REGULATIONS, CURRICULUM AND SYLLABUS

for

B. TECH

MECHANICAL ENGINEERING

PONDICHERRY UNIVERSITY
PONDICHERRY-605 014

PONDICHERRY UNIVERSITY
BACHELOR OF TECHNOLOGY PROGRAMMES
(EIGHT SEMESTERS)
REGULATIONS

1. Conditions for Admission:

(a)Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed :

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(b) For Lateral entry in to third semester of the eight semester B.Tech programme :

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with mathematics as one of the subjects of study with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programs approved for admission for each of the degree programs is given in **Annexure A**.

2. Age Limit :

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme , candidates should not have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit is relaxable by 3 years for both the cases.

3. Duration of Programme :

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. Eligibility for the award of Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. Branches of Study:

Branch I - Civil Engineering
Branch II - Mechanical Engineering
Branch III - Electronics & Communication Engineering
Branch IV - Computer Science & Engineering
Branch V - Electrical & Electronics Engineering
Branch VI - Chemical Engineering
Branch VII - Electronics & Instrumentation Engineering
Branch VIII - Information Technology
Branch IX - Instrumentation & Control Engineering
Branch X - Biomedical Engineering

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. Subjects of Study:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. Examinations:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination**.**

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

5 marks for 95% and above
4 marks for 90% and above but below 95%

3 marks for 85% and above but below 90%
2 marks for 80% and above but below 85%
1 mark for 75% and above but below 80%

In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks**:**
The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared "Failed" in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempts, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11 Award of Letter Grades:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total Marks	Letter Grade	Grade Points
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	F	

'F' denotes failure in the course. 'FA' denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$GPA = \left(Sum\ of\ \ (C \times GP) / Sum\ of\ \ C \right)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

The conversion of CGPA into percentage marks is as given below

$$\%\, Marks = (CGPA - 0.5) \times 10$$

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. Provision for withdrawal:

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. Discontinuation of Course:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. Revision of Regulations and Curriculum:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

NNEXURE – A

B.Tech courses in which admission is sought	Diploma courses eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology / Engineering Textile Engineering / Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Electronics and Communication Engg. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Chemical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology Polymer Technology
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology

CURRICULUM
B.Tech. – CIVIL ENGINEERING

I SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
T 101	Mathematics – I	3	1	-	4	25	75	100
T 102	Physics	4	-	-	4	25	75	100
T 103	Chemistry	4	-	-	4	25	75	100
T 104	Basic Electrical and Electronics Engineering	3	1	-	4	25	75	100
T 105	Engineering Thermodynamics	3	1	-	4	25	75	100
T 106	Computer Programming	3	1	-	3	25	75	100
	Practicals							
P 101	Computer Programming Lab	-	-	3	2	50	50	100
P 102	Engineering Graphics	2	-	3	2	50	50	100
P 103	Basic Electrical & Electronics Lab	-	-	3	2	50	50	100
	Total	22	4	9	29	300	600	900

II SEMESTER

Code No.	Name of the Subjects	Periods			Cr	Marks		
		L	T	P		IA	UE	TM
	Theory							
T 107	Mathematics – II	3	1	-	4	25	75	100
T 108	Material Science	4	-	-	3	25	75	100
T 109	Environmental Science	4	-	-	3	25	75	100
T 110	Basic Civil and Mechanical Engineering	4	-	-	4	25	75	100
T 111	Engineering Mechanics	3	1	-	4	25	75	100
T 112	Communicative English	4	-	-	3	25	75	100
	Practical							
P 104	Physics lab	-	-	3	2	50	50	100
P 105	Chemistry lab	-	-	3	2	50	50	100
P 106	Workshop Practice	-	-	3	2	50	50	100
P 107	NSS / NCC *	-	-	-	-	-	-	-
	Total	22	2	9	27	300	600	900

** To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation.*

III Semester

Sl. No.	Sub. Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MAT31	Mathematics - III	3	1	0	4	25	75	100
2	MET32	Mechanics of Solids	3	1	0	3	25	75	100
3	MET33	Mechanics of Fluids	3	1	0	3	25	75	100
4	MET34	Applied Thermodynamics	3	1	0	4	25	75	100
5	MET35	Engineering Metallurgy	4	0	0	3	25	75	100
6	MET36	Manufacturing Process – I	4	0	0	3	25	75	100
Practicals									
7	MEP31	Material Testing and Metallurgy Lab	0	0	3	2	50	50	100
8	MEP32	Fluid Mechanics Lab	0	0	3	2	50	50	100
9	MEP33	Manufacturing Processes Lab - I	0	0	3	2	50	50	100
Total			20	4	9	26	300	600	900

IV Semester

Sl. No.	Sub. Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MAT41	Mathematics - IV	3	1	0	4	25	75	100
2	MET42	Kinematics of Machinery	3	1	0	4	25	75	100
3	MET43	Fluid Machinery	3	1	0	3	25	75	100
4	MET44	Heat and Mass Transfer	3	1	0	3	25	75	100
5	MET45	Machine Drawing	2	0	3	3	50	50	100
6	MET46	Electrical & Electronics Engineering	3	1	0	3	25	75	100
Practicals									
7	MEP41	Computational Methods Lab	2	0	3	3	50	50	100
8	MEP42	Fluid Machinery Lab	0	0	3	2	50	50	100
9	MEP43	Electrical & Electronics Lab	0	0	3	2	50	50	100
10	MEP44	Physical Education*			2				
Total			19	5	14	27	325	575	900

* Pass / Fail option only and not counted for CGPA calculation.

