities. **Impact of Free Jets** Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes.	**8**
II	**Impulse Turbine** Classification of turbine, impulse turbines, Pelton wheel, Construction, working. Work done, head, efficiency and design aspects. Governing of impulse turbine.	**8**
III	**Reaction Turbine** Radial flow reaction turbine, Francis turbine: construction and working. Work done, efficiency, design aspects. **Axial flow reaction turbine** Propeller and Kaplan turbine, bulb or tubular turbine- construction and working. Draft tube, governing of reaction turbine. Performance characteristics and comparison of all the turbines. **Cavitation Phenomenon in hydraulic machines**	**8**
IV	**Reciprocating Pumps** Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip,effect of friction and acceleration theory of air vessels. **Fluid system** Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.	**8**
V	**Hydro Electric power station (HEPP)** – Advantages and disadvantages of water power, selection of site for HEPP, hydrological cycle, hydrographs, essential elements of HEPP. Types of dams, conduits, spillways, surge tanks. Classification of HEPP. Major, mini and micro powerplants- present scenario in Rajasthan and India. Selection of turbine.	**8**

Text Books:	Reference Books:
• A Text Book of Fluid Machine, Bansal R.K., Laxmi Publication • A Text Book of Fluid Machine and Hydraulic Machine, Domkundwar, Dhanpat Rai Publication.	• Hydraulic Machine, Rajput R.K., S. Chand Publication. • Hydraulic Machine: Turbines and Pumps, Nazarov N.T., Springer New York. • Hydraulic Machinery, Jagdish Lal, Metropolitan Books. • Power generation Technology, Paul Breeze, Elsevier Publications. • Fluid Machinery Performance, Analysis and Design, Wright Terry, CRC Press.

ME 606 NUMERICAL METHODS AND APPLIED STATISTICS

UNIT	CONTENTS	CONTACT HOURS
I	Errors and significant digits, Roots of algebraic equations Bisection method, secant method, Newton Raphson method, Graff's root- squaring method, Iterated synthetic division with quadratic factors method for finding complex roots,	8
II	Solutions of systems of equations (Gauss elimination, Gauss Jordan, and Partition method for linear system of equations, power method for partition, method for linear system of equations, power method for finding eigen values), Forward, backward , central and Divided differences, Newton's formula of interpolation for equal and unequal intervals. Lagrange's interpolation formula, Stirling's and Bessell's formula,	8
III	Numerical differentiation, Numerical Integration:- Trapezoidal, Simpson's rule and Gaussian integration (only formula applications) Differential equations and their solutions. Numerical methods for ordinary differential equations (Picard method, Taylor series method, Euler's method, Ranga Kutta Method, Predictor- corrector method, Adams- Bashforth method).	8
IV	Sampling theory: Introduction: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Normal sampling distributions; Binomial distribution, Poisson distribution, Normal distribution; Sampling distribution of the means; sampling distribution of the differences of the means; sampling distributions of proportions	8
V	Tests of Significance; t-distributions, chi square distributions, F-distributions. Regression And Correlation; Linear regression; correlation, multiple correlation & partial correlation Confidence Limits; Large samples, small samples, error bands in regression	8

Text Books:	Reference Books:
• Probability and Statics in Engineering, Hines, John Willey and Sons. • Applied Statistics and Probability for Engineers, Montgomery, John Wiley and Sons	• Introductory Methods of Numerical Analysis, Sastry S.S., Prentice Hall India • Numerical Methods for Engineering and Scientific Computation, Jain and Jain, New Age International Pvt. Ltd. New Delhi. • Engineering Statistics, Bowker, A.H. and Liberman G.J., Prentice Hall.

ME 606-P COMPUTER ORIENTED NUMERICAL METHODS LAB

1	To develop computer program to determine roots of a given equation using method of a. False position b. Newton -Raphson method,
2	To develop computer programs for solution of system of simultaneous linear equations using: a. Gauss Elimination Technique, without and with specified boundary conditions, for full as well as bounded symmetric and unsymmetrical matrices b. Gauss Shield iterative technique Successive over Relaxation(S.O.R) Technique
3	Linear and Non-Linear curve fitting technique
4	Numerical Integration with Simpson's rule and Gaussian Integration
5	Solution of ordinary differential equations by (i) Eular Method (ii) Runge-Kutta Method (iii) Taylor Series Methods
6	Solution of partial differential equations using S.O.R. Technique with special reference to heat conclusion equation.

ME 607-P AUTOMOBILE ENGG. LAB

1.	Valve refacing and valve seat grinding and checking for leakage of valves
2.	Trouble shooting in cooling system of an automotive vehicle
3.	Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4.	Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5.	Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing
6.	Fault diagnosis in transmission system including clutches, gear box assembly and differential
7.	Replacing of ring and studying the method of replacing piston after repair.

ME 608-P PROD. ENGG. LAB. – I

1.	Study of single point cutting tool geometry & grind the tool as per given tool geometry.
2.	Study the milling machine, milling cutters, indexing heads and indexing methods.
3.	Prepare a gear on milling machine.
4.	Prepare a hexagonal / octagonal nut using indexing head on milling m/c and to cut BSW/METRIC internal threads on lathe.
5.	To cut multi-start square / metric threads.
6.	To cut external metric threads & to meet it with the nut
7.	To prepare the job by eccentric turning on lathe machine.
8.	To prepare a job on shaper from given MS rod.
9.	To study the various crystal structures and dislocations through models.
10.	To study the Iron-Iron Carbide Equilibrium Diagram and sketch the various structures present at room temps.
11.	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
12.	Study the principle & construction of the Metallurgical Microscope.
13.	Prepare metallic samples for metallographic examination for study of Microstructure
14.	Study the hardening of steel in different medium and at different cooling rates.
15.	Study the effect of Carbon percentage on the hardness of Steel

ME 701 COMPUTER AIDED DESIGN

UNIT	CONTENTS	CONTACT HOURS
I	Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphics Display devices. Raster Scan Graphics : DDA for line generation and Bresenham's algorithm for line and circle generation.	**8**
II	Wire frame models, Parametric representation of curves, Plane curves: line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.	**8**
III	Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier surfaces and B-spline surfaces. Solid Models and entities, Solid Representation: B-rep. and CSG. Comparison between three types of models**.**	**8**
IV	Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.	**8**
V	Clipping: Point clipping, Line clipping, Cohen- Sutherland algorithm etc. Viewing Transformation, Hidden Line and surface Removal: Techniques and Algorithms.	**8**

Text Books:	**Reference Books:**
• Mathematical elements for Computer Graphics, Rogers and Adams, Tata McGraw Hill	• CAD/CAM: Theory and Practice, Zeid and Sivasubramanian., Tata McGraw Hill • Elements of Computer Aided Design and Manufacturing, Pao Y.C., John Wiley and Sons. • CAD/CAM: Concepts and Applications, Alavala C.R., Prentice Hall of India.

ME 701-P CAD LAB.

1	Introduction & different features of the CAD Software
2	2-D Drafting
3	3-D Modeling
4	3-D Advanced Modeling
5	Assembly modeling
6	Feature Modification and Manipulation
7	Detailing
8	Sheet Metal Operations
9	Surface Modeling
10	One Dimensional problems of Finite Element Method.
	(These exercises may be performed by any of the following Advanced CAD Software such as Pro E /Unigraphics/ AotoCAD Inventor)

ME 702 REFRIGERATION AND AIR CONDITIONING

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction** -Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. **Multiple Evaporator and compressor system.** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.	**8**
II	**Gas cycle Refrigeration** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative H.E. **Air cycle for air craft** Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.	**8**
III	**Vapour Absorption System** Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System. **Refrigerants** Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. **Refrigeration Equipments** Compressor, condenser, evaporator, expansion devices – types & working.	**8**
IV	**Psychrometry** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. **Human Comfort** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.	**8**
V	**Cooling load calculations** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.	**8**

Text Books:	Reference Books:
• Refrigeration and Air Conditioning, Arora C.P., Tata McGraw Hill New Delhi. • Refrigeration and Air Conditioning, Jorden and Priester, Prentice Hall of India.	• Refrigeration and Air Conditioning, Stoecker W.F., McGraw Hill Publication. • Refrigeration and Air Conditioning, Ballaney R.C., Khanna Publication. • Refrigeration and Air Conditioning, Jain V.K., Tata McGraw Hill New Delhi.