V Semester

Sl. No.	Sub. Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MET51	Dynamics of Machinery	3	1	0	4	25	75	100
2	MET52	Design of Machine Elements	3	1	0	4	25	75	100
3	MET53	Metrology and Quality Control	3	1	0	3	25	75	100
4	MET54	Thermal Engineering (IC Engines, Gas dynamics and Propulsion)	3	1	0	4	25	75	100
5	MET55	Manufacturing Process – II	4	0	0	3	25	75	100
6	MET56	Control System Engineering	3	1	0	3	25	75	100
Practicals									
7	MEP51	Manufacturing Processes Lab - II	0	0	3	2	50	50	100
8	MEP52	Dynamics of Machines Lab	0	0	3	2	50	50	100
9	MEP53	Computer Aided Machine Drawing	0	0	3	2	50	50	100
10	MEP54	General Proficiency - I	0	0	3	2	100	-	100
		Total	19	5	12	29	400	600	1000

VI Semester

Sl. No.	Sub. Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MET61	Operations Research	3	1	0	4	25	75	100
2	MET62	Design of Transmission Systems	3	1	0	4	25	75	100
3	MET63	Power Plant Engineering	3	1	0	4	25	75	100
4	MET64	Advanced Manufacturing Technology	4	0	0	3	25	75	100
5	MET65	Mechanical Measurements	3	1	0	3	25	75	100
6		Elective - I	3	1	0	3	25	75	100
Practicals									
7	MEP61	Manufacturing Processes Lab - III	0	0	3	2	50	50	100
8	MEP62	Mechanical Measurements and Metrology Lab	0	0	3	2	50	50	100
9	MEP63	Thermal Engineering Lab – I	0	0	3	2	50	50	100
10	MEP64	General Proficiency - II	0	0	3	2	100	-	100
		Total	19	5	12	29	400	600	1000

VII Semester

Sl. No.	Sub. Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MET71	Computer Aided Design	3	1	0	4	25	75	100
2	MET72	Computer Integrated. Manufacturing	4	0	0	4	25	75	100
3	MET73	Refrigeration, Air Conditioning and Cryogenics	3	1	0	3	25	75	100
4		Elective – II	3	1	0	4	25	75	100
5		Elective - III	3	1	0	3	25	75	100
6		Elective - IV	3	1	0	3	25	75	100
Practicals									
7	MEP71	Thermal Engineering Lab – II	0	0	3	2	50	50	100
8	MEP72	CAD Lab	0	0	3	2	50	50	100
9	MEP73	Comprehensive Viva - Voce	0	0	3	2	50	50	100
10	MEP74	Industrial Visit / Training Report	-	-	-	1	100	-	100
11	MEPW7	Project Work (Phase I)*	-	-	3			-	
		Total	19	5	12	29	400	600	1000

VIII Semester

Sl. No.	Sub Code	Subject	Periods			Credits	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MET81	Industrial Engineering & Management	4	0	0	3	25	75	100
2	MET82	Maintenance and Safety Engineering	4	0	0	3	25	75	100
3	MET83	Energy & Environmental. Management	3	0	0	3	25	75	100
4		Elective - V	3	1	0	3	25	75	100
5		Elective - VI	3	1	0	3	25	75	100
Practicals									
6	MEPW8	Project Work (Phase II)	0	0	12	8	50*	50	100
7	MEP81	Seminar	0	0	3	1	100	-	100
8	MEP82	Professional Ethics and Indian Constitution	0	0	3	1	100	-	100
		Total	14	2	18	25	375	425	800

* Note: 15 marks of Internal Assessment of Project Work (Phase II) should be based on Project Work (Phase I) of VII Semester

LIST OF ELECTIVES

Elective – I

MEE61 Industrial Casting Technology
MEE62 Total Quality Management
MEE63 Design of Heat Exchangers
MEE64 Finite Element Methods
MEE65 IT Applications in Manufacturing
MEE66 Theory of Metal Cutting
MEE67 Engineering Tribology

Elective – II, III & IV

MEE71 Automobile Engineering
MEE72 Fuzzy Logic and Neural Networks
MEE73 Integrated Materials Management
MEE74 Metal Forming Processes
MEE75 Nuclear Power Engineering
MEE76 Plastics Engineering
MEE77 Product Design and Development
MEE78 System Design & Optimization in Thermal Engg.
MEE79 Computational Fluid Dynamics
MEE710 Mechatronics
MEE711 Renewable Energy
MEE712 Advanced Welding Techniques

Elective – V & VI

MEE81 Automotive Fuels, Pollution, and Control
MEE82 Composite Materials
MEE83 Direct Energy Conversion Systems
MEE84 Fluid Power Automation
MEE85 Industrial Robotics
MEE86 Pressure Vessel Design
MEE87 Project Management
MEE88 Modeling & Simulation in Manufacturing
MEE89 Solar Power Engineering

T101 MATHEMATICS – I

Unit I - Calculus

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

Unit II - Multiple Integrals And Applications

Multiple integrals – change of order of integration. Applications: Areas (double integration) and volumes by triple integration (Cartesian and polar) – mass and center of mass (constant and variable densities).

Unit III - Analytical Solid Geometry

Directional cosines and ratios – angle between two lines – the equation of plane - equations to a straight line and shortest distance between two skew lines.

Unit IV - Differential Equations

Exact equations, First order linear equations, Bernoulli's equation, orthogonal trajectories, growth and decay, geometrical applications and electric circuits. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit V - Differential Equations (Higher order)

Linear differential equations of higher order – with constant coefficients, the operator D - Euler's linear equation of higher order with variable coefficients - simultaneous linear differential equations – solution by variation of parameters method – simple applications to electric circuits.

Text Book

Dr.M.K.Venkataraman, Engineering Mathematics (First Year), Second Edition, The National Publishing Company, Madras, 2001.

Reference Book

N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, New Delhi , 2007.

T102 PHYSICS

Unit I – Acoustics & NDT

Ultrasonics - *U*ltrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating)
Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time
NDT applications - Pulse Echo Method - Liquid Penetrant Method

Unit II – Optics

Interference - Air Wedge – Michelson's Interferometer – Wavelength Determination – Interference Filter – Antireflection Coatings
Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism
Polarisation - Huygens Theory of Double Refraction – Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

Unit III – Lasers & Fiber Optics

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – Optical resonators – Types of Lasers - NdYAG, CO_2 laser, GaAs Laser
Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)

Unit IV – Wave Mechanics

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional Box – Quantum Mechanical Tunneling – Tunnel Diode.

Unit V – Nuclear Energy Source

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission – Nuclear Fusion (p-p & C-N cycle) – *Nuclear Reactor:* Materials Used in Nuclear Reactors. – PWR – BWR - FBTR

Text Books

1. A S Vasudeva, Modern Engineering Physics, S. Chand & Co, New Delhi, 2006.
2. V Rajendran, Engineering Physics, TMH, New Delhi 2008.