ME 702-P REFRIGERATION AND AIR CONDITIONING LAB

1	Test on Vapour compression Test Rig.
2	Test on ice plant test rig.
3	Test on air conditioning test rig.
4	Test on vapour absorption refrigeration system.
5	Study of installation/operatio/maintenance practices for refrigeration systems.
6	Determination of refrigeration load in cold storage (case study/visit).
7	Visit to any refrigeration or air conditioning plant.
8	Thermal analysis of any refrigeration or air-conditioning cycle.

ME 703 OPERATIONS RESEARCH

UNIT	CONTENTS	CONTACT HOURS
I	**Linear Programming-** Introduction & Scope, Problem formulation, Simplex methods, primal & dual problem dual Simplex, sensitivity analysis	8
II	Transportation, Transshipment & Assignment problems **Dynamic Programming-** Multistage decision problems & solution, Principle of optimality	8
III	**Decision theory-** Decision under various conditions. **Game Theory-** Minimax & maximum strategies. Application of linear programming. **Integer Programming-** Cutting Plane method and Branch & Bound method	8
IV	**Deterministic and Stochastic inventory models-** Single & multi period models with continuous & discrete demands, Service level & reorder policy	8
V	**Simulations-** Simulation V/S mathematical modeling, Monte Carlo simulation, simulation language ARENA, Example & cases. **Queing models-** Introduction Model types, M.M. 1 & M/M/S system cost consideration**.**	8

Text Books:	Reference Books:
• Linear Programming and Network Flows, Bazaraa, Jarvis and Sherali, Wiley India. • Operations Research, Gupta and Heera, S. Chand Publications.	• Introduction to Operations Research, Hillier F.S. and Lieberman G.J., CBS Publishers. • Operations Research, Taha H.A., Pearson Education. • Operations Research, Ravindran, Phillips and Solberg, Wiley India. • Principles of Operations Research, Wagner H.M., Prentice Hall of India.

ME 704 STEAM TURBINES AND STEAM POWER PLANT

UNIT	CONTENTS	CONTACT HOURS
I	**Steam Turbines:** Principle and working of steam turbines, type of turbines, impulse and reactions, compounding for pressure and velocity. Velocity triangles for various types.	8
II	Stage efficiency, diagram efficiency, steam speed to blade, speed ratio for optimum performance. Energy losses in steam turbine, turbine performance at various loads and governing of steam turbines. Constructional details and description of steam turbine components in brief.	8
III	**Regenerative feed heating cycles:** Introduction : Most Ideal Regenerative feed heating cycle. Regenerative feed heating cycles and their representation on T-s and h-s Diagram.Representation of actual process on T-s and h-s Diagram Regenerative cycles. Othertypes of feed heating arrangements. Optimum feed water and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters **Reheating – Regenerative and Regenerative water – Extraction Cycles.** Reheating of steam, Practical reheating and Non- reheating cycles, advantage & disadvantages of reheating, regenerative water extraction cycles, practical feed heating arrangements.	8
IV	Governing and performance of Steam Turbines. Description of back pressure Turbines, pass-out Turbines and Mixed Pressure Turbines.	8
V	**Steam Power Plant** Steam power plants selection of location, working medium. Fuels and fuel handling equipments, ash handling equipments. Air pre-heater, feed water treatment. Methods of combustion and various type of combustors. Types of boilers. Modern developmentsin steam boilers. Description of cooling tower.	8

Text Books:	Reference Books:
• Power Plant Engineering, Domkudwar and Arora, Dhanpat Rai Publication. • Steam, Gas Turbine and Power Plant Engineering, Yadav R., CPH Allahabad	• A Practical Guide to Steam Turbine, Heinz P. Bloch, McGraw Hill Publication. • Steam Turbines: Design Application and Rerating, Heinz P. Bloch, McGraw Hill Publication. • Steam Turbine: Theory and Design, Shlykhin P., University press of Pacific. • Steam Turbine: Theory and Construction, Wilde and Salter, Merchant Books. • Power Plant Engineering, Shamsher Gautam, Vikas Publication. • Power Plant Engineering, Nag P.K., Tata McGraw-Hill, New Delhi. • Power Plant Technology, El-Wakil, McGraw-Hill (student Edition). • Modern Power Plant Engineering, Joel Weisman and Roy Eckert, PHI Pvt. Ltd., New Delhi

ME 705 PRODUCT DEVELOPMENT AND LAUNCHING

UNIT	CONTENTS	CONTACT HOURS
I	**Importance of new product-Definition-importance-Development Process.** Importance of new product for growth of enterprise. Definition of product and new product. Responsibility for new product development. Demands on product development team. Classification of products from new product development. Point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products. New product development process and organization. Generic product development process for Market Pull Products. Modification of this process for other types of products	8
II	**Need analysis- Problem Formulation** Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification.	8
III	**Generation of Alternatives and Concept Selection** Concept generation- a creative process, Creativity, Road Elects to creative thinking- Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.	8
IV	**Preliminary & detailed design- Design Review** Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.	8
V	**Management of New Product – development and Launch.** New Product Management's Challenges – Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention. Design Team Staffing and Organization. Setting key mile stone, Identification of Risk Areas, Execution and Evaluation Product Launch Strategies. Project Planning – Project Task matrix, estimation of time & resources, projectscheduling.	8

Text Books:	Reference Books:
• Product Design and Manufacturing, Chitale and Gupta. McGraw Hill. • Product Design and Development, Ulrich and Eppinger, McGraw Hill.	• Project Management in New Product Development, Barkley B.T., Tata McGraw Hill. • Product Management, Anandan C., McGraw Hill. • Engineering Design Methods, Cross, Nigel, John Wiley and Sons. • Product Design and Manufacture, Lindbeck, J.R., Prentice Hall of India.

ME 706. I ROBOTICS

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Robotics** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.	8
II	**Coordinate Frames, Mapping and Transforms** Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Transform, Fundamental Rotation Matrices	8
III	**Symbolic Modeling of Robots – Direct Kinematic Model** Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model	8
IV	**Robotic Sensors and Vision** The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition.	8
V	**Robot Applications** Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications.	8

Text Books:	Reference Books:
• Introduction to Robotics: Analysis, Systems, Applications, Niku S., Dorling Kindersley India. • Introduction to Robotics, Mechanics and Control, Craig JJ, Addison Wesley	• Automation, Robotics and CAD/CAM, Groover M.P., Pearson Education. • Robotics Technology and Flexible Automation, Deb S.R., Tata McGraw Hill. • Robotics: Control Sensing, Vision and Intelligent, King Sun Fu, McGraw Hill Education Asia. • Industrial Automation and Robotics, Gupta and Arora, Laxmi Publication. • Introduction to Mechatronics, Dr. Appu Kuttan, Oxford University Press.

ME 706. II Maintenance management

UNIT	CONTENTS	CONTACT HOURS
I	Introduction #Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material &energy conservation, inventory control, productivity, safety, pollution control etc. Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.	8
II	Maintenance Management # types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations. Computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.	8
III	Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants # types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing. Repair methods for basic machine elements: Repair methods for beds, slide ways, spindles, gears, lead screws and bearings–Failure analysis–Failures and their development Logical fault location methods–Sequential fault location.	8
IV	Machine Health Monitoring # Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.	8
V	Reliability, availability & maintainability (RAM) Analysis # Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems. Improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo Simulation Technique.	8

Text Books:	Reference Books:
• Anthony Kelly, Strategic Maintenance Planning, Butterworth Heinemann • R. C. Mishra, K. Patha ,Maintenance Engineering and Management, PHI Learning Pvt. Ltd	• Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill • Maintenance & Spare parts Management Gopal Krishnan • Srivastava S.K., "Industrial Maintenance Management", S. Chand and Co • Hand book of Condition Monitoring CNR Rao • White E.N., "Maintenance Planning", I Documentation, Gower Press • Armstrong, "Condition Monitoring", BSIRSA