Reference Books

1. Richtmyer, Kennard and cooper , Introduction to Modern Physics, TMH, New Delhi 2005.
2. Ajay Ghatak, Optics, TMH, New Delhi, 2007.
3. Thiagarajan and Ghatak, Laser and Application, TMH, New Delhi 2008.
4. Arthur Beiser, Concept of Modern Physics, TMH, New Delhi 2008.
5. Avadhanulu M N and Kshir Sagar , A Text Book of Engineering Physics, S. Chand & Co 2007.
6 . R. Murugeshan, Modern Physics, S. Chand & Co, New Delhi 2006.
7 . K.R.Nambiar, Lasers, New Age International, New Delhi 2008.

T103 CHEMISTRY

Unit I - Water

Hardness of water – units and calcium carbonate equivalent. Determination of hardness of water- EDTA method. Disadvantages of hardwater-boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening method – internal & external conditioning – lime-soda process, zeolite process and ion exchange process. Desalination – reverse osmosis & electrodialysis.

Unit II – Polymers

Classification, types of polymerization reactions - mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties - chemical resistance, crystallinity and effect of temperature. Thermoplastics and thermosets. Polymerization techniques - bulk, suspension, emulsion, solution and gas phase polymerization. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, polyurethane, Mn and Mw. Rubbers - vulcanization, synthetic rubber, buna S, buna N, silicone and butyl rubber. Conducting polymers - classification and applications. Polymer composites – FRP - laminar composites.

Unit III - Electrochemical Cells

Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen calomel, Ag /AgCl & glass electrodes. Batteries - primary and secondary cells, laclanche cell, lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells - H_2-O_2 fuel cell.

Unit IV - Corrosion and Its Control

Chemical & electrochemical corrosion-Galvanic series-galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion-corrosion control methods - cathodic protection and corrosion inhibitors. Protective coating - types of protective coatings-metallic coating-tinning and galvanizing, cladding, electroplating and anodizing.

Unit V - Phase Rule

Definition and derivation of phase rule. Application to one component system - water and sulphur systems. Thermal analysis, condensed phase rule. Two component alloy systems - Pb-Ag, Cu-Ni and Mg-Zn systems.

Text books

1. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 2004.
2. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd edition. PHI Learning PVT., LTD, New Delhi, 2008.

Reference Books

1. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co., Ltd. New Delhi.
2. B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P) Ltd., Meerut, 2001.

T104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Part A - Electrical

Unit – I

Review of Kirchoff's laws – series and parallel circuits, equivalent resistance, star/delta conversion. Concepts of AC circuits – rms value, average value, form and peak factors – real and reactive power – power factor.

Unit – II

Node and mesh methods of analysis of DC circuits and simple AC circuits. Introduction to three phase circuits, Introduction to three phase system - phase and line parameters – relations, power measurement – voltmeter and ammeter method, two and three wattmeter methods.

Unit – III

Principle of DC generator and motor, Transformer, synchronous generator, induction motor (single phase). Sources for electrical energy conversion-thermal and hydraulic plant (Block diagram approach only). Components of AC transmission and distributions systems – line diagram.

Part B – Electronics

Unit – IV

Half-wave rectifier and Full-wave rectifier- filters - Amplifiers-common emitter and common collector amplifiers- Hartley oscillator and RC phase shift oscillator.
Transducers – Resistance temperature detector (RTD) – Linear variable differential transformer (LVDT) - Strain gauge – Piezo electric transducer.

Unit – V

Boolean algebra – Reduction of Boolean expressions – De-Morgan's theorem – Logic gates – Implementation of Boolean expressions – Flip flops – RS, JK, T and D. Combinational logic – Half adder, Full adder and Subtractors. Sequential logic – Ripple counters and shift registers.

Unit – VI

Model of communication system – Analog and digital – Wired and wireless channel. Block diagram of various communication systems – Microwave, satellite, optical fiber and cellular mobile system.
Network model – LAN, MAN and WAN – Circuit and packet switching – Overview of ISDN.

Text Books

1. Hughes revised by John Hiley, Keith Brown, Ian McKenzie Smith, Electrical and Electronics Technology, Pearson Education Limited, New Delhi, 2007.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, Second Edition, Prentice Hall of India Private Limited.
3. George Kennedy and Bernard Davis, Electronics communication Systems, Tata McGraw-Hill Ltd, New Delhi.

Reference Books

1. D.P.Kothari and I.J.Nagrath, Theory and Problems of Basic Electrical Engineering, Prentice Hall of India Ltd., New Delhi.
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi, 1993.

T105 THERMODYNAMICS

Unit I - Basic Concepts and Definitions

Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics.

Unit II - First Law of Thermodynamics

The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

Unit III - Second Law of Thermodynamics

Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

Unit IV - Gas Power Cycles
Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies

Unit V - Refrigeration Cycles and Systems

Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system (only theory)- Liquifaction and solidification of gases

Text Books

1. Nag, P. K., "Engineering Thermodynamics", 4th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi,1995
2. Wark, K., "Thermodynamics", 4th edition ,Mc Graw Hill, N.Y.,1985

Reference Books

1. Arora, C.P., "Thermodynamics" , Tata Mc Graw Hill Publishing Co. Ltd., New Delhi,1998.
2. Burghardt, M.D., "Engineering Thermodynamics with Applications", 4th edition, Harper & Row, N.Y., 1986.
3. Huang, F.F., "Engineering Thermodynamics" 2nd edition , Macmillan Publishing Co. Ltd., N.Y.,1989.
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, Mc-Graw Hill, 2006

T106 COMPUTER PROGRAMMING

Unit – I

History of Computers – Block diagram of a Computer – Components of a Computer system – Classification of computers - Hardware – Software – categories of Software – Operating System – Applications of Computers - Role of Information Technology – Internet and its services – Intranet – Study of word processor – Preparation of worksheets

Unit – II

Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code.
Introduction to C – C tokens – data types – Operators and expressions – I/O functions

Unit – III

Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions
Storage classes – Strings – String library functions

Unit – IV

Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types– Union
Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and structures

Unit – V

Files – operations on a file – Random access to files – command line arguments
Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives

Text Books

1. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.