ME 706. III CNC machine and programming

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Definition of NC, Applications of NC,Historical Developments in Automation, Classification of NC Systems, Comparison of NC and Conventional Machines, Advantages of NC	8
II	NC Hardware: Architecture of NC Systems, Design Considerations, Mechanical Elements, Structure, Guideways and Slides, Guideway Elements, Transmission Systems, Spindle Unit, Coolant system, Lubrication System, Tool and work Changing Mechanisms, Electrical Elements, Drives, Sensors, Control Loops, Computing Elements/ Firmware, Interpolators	8
III	NC Software: Introduction, Manual Part Programming, Computer Assisted Part Programming, Language Based, Geometric Modeling Based, Automatic Part Program Generation	8
IV	CAPP Systems , 5 Axis Programming, Post Processing, Programming Robots and CMMs NC Simulation, Kinematic simulation, Volumetric simulation, Applications of Volumetric NC Simulation, Verification	8
V	Advanced Topics:, Adaptive Control, Offline adaptive control, Various optimization criteria, Hardware Based AC, Software Based AC, Tooling and Instruments for NC Special Considerations in High Speed Cutting (HSC) and Die Sinking, Rapid Product Development, CAM, FMS, CIM	8

Text Books:	Reference Books:
• Krar S. and Gill A., CNC: Technology and Programming, McGraw Hill	• Koren Y., Computer Control of Manufacturing Systems, Tata McGraw Hill. • Pressman R.S. and Williams J.E., Numerical Control and Computer Aided Manufacturing, John Wiley & Sons • Jones B.L., Introduction to Computer Numerical Control, John Wiley & Sons.

ME 707-P P.E. LAB.-II

	EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1	By using lathe tool dynamometer measure the cutting forces in all directions and calculate the following: a) Shear plane angle b) Coefficient of friction c) Power consumption
2	By using the drill dynamometer measure the torque, and thrust in Drilling operation.
3	By using the tool work thermocouple, measure the tool chip interface temp
4	To determine chip reduction coefficient in turning.
5	To study the different mechanisms of tool wear and their measurements
6	To determine Taylor Tool life exponents by Facing test
7	To study the effect of cutting variables on surface finish in any cutting (Turning, Drilling, Milling, Shaping, grinding etc) operation
8	Study of the effect of clearance and shear angle on the blanking and piercing operations
9	To determine the effect of percentage of reduction and the semicone angle of the die on the drawing load.
10	To find the effect of percentage of reduction and the die geometry on extruding force.
11	Experimental determination of coefficient of friction for metal forming.
12	Study of the drop forging operation (flow ability, forging load etc by plasticine model.
13	To determine roll load in the sheet rolling process.
14	Students will be given at least one practical problem regarding design and fabrication of Jig, Fixture or Press tool.
15	To measure a gap with help of slip gauges
16	Measurement of angle/taper using a sine bar.
17	Study and use of a bore gauge.
18	Flatness testing of a surface pate and machine tool bed by using a sensitive spirit level.
19	Measurement of screw thread elements by tool Makers microscope and Inspection of various elements of screw thread by optical projector.
20	To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
21	Measurement of chordal thickness of Gear tooth by Gear tooth vernier caliper.
22	Use of three-wire method to determine the effective diameter of external threads
23	To study the capstan lathe, tool holders and attachments and to prepare the given job as per given drawing.
24	Cutting forces measurement during milling using milling dynamometer.
25	Measurement of flatness and roundness of a given machine/ground/lapped flat and round surface respectively using dial gauge.

ME 801 RENEWABLE ENERGY TECHNOLOGY

UNIT	CONTENTS	CONTACT HOURS
I	Global and National scenarios, Form and characteristics of renewable energy sources **Solar Energy**Solar radiation, its measurements and prediction. Solar thermal collectors, flat plate collectors, concentrating collectors. Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. **Solar Photovoltaic** Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes	**8**
II	**Wind Energy** Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, applications.	**8**
III	**Ocean Energy** Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.	**8**
IV	**Other Sources:** Nuclear fission and fusion; Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion. Formation of biomass, photosynthesis; Biomass resources and their classification; Chemical constituents and physicochemical characteristics of biomass; Biomass conversion processes;	**8**
V	**Fuel Cells** Thermodynamics and electrochemical principles; Basic design, types, applications. **Hydrogen Energy** Economics of hydrogen; Production methods.	**8**

Text Books:	Reference Books:
• Renewable Energy Sources and Conversion Technology, Bansal, Kleemann and Meliss, Tata McGraw Hill, New Delhi.	• Power Generation through Renewable Source of Energy, Rai and Ram Prasad, Tata McGraw-Hill, New Delhi. • Solar Energy: Fundamental and Applications, H. P. Garg J Prakash, Tata McGraw-Hill. • Solar Energy: Principles of Thermal Collection and Storage, S P Sukhatme, Tata McGraw-Hill.

ME 802 OPERATIONS MANAGEMENT

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Scope of Operations Management, operations manager and the management process. Operations Strategy, Competitiveness and Productivity. Demand Forecasting: components of forecasting demand, Approaches to forecasting: Qualitative methods, Time series methods, Regression methods, Accuracy and control of forecasts, Selection of forecasting technique.	**8**
II	Products and Services, Process, Types of Production Systems: Mass, Batch, Job shop production. Product and process matrix. Process planning and Process analysis. Capacity Planning: Defining and measuring capacity, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives- Cost- Volume analysis etc.	**8**
III	Production Planning: Production planning objective and functions, Bill of material, Capacity and man power requirement planning, Planning levels: long range, Intermediate range and Short range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques of aggregate planning, master production scheduling, MRP and MRPII Systems	**8**
IV	Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems,	**8**
V	Material Management: Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. Methods of physical stock control	**8**

Text Books:	**Reference Books:**
• Production and Operations Management, S.N. Charry, Tata McGraw Hill. • Operations Management, Russel Taylor, Pearson Education. • Operations Management, Stevenson, Tata McGraw Hill.	• Operations Management: A System Model Building Approach, Vollman T.E., Addison Wesley Publication. • Operation Management: The Management of Productive System, Buffa E.S., John Willey and Sons. • Forecasting Methods and Applications, Markridakis and Wheeleright, Wiley India. • Product Planning and Inventory Control, Narsimha and Narsimha, Prentice Hall India.

ME 803 GAS TURBINES AND GAS POWER PLANT

UNIT	CONTENTS	CONTACT HOURS
I	Review of basic principles and fundamentals of rotating machines. Cycle arrangements, open cycle arrangements, closed cycle arrangements, basic requirement of the working medium, properties of various working media, applications of gas turbine, comparison of gas turbines with reciprocating engines. Ideal cycles: simple gas turbine cycle, heat exchange cycle, reheat cycle, reheat and heat exchange cycle, intercooled cycle, intercooled cycle with heat exchanger, intercooled and reheat cycle, intercooled cycle with heat exchange and reheat. Comparison of various cycles.	8
II	Practical cycles and their analysis, effect of variable specific heat, mechanical losses, loss due to incomplete combustion, polytropic efficiency, performance of actual cycles, comparison of ideal vs actual cycles. Jet propulsion cycles	8
III	Thermodynamic cycles, advantages, disadvantages and performance characteristics of Ramjet engine, pulsejet engine, turboprop engine, turbojet engine, turbofan engine. Calculation of specific thrust and efficiency.	8
IV	Combustion systems, combustion theory applied to gas turbine combustor, factors affecting combustion chamber design and performance. Combustion chamber geometry, fuel injection and ignition, use of cheap fuels. Impulse and reaction type gas turbines. Velocity triangles and calculation of work done,efficiency etc..	8
V	Advantages of a gas turbine power plant, comparison with steam, diesel and hydel power plant. Performance of GT power plant-part load efficiency, airflow rate, thermal efficiency, gas turbine blading and fuels. Gas turbine materials. Free piston engine plant.	8

Text Books:	Reference Books:
• Gas turbines, V. Ganesan, Tata McGraw-Hill.	• Power Generation Handbook, Philip Kiameh, McGraw Hill. • Gas Turbine Engineering Handbook, Meherwan P. Boyce, Gulf Professional Publication. • Power Plant Engineering, Elanchezhian C., I.K. International Publicity House. • Power Plant Engineering, Nag P.K., McGraw Hill Publication. • Fundamental of Gas Turbine, William W. Bathie, Willey Eastern Ltd. • Gas turbine theory, Cohen and Saravanamutto, Pearson Educational Publication.