2. K. Venugopal and C.Kavichithra, "Computer Programming", New Age International Publishers, First Edition, 2007.

Reference Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006.

P101 COMPUTER PROGRAMMING LAB
List of Exercises

OS Commands, Word Processor and Spreadsheets

1. Study of OS commands-Compilation and execution of simple C programs
2. Use of mail merge in word processor
3. Use of spreadsheet to create Charts(XY, Bar, Pie) and apply the formulae wherever necessary C Programming (Flowcharts and algorithms are essential for the programming exercises)
4. Greatest of three numbers using conditional operator and if statement
5. Read two numbers and swap those two numbers using temporary variable and without using temporary variable.
6. Solve quadratic equation for different sets of inputs.
7. Use of Switch….Case statements
8. Generation of prime and Fibonacci series
9. Evaluate the COSINE series using for, while and do..while loops
10. Matrix operations
    a) Addition
    b) Transpose
    c) Multiplication
11. Evaluate the sin(x) series using functions and recursive functions
12. Read a string and find solution to remove the duplicates of a given string from the given sentence
13. Create an array of structures for a list of items with the following details

Item_Code	Item_ Name
102	Paste – Colgate
102	Paste –Pepsodent
102	Paste –Close-up
101	Soap-Cinthol
101	Soap-Lux
101	Soap-Hamam
101	Soap-Dove

Arrange the set of items in ascending order of its Item_Code and descending order of its Item_ name as given below

Item_Code	Item_ Name
101	Soap-Lux
101	Soap-Hamam
101	Soap-Dove
101	Soap-Cinthol
102	Paste –Pepsodent
102	Paste –Colgate
102	Paste – Close-up

14. Use of Structure to define a user defined data types, input the data and write the data into the file

15. Use of pointers and array of pointers

16. Functions with static data types

17. Write command line program to implement the following DOS commands using files

    - Del
    - Copy

P102 ENGINEERING GRAPHICS

Unit 0

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

Unit I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

Unit II

Projection of Solids and Sections of Solids.

Unit III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

Unit IV

Isometric projections and Orthographic projections

Unit V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.
2. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
3. BIS, Engineering Drawing practice for Schools & College, 1992.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4th edition, New Age International Publication Ltd., 2004 .
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn. 1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.

P103 BASIC ELECTRICAL AND ELECTRONICS LAB

ELECTRICAL LAB

1. Study of tools and accessories
2. Study of joints
3. Staircase wiring
4. Doctor's room wiring
5. Godown wiring
6. Tube Light and Fan connection
7. Lamp controlled from three different places-wiring

ELECTRONICS LAB

1. Rectifiers

Construction of half wave and full wave rectifiers with and without filters – Calculation of ripple factors.

2. Frequency Response of RC Coupled Amplifiers

Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

3. Verification of Kirchoff's Voltage and Current Laws

Determine the voltage and current in given circuits using Kirchoff"s laws theoretically and verify the laws experimentally.

4. Study of Logic Gates
    a. Verification of Demorgan's theorems
    b. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
    c. Implementation of digital functions using logic gates

5. Study of CRO
    a. Measurement of AC and DC voltages
    b. Frequency and phase measurements (using Lissajou's figures)

6. Study of Transducers
    a. Displacement and load measurements with transducers
    b. Temperature measurement with thermocouple

T107 MATHEMATICS – II

Unit I - Algebra

Binomial, exponential and logarithmic series (without proof) – problems on summation, approximation and coefficients.

Unit II – Matrices

Inverse of matrix by row transformation – Eigen values and Eigen vectors - Cayley-Hamilton theorem (without proof) – Diagonalisation – rank of matrix – solution of a general system of m linear algebraic equations in n unknown ($m \leq n$).

Unit III – Trigonometry

Expansions for $\sin^n \theta$, $\cos^n \theta$, $\tan^n \theta$, $\sin(n\theta)$, $\cos(n\theta)$, $\tan(n\theta)$. Exponential, circular, hyperbolic, inverse hyperbolic and logarithmic functions of a complex variable – separation of real and imaginary parts.

Unit IV - Vector Analysis

Scalar fields and Vector fields – Gradient, Divergence and Curl – their properties and relations – Gauss and Stokes theorems (without proof), simple problems for their verification.

Unit V – Statistics

Moments, kurtosis and skewness based on moments only. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions. Correlation and regression – rank correlation.

Text Books

1. Dr.M.K. Venkataraman, Engineering Mathematics (First Year), Second Edition, The National Publishing Company, Madras, 2001.
2. Dr.M.K. Venkataraman, Engineering Mathematics (Third Year-Part A), The National Publishing Company, Madras, 2001.

Reference Books

1. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, New Delhi, 2007.

T108 MATERIAL SCIENCE

Unit I - Crystal structure and Defects

Crystal Systems – Bravais Lattices – Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices for a cubic crystal– Powder X Ray Diffraction Method - Lattice defects – Qualitative ideas of point, line, surface and volume defects

Unit II – Dielectric properties

Dielectric Polarization and Mechanism – Internal or local Field - Clausius-Mossotti relation – Dielectric loss - Temperature and frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and its Applications

Unit III – Magnetic Properties

Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro & Ferri) – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications: floppy disks, CD ROM, Magneto optical recording

Unit IV – Semiconductors and superconductors

Derivation of Carrier concentration in intrinsic Semiconductor – Hall effect in Semiconductors -- Application of Hall Effect - Basic Ideas of Compound Semiconductors (II-VI & III-V) - Basic concepts of superconductivity – transition temperature – Meissener effect – Type I and II superconductors – high temperature superconductors – 123 superconductor.

Unit V – Advanced Materials

Liquid Crystals – Types – Application as Display Devices – Metallic Glasses – Nanomaterials (one, Two & three Dimensional) – Physical Properties and Applications of Carbon Nano Tubes

Text books

1. V Raghavan , Materials Science and Engineering- A First Course, Prentice Hall of India, 2008.
2. M Arumugam , Materials Science, Anuratha Printers, 2004.

Reference Books

1. M Ali Omar, Elementary Solid State Physics, Addison Wesley Publishing Co., 2000.
2. William D Callister Jr., Material Science and Engineering, John Wiley and sons, 2006.
3. Srivatsava J P, Elements of Solid State Physics, Prentice Hall of India, 2001.
4. Charles Kittel, Introduction to Solid State Physics, John Wiley & sons, Singapore ,2007.
5. S.O Pillai , Solid State Physics– New Age International,2005.
6. Charles P Poole & Frank J Owens, Introduction to Nanotechnology, Wiley Interscience, 2003.

T109 ENVIRONMENTAL SCIENCE

Unit I - Environmental Segments and Natural Resources

Environmental segments-lithosphere, hydrosphere, biosphere and atmosphere-layers of atmosphere. Pollution-definition and classification. Pollutants-classification.
Forest resources-use and overexploitation, deforestation, forest management. Water resources-sources, use and conflicts over water, dams-benefits and problems. Mineral resources-mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources-world food problems, environmental impact of modern agriculture-fertilizer and pesticides, overgrazing and land resources-land degradation-land slides, soil erosion and desertification. Energy resources-growing energy needs renewable and non-renewable energy resources and use of alternate-energy sources.

Unit II - Ecosystem & Biodiversity

Concept of an ecosystem-structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grass land, desert and aquatic (fresh water, estuarine and marine) ecosystem. Biodiversity-definition-genetic species and ecosystem diversity. Value of biodiversity – consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity-habitat loss, poaching of wild life, human-wildlife conflicts. Endangered and endemic species. Conservation of biodiversity-in situ and ex-situ conservation of biodiversity.

Unit III - Air Pollution

Air pollution-sources of air pollution. Sources, effects and control measures of oxides of nitrogen, oxides of sulphur, oxides of carbon, hydrocarbon, chlorofluro carbons and particulates. Green house effect-causes and effects on global climate and consequences. Ozone depletion-causes, mechanism and effect on the environment. Smog-sulfurous and photochemical smog-effect on the environment. Acid rain-theory of acid rain and effects.

Unit IV - Water Pollution and Solid Waste Management

Sources, effects and control measures of –water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and radioactive pollution. Solid waste management – causes, effect and control measures of urban and industrial wastes.

Unit V - Social Issues and the Environment

From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, water shed management. Resettlement and rehabilitation of people. Environmental ethics. Consumerism and waste products. Environmental protection act-air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife protection act, forest conservation act. Role of an individual in prevention of pollution.
Human population and the environment-population growth, variation among nations, population explosion, role of information technology in environment and human health.

Text Books

1. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2nd edition, Scitech Publications, India, Pvt. Ltd, Chennai, 2008.
2. A. K. De, "Environmental chemistry" 6rd edn; New age international (P) Ltd, New Delhi, 2006.

Reference Books

1. B.K. Sharma, "Environmental chemistry" goel publishing house, Meerut, 2001.
2. G. S. Sodhi, Fundamental concepts of environmental chemistry, Narosa publishing house, New Delhi
3. S .S.Dara, " A text book of environmental chemistry and pollution control, S. Chand & Company Ltd, New Delhi, 2002.
4. Richard T. Wright, environmental science, 9th edition, Pearson education inc, New Delhi, 2007
5. P. Meenakshi, "Elements of environmental science and engineering" Prentice-hall of India, New Delhi, 2006.

T 110 BASIC CIVIL AND MECHANICAL ENGINEERING

Part-A Civil Engineering

Unit I - Buildings, Building Materials

Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

Unit II - Buildings and their components

Buildings- Various Components and their functions. Soils and their classification Foundations-Functions and types of foundations, Masonry, Floors-functions and types of floors, Roofs and types of roofs.

Unit III - Basic Infrastructure

Surveying-classification, general principles of surveying – Basic terms and definitions of chain, compass and leveling surveying , uses of surveying , contours, their characteristics and uses. Roads-types, Water bound macadam road, cement concrete road, bituminous road. Bridges-components and types of bridges. Dams-Purpose, selection of site, types of dams and components. Water supply-sources and quality requirements. Rainwater harvesting.

PART - B Mechanical Engineering

Unit IV - Internal and external combustion systems

Working principles of IC engines – Classification – Diesel and petrol engines: two stroke and four stroke engines. Steam generators(Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories.

Conventional Power Generation Systems

Hydraulic, steam and gas turbines power plants – Schemes and layouts – Selection criteria of above power plants.

Unit V - Non-Conventional Energy Systems (Description Only)

Solar thermal systems – Solar photovoltaic – Solar pond – wind, wave, tidal, geothermal and ocean thermal energy conversion systems.

Casting

Green and dry sand moulding processes for ferrous and non-ferrous metals – applications.

Unit VI - Metal Joining

Elements of arc and gas welding, brazing and soldering – Bolted joint types – Adhesive Bonding; classification of adhesives – applications.

Sheet Metal Processing

Punching, blanking, shearing, bending, and deep drawing processes; descriptions and applications

Text Books

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai, 2001.
2. Natarajan, K V, Basic Civil Engineering, 11th Edition, Dhanalakshmi Publications Chennai, 2001.
3. Lindberg, R.A.Process and Materials of Manufacture, PHI, 1999.
4. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

Reference Books

1. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New Delhi, 2002.
2. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi, 2002.
3. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi ,2002.
4. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co.,1985.
5. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004.

T 111 ENGINEERING MECHANICS

Unit I - Fundamental of Mechanics

Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, concept of free body diagrams, applications in solving the problems on static equilibrium of bodies.

Unit II - Plane Trusses

Degrees of freedom, Types of supports and reactions, Types of loads, Analysis of Trusses-method of joints, method of sections

Friction

Introduction, Static dry friction, simple contact friction problems, ladders, wedges, screws and belt friction.

Unit III - Properties of Surfaces

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

Unit IV - Kinematics and Kinetics of Particles

Equations of motion - Rectilinear motion, curvelinear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact.

Unit V - Kinematics and Kinetics of Rigid bodies

Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Bhavikatti,S.S and K.G.Rajashekarappa, Engineering Mechanics, New Age International (p) Ltd, New Delhi,2008.
2. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2002.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill,2001.
2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw – Hill International Edition, 1997.