ME804.I COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER

UNIT	CONTENTS	CONTACT HOURS
I	Review of basic fluid mechanics and the governing (Navier-Stokes) equations. Types of partial differential equations- hyperbolic, parabolic and elliptic. Traditional solution methods- method of characteristics, separation of variables, Greens function method.	**8**
II	Preliminary computational techniques: Discretisation, converting derivatives to discrete algebric expressions, spatial derivatives, time derivatives. Approximation of derivatives, Taylor series expansion, general techniques. Accuracy of discretisation process-higher order vs lower order formulae.	**8**
III	Finite difference method: conceptual implementation, application to transient heat conduction problem. Convergence, consistency and stability of FD equation.	**8**
IV	Weighted residual methods: General formulation, Introduction to Finite Volume method. Finite Volume method: Equations with first derivatives and second derivatives. FV method applied to Laplace's equation.	**8**
V	Finite Element method: Linear interpolation, quadratic interpolation, two dimensional interpolation. Application to heat transfer problems.	**8**

Text Books:	**Reference Books:**
• Computational Fluid Dynamics, Jiynan Tu, Butter worth Henman. • Computational Fluid Dynamics, John Anderson, McGraw Hill Publication.	• Computational Fluid and Heat Transfer, Anderson & Tannehill, Taylor & Francis Publication. • Computational Methods for Fluid Dynamics, Joel H. Ferziger, Springer Publication. • Computational Heat Transfer, Jaluria Y., Taylor and Francis Publication. • Computational Heat Transfer and Fluid Flow, Murlidhar and T. Sunder Rajan, Narosa Publications.

ME804.II Mechatronics

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Introduction, scope and applications of Mechatronics systems. Process control automation, FMS and CNC Machines. MEMS: Basics of Micro and Nanotechnology, microprocessor-based controllers and Microelectronics	**8**
II	Introduction to Sensors: Linear and Rotational Sensors, Acceleration, Force, Torque, Power, Flow and Temperature Sensors, Light Detection, Image, and Vision Systems, Integrated Micro-sensors, Introduction to Actuators: Electro-mechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro-transducers Analysis, Design and Fabrication.	**8**
III	Systems and Controls: The Role of Controls in Mechatronics, Role of Modelling in Mechatronics Design, Signals and Systems: Continuous and Discrete time Signals, Z-Transforms and Digital Systems, Continuous and Discrete-time State-space Models. Advanced Control Systems: Digital Signal Processing for Mechatronics Applications, Control System Design, Adaptive and Nonlinear Control Design, Neural Networks and Fuzzy Systems, Design Optimization of Mechatronics Systems.	**8**
IV	Data Acquisition and related Instrumentation: Introduction to Data Acquisition Measurement Techniques: Sensors and Transducers, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, Signal Conditioning. Real time Instrumentation: Computer-Based Instrumentation Systems, Software Design and Development, Data Recording and Logging.	**8**
V	Design of Mechatronics systems: Introduction of mechatronics systems: Home appliances, ABS (anti-lock braking system) and other areas in automotive engineering, Elevators and escalators, Mobile robots and manipulator arms, Sorting and packaging systems in production lines, Computer Numerically Control (CNC) production machines, Aeroplanes and helicopters, Tank fluid level and temperature control systems.	**8**

Text Books:	**Reference Books:**
• Bolton, W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson Education	• Mechatronics, HMT Hand Book, Tata McGraw Hill • Alciatore and Histand, "Introduction to Mechatronics and Measurement Systems", Tata McGraw Hill • Smaili and Mrad, "Mechatronics: Integrated Technologies for Intelligent Machines", Oxford

ME804.III Design and manufacturing of plastic products

UNIT	CONTENTS	CONTACT HOURS
I	Plastics Materials: An Overview, Classification, Thermoplastics, Thermosets, Crystalline, Amorphous, and Liquid, Crystalline Polymers, Copolymers, Alloys, Elastomers, Additives, Reinforcements, and Fillers, Physical Properties and Terminology. Mechanical Properties, Thermal Properties, Electrical Properties, Environmental Considerations	**8**
II	Design Considerations for Injection-Molded Parts: Injection Molding Process, Design Strategy, Efficient and Functional Design, Material Selection, Nominal Wall Thickness, Normal Ranges of Wall Thickness, Structural Requirements of the Nominal Wall, Insulation Characteristics of the Nominal Wall, Impact Response of the Nominal Wall, Draft, Structural Reinforcement, Ribs, Other Geometric Reinforcement, Bosses, Coring, Fillets and Radii, Undercuts	**8**
III	Polymer processing techniques such as extrusion, compression and transfer moulding. Injection moulding, blow moulding, thermoforming, rotational moulding, calendaring	**8**
IV	Assembly: General Types of Assembly Systems, Molded-In Assembly Systems, Snap-Fit Assembly, Molded-In Threads, Press-Fits, Chemical Bonding Systems, Solvent Welding, Adhesive Bonding, Thermal Welding Methods. Spin Welding, Radio Frequency (RF) Welding, Electromagnetic or Induction Welding, Assembly with Fasteners, Bolted Assembly, Threaded Metal Inserts, Self-Tapping Screws, Riveted Assembly, Sheet Metal Nuts, Specialty Plastic Fasteners	**8**
V	Machining of Plastics: Drilling and Reaming, Thread Tapping, Sawing, Milling, Turning, Grinding. Finishing and Decorating of Plastics: Painting, Vacuum Metallizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping	**8**

Text Books:	**Reference Books:**
• Design and Manufacture of Plastic Parts, R.L.E. Brown, John Wiley and Sons, New York	• Designing with Plastics, Gerhard, Hanser Verlag • Handbook of Plastics Joining: a practical guide, PDL handbook series, Plastics Design Library, William Andrew • Modern Plastics Handbook, McGraw Hill handbooks, Modern plastics series, Charles A. Harper, McGraw-Hill Professional

ME 805-P CAM AND ROBOTICS LAB

	CAM (Minimum Five Experiments)
1	To prepare part programming for plain turning operation.
2	To prepare part programming for turning operation in absolute mode.
3	To prepare part program in inch mode for plain turning operation.
4	To prepare part program for taper turning operation.
5	To prepare part program for turning operations using turning cycle.
6	To prepare part program for threading operation.
7	To prepare part program for slot milling operation.
8	To prepare part program for gear cutting operation.
9	To prepare part program for gear cutting using mill cycle.
10	To prepare part program for drilling operation.
11	To prepare part program for multiple drilling operation in Z-axis.
12	To prepare part program for multiple drilling in X-axis.
13	To prepare part program for multiple drilling in X and Z axis using drilling cycle.
	Robotics (Minimum Five experiments)
1	To detect the sensor scanning system to overcome limitation of fixed sensors on various robotic applications, ultrasonic sensor, laser range finders, infrared detectors and miniature.
2	To find the horizontal and vertical movement up to 180o in either direction.
3	To detect objects with infrared ray detector.
4	To determine object distance (3cm – 300cm).
5	To detect distance (10cm to 80 cm) with infrared object detector.
6	To determine 5 Axis Robotic Arm movement and its degree of rotation
7	To lift the object and place 100m away in various directions.
8	To find the gripper movement (0 to 50mm).
9	To study various Robotic Arm Configurations.
10	To study Pick and Place Robot

ME 806-P INDUSTRIAL ENGINEERING LAB

1	Determination of time standard for a given job using stopwatch time- study.
2	Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3	Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4	To carryout a work sampling study.
5	To conduct process capability study for a machine in the workshop.
6	To design a sampling scheme based on OC curve.
7	To conduct Shewart's experiments on known population
8	Generation of random numbers for system simulation such as facility planning, job shop scheduling etc.