T112 COMMUNICATIVE ENGLISH

Unit I – Basic Communication Theory

Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.

Unit II – Comprehension And Analysis

Comprehension of technical and non-technical material – Skimming, scanning, inferring- Note making and extension of vocabulary, predicting and responding to context- Intensive Reading and Reviewing

Unit III – Writing

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

Unit IV – Business Writing / Correspondence

Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications

Unit V – Oral Communication

Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice

Reference Books

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.
2. Boove, Courtland R et al., Business Communication Today. Delhi. Pearson Education,2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles And Practice,OUP, 2007.
4. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2006.
5. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2007.
6. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, New Delhi,2007.

P104 PHYSICS LABORATORY

List of experiments (Any 10 Experiments)

1. Thermal conductivity – Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton's rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly's experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber

P105 CHEMISTRY LABORATORY

List of experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

Demonstration Experiments(Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.

P106 WORKSHOP PRACTICE

Sl.No.	Trade	List of Exercises
1.	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2.	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray.
4.	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

List of Exercises

I Fitting

1.Study of tools and Machineries
2.Symmetric fitting
3.Acute angle fitting

II Welding

1.Study of arc and gas welding equipment and tools
2.Simple lap welding (Arc)
3.Single V butt welding (Arc)

III Sheet metal work

1.Study of tools and machineries
2.Funnel
3.Waste collection tray

IV Carpentry

1.Study of tools and machineries
2.Half lap joint
3.Corner mortise joint.

P107 NCC / NSS

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behaviour. If a candidate Fails, he/she has to repeat the course in the subsequent years
6. Pass in this course is mandatory for the award of degree.

MAT31 MATHEMATICS – III (3 1 0 4)

(Offered by the Department of Mathematics)

UNIT – I

Laplace Transform: Definitions – Laplace transform of unit impulse and step functions – Laplace transform of periodic functions – Exponential shift formula – Initial and final value theorems – Laplace transform of derivatives and integrals – Convolution theorem – Inverse Laplace transform – Methods of determining inverse Laplace transform – Solution of linear differential equations using Laplace transforms. (12 hrs)

UNIT – II

Function of a Complex Variable : Functions of a complex variable – continuity, derivative and analytic function – Cauchy-Reimann equations – Necessary and sufficient conditions for analyticity – Harmonic and orthogonal properties of real and imaginary parts – Conformal mapping – Bilinear transformations. (12 hrs)

UNIT – III

Complex Integration: Cauchy's theorem – Cauchy's integral formula – Taylor's and Laurent series – Residue theorem- Contour integration round the unit circle and semicircular contour. (12hrs)

UNIT – IV

Fourier Series: Dirichlet's conditions – Expansion of periodic functions into Fourier series – Change of interval – Half range Fourier series.

Complex form of Fourier series – Root mean square value – Parseval's theorem on Fourier coefficients – Harmonic analysis. (12 hrs)

UNIT – V

Fourier Transform: Fourier integral (statement only), Fourier transform, Inverse Fourier transform, Fourier sine and Cosine transforms, definitions and properties. (12 hrs)

TEXT BOOKS:

1. M.K. Venkataraman, Engineering Mathematics, Vol. II, National Publishing Co., Madras, 2009 (for Units I, II and III)
2. M.K. Venkataraman, Engineering Mathematics, Vol. III, National Publishing Co., Madras, 2009 (for Units IV and V)

REFERENCE BOOKS:

1. N.P. Bali & Manish Goyal: A text book of Engineering Mathematics, Laxmi Publications, New Delhi, 2008.
2. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley Sons, New York, 2005.
3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 2008.

MET32 MECHANICS OF SOLIDS (3 1 0 3)

Unit – I

Simple Stresses and Strain – Relation between three modulus and Poisson's ratio – Thermal Stress – Principal stress and Principal planes - Shear Force – Bending Moment – Cantilever and simply supported beams subjected to point loads and uniformly distributed loads. (12 hours)

Unit – II

Theory of simple bending - stress variation in beam cross Section; Normal and Shear stress in Beams – Beam of uniform strength for bending, combined direct and bending stresses. (12 hours)

Unit – III

Double integration method – moment area method – Introduction to strain energy method and Principle of virtual work. (12 hours)

Unit – IV

Torsion of circular solid and Hollow shafts – Shafts in Series and parallel – Combined bending and torsion -Application of Torsion in helical springs: Open and closed coil springs, Leaf Springs.
(12 hours)

Unit – V

Euler's Equation – short and long column, Empirical formulae: Johnson – Rankine. Introduction to thin cylinder – Thick cylinder – Lame's Equation – Compound Cylinders – Interference fit.
(12 hours)

Text Books :

1. R K Bansal, Strength of Materials, 4th Edition, Laxmi Publications, New Delhi, 2007
2. Bhavikatti. S. S., Strength of Materials, Vikas Publishing House (P) Ltd., New Delhi, Second Edition, 2002.

Reference Books :

1. U.G.Jindal - Strength of Materials, Galgotia Publication Pvt. Ltd., New Delhi, 1996.
2. R.K.Rajput - Strength of Materials, S.Chand and Company Ltd., New Delhi, 2003.
3. Beer F, Jonston E R, DeWolf J, Mechanics of Materials, McGraw-Hill Publications, 2005

MET33 MECHANICS OF FLUIDS (3 1 0 3)

Unit – I

Basic concepts of fluid properties – pressure head – measurement of pressure – static force – hydrostatic force on plane and curved surfaces – buoyancy – metacentre – metacentric height – stability of submerged and floating bodies. (12 hours)

Unit – II

Velocity – rate of flow – acceleration – continuity equation – rotation and vorticity – velocity potential and stream function – flow net – Bernoullie's equation – application of Bernoullie's equation – cavitation – one dimensional unsteady flow. (12 hours)

Unit – III

Introduction to mass, momentum and energy transfer – momentum equation – Navier Stoke's equation – impulse momentum equation and its applications – dimensions and equations – Buckingham ∏ theorem – dimensionless numbers and its significance – models – laws of similitude. (12 hours)

Unit – IV

Concept of boundary layer – boundary layer growth over a flat plate- boundary layer thickness, displacement, momentum and energy thickness – Solution of simplified Navier Stokes equation: Blasius solution – laminar and turbulent boundary layers – drag force in laminar and turbulent flow – boundary layer separation and control. (12 hours)

Unit – V

Reynold's experiment – Hagen Poiseuille equation – Stoke's Law – Measurement of viscosity – Darcy Weisbach equation – Friction factor – losses due to sudden enlargement, contraction, bends and elbows – compound pipes – flow measurement. (12 hours)

Text Books :

1. R.A.Granger, Fluid Mechanics, CBS College Publishing, New York, 1995.
2. R.Fox and Mc Donald, Introduction to Fluid Mechanics, John Wiley & Sons Inc., 2001.

Reference Books :

1. J.A.Roberson and C.T.Crowe, Engineering Fluid Mechanics, Jaico Publication, 1999.
2. S.W.Yuan , Foundation of Fluid Mechanics, Prentice Hall of India, New Delhi, 1988.
3. P.N.Modi and Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998.

MET34 APPLIED THERMODYNAMICS (3 1 0 4)

Unit – I

Real gas equation and Pure substances – Law of perfect gases – Boyles law – Charles law – Gay Lussac law – Joules law – Avogadro's law – characteristic equation of gases – specific heat of gases – Regnaults law – Perfect gases – Vander Walls equation – Redlich Kwong equation – Dietric equation – properties of pure substances – pure substance – phase change – thermodynamic diagram of a simple compressible substances – thermodynamic substances – properties of steam – tables of thermodynamic properties – Mollier diagram – gaseous phase. (12 hours)

Unit – II

Thermodynamic analysis of system – Energy and first law of thermodynmics – thermodynamic concept of energy – energy transfer – energy accounting – energy balance for closed and open system.
Exergy analysis – introduction to exergy – closed system exergy balance – flow exergy – exergy rate balance for control volume – second law efficiencies. (12 hours)

Unit – III

General Conservation of Energy and mass principles for control volume – Charging and discharging Rigid Vessels – Transient System analysis with boundary work – Irreversibility and Availability in Transient Systems.

Unit – IV

General thermodynamic properties and its relation – Helm Holtz and Gibbs function – Gibbs phase equilibrium condition – Maxwell equation – Clapeyran equation – Newton Raphson technique – property relation. (12 hours)

Unit – V

Combustion Reactions – Enthalpy of formation – Steady flow analysis of reacting mixtures – Adiabatic combustion temperature – Enthalpy of reaction and heating values – Second law analysis of chemical reactions – Availability analysis of chemical reactions. (12 hours)

Text Books :

1. P.K.Nag, Engineering Thermodynamics, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2003.
2. M.J.Moran & H.N.Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley & Sons,Singapore, 2000.
3. Rathakrishnan E, Fundamentals of Engineering Thermodynamics, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2008

Reference Books :

1. C.P.Arora, Thermodynamics, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1998.
2. K.Wark, Thermodynamics, McGraw Hill Book Publishing Co., New York, 1985

MET35 ENGINEERING METALLURGY (4 0 0 3)

Unit – I

Crystal structures - Solid Solutions – Types - Metallography – Metallurgical microscopes – specimen preparation- Cooling curves – Allotropy concept (12 hours)

Unit – II

Construction and interpretation of binary phase diagrams – Types – Eutectic, Eutectoid, Petitectic and Peritectoid systems – Iron Carbon equilibrium diagrams – classification of steels and alloy steels – types, manufacture, properties and applications of cast irons. (12 hours)

Unit - III

Heat treatment of steel: Critical temperature on heating and cooling, effects of residual stresses – Annealing, normalizing, hardening, Hardenability tests, tempering – construction and interpretation of TTT diagram – Martensitic transformation – Sub zero treatment - Surface hardening processes. (12 hours)

Unit – IV

Non ferrous metals and alloys : Copper, Aluminium, , Nickel, Zinc and Lead based alloys – concept and applications of metal matrix composites.
Mechanical properties of materials – Testing of materials: Tensile, compression, torsion, hardness (micro & macro) and impact testing. (12 hours)

Unit – V

Plastic deformation, Slip and twinning – Hot, cold and warm working – recovery and recrystallization concepts.
Introduction to fracture mechanics – Types - ductile to brittle transition – Creep and Fatigue failures – Testing. (12 hours)

Text Books :

1. Raghavan V, Physical Metallugy – Principles and Practice, Prentice Hall India Pvt. Ltd., New Delhi, 2006
2. S.H.Avner, Introduction to Physical Metallurgy, Tata-McGraw Hill Publishing Co., New Delhi, 2000.
3. G.E.Dieter, Mechanical Metallurgy, McGraw Hill Publishing Co., New York, 1988.

Reference Books :

1. Donald R. Askeland, The Science and Engineering of Materials, Chapman and Hall,1990.
2. Raghavan V, Materials Science and Engineering, Prentice Hall India Pvt. Ltd.,New Delhi, 2007
3. Budinski and Budinski, Engineering Materials – Properties and Selection, Prentice Hall India Pvt. Ltd., 2005

MET 36 MANUFACTURING PROCESSES – I (3 0 0 3)

Unit I :

Introduction to manufacturing processes – classification – steps involved in casting process – different types of casting – pattern and core making – materials, types and allowances – moulding tools and equipment - properties of moulding sand - casting defects and remedies.

(9 hours)

Unit II :

Types of welding processes – weldability - gas welding – oxy acetylene welding - Introduction to arc welding – types and equipment – resistance welding – types and applications - welding defects – Introduction to welding standards – welding of dissimilar metals and non-metals.

(9 hours)

Unit III :

Classification of metal forming processes – Rolling, Forging, Extrusion, Drawing and other Sheet metal operations : terminology used, processes, machines and defects. (9 hours)

Unit IV :

Surface Finishing Processes : Surface Finish and Surface Roughness Honing – Lapping – Superfinishing – Abrasive Belt Finishing – Mass Finishing Processes – Polishing – Buffing.

Grinding : Types of grinding – Types of Grinding machines – Size and specification of Grinding machines - Work Holding Devices – Grinding Operations - Grinding Fluids – Grinding Speed, Feed and Depth of Cut. (9 hours)

Unit V :

Plastics and polymers – structure of polymers – additives in plastics – thermoplastics and thermosetting plastics – manufacturing of plastic products – different moulding methods – forming or shaping methods – laminating methods – machining of plastics – joining plastics – industrial applications of plastics. (9 hours)

Note: Elementary treatment only for all the five units

Text Books :

1. B.S.Nagendra Parashar & R.K.Mittal – Elements of Manufacturing Processes, Prentice Hall India Pvt. Ltd.,
2003.
2. J.P.Kaushish – Manufacturing Processes, Prentice Hall India Pvt. Ltd., 2008.

Reference Books :

1. E.Paul DeGarmo, J.T.Black and Ronald A.Kosher – Materials and Processes in Manufacturing, Prentice Hall
India Pvt. Ltd., 2008.
2. Roy A.Lindberg - Processes and Materials of Manufacture, Prentice Hall India Pvt. Ltd., 2002.
3. S.K.Hajra Choudry - Workshop Technology, Vol. - I, & II, Media Promoters and Publishers Pvt. Ltd., 1997.

MEP31 Material Testing and Metallurgy Lab (0 0 3 2)

Materials Testing Laboratory

1. Tension test - metals and composites
2. Compression Test – metals and composites
3. Hardness test : Rockwell and Brinell
4. Ductility test : Sheet metals (Al, GI and MS).
5. Impact Test

Metallurgy Laboratory

1. Study of microstructure in metals
2. specimen preparation & microscopic study of ferrous/nonferrous metals
3. Effect of heat treatments viz., Annealing and hardening on ferrous/nonferrous metals
4. Study of various Quenching mediums
5. Jominy end quenching test

MEP32 FLUID MECHANICS LAB (0 0 3 2)

1. Determination of Metacentric height of a buoy
2. Determination of force due to impact of jets
3. Determination of co-efficient of discharge of venturi meter
4. Determination of co-efficient of discharge of orifice meter
5. Determination of co-efficient of discharge of orifice by (a) constant head method and (b) variable head method
6. Determination of co-efficient of discharge of mouth piece by (a) constant head method and (b) variable head method
7. Determination of major losses in pipe flow
8. Determination of minor losses in pipe flow
9. Measuring discharge using V notch
10. Measuring discharge using rectangular weir

MEP33 MANUFACTURING PROCESS LABORATORY-I (0 0 3 2)

TURNING:

1. Study of Lathe
2. Plain turning and facing
3. Step turning, Grooving & Chamfering
4. Taper turning by swiveling compound rest method
5. Taper turning by attachment method
6. V – Thread cutting

SHAPING:

7. Study of Shaper
8. Cube shaping
9. Step shaping

MILLING:

10. Study of Milling Machine
11. Cube Milling
12. Step Milling

MAT41 MATHEMATICS – IV (3 1 0 4)

Partial Differential Equations

Unit – I

Formation of PDE by elimination of arbitrary constants and arbitrary functions – General singular. Particular and complete integrals – Lagrange's linear first order equation – Higher order differential equations with constant coefficients. (12 hours)

Unit - II

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions – Transverse vibration of an elastic string. (12 hours)

Unit – III

Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state conditions (Cartesian and polar forms). (12 hours)

Applied Statistics

Unit – IV

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. (12 hours)

Unit – V

Small samples: Test for single mean, difference of means and correlation coefficients – test for ratio of variances – Chi–Square test for goodness of fit and independence of attributes. (12 hours)

TEXT BOOK:

1. M.K.Venkataraman, Engineering Mathematics, Vol. II & III, National Publishing Co., Madras, 2007.
2. S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand Sons , New-Delhi, 2008.

REFERENCE BOOKS:

1. N.P. Bali & Manish Goyal : A text book of Engineering Mathematics, Laxmi Publications, New- Delhi, 2008.
2. Erwin Kreyszig : Advanced Engineering Mathematics, John- Wiley sons, New-York, 2005.
3. B. S. Grewal, : Higher Engineering Mathematics, Khanna Publishers, New-Delhi, 2008.

MET42 Kinematics of Machinery (3 1 0 4)

Unit – I :

Introduction: Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, Definition & Concept - inversion of single and double slider chain and four bar chain and its applications

Mechanism with lower pairs -Pantograph, Straight line mechanism- exact and approximate Motion, Engine indicator, Motor car Steering gears, Hooke joint, Toggle mechanism.

(12 hours)

Unit-II

Kinematic Analysis of Mechanisms: Analysis of displacement, velocity & acceleration diagrams of simple planar mechanisms by graphical (Instantaneous center method and relative velocity method), analytical and computer aided methods (for four-bar and slider crank mechanism only), coriolis component of acceleration .

(12 hours)

Unit – III

Kinematic Synthesis of Mechanisms: Kinematic synthesis, graphical method using relative pole method, Inversion method and overlay 3 point synthesis problems - Motion, path & function generation, Chebyshev's spacing of accuracy points Freudenstein Method of 3 point synthesis of four link mechanism and slider crank mechanism. Coupler curves

(12 hours)

Unit – IV

Cams:Types of cams and followers, displacement velocity and acceleration curves for uniform velocity, uniform acceleration and retardation, SHM, cycloidal motion, layout of profile of plate cams of the above types with reciprocating, oscillating, knife-edge, roller and flat faced followers. Cylindrical and face cams, polynomial cams, cams with special contours. Tangent cams with reciprocating roller follower, circular arc cam with flat faced follower. (12 hours)

Unit - V

Gears and Gear Trains**:** Classification and terminology used, Fundamental law of gearing – friction wheel, teeth for positive action and condition for constant velocity ratio. Conjugate profiles cycloidal and involute teeth profiles. Involute construction, properties and computation of path of contact and contact ratio. Interference and undercutting- Minimum number of teeth to avoid Interference, methods to avoid Interference.

Introduction, classification, examples, gear ratio in simple and compound gear trains, Automobile gear box,Planetary gear trains-methods of evaluating gear ratio - Differential gear box.

(12 hours)

Text Books :

1. J.E.Shigley and J.J.Uicker - Theory of Machines & Mechanisms, McGraw Hill International Edition, 2006.
2. Rattan - Theory of Machines, Tata McGraw Hill, 2009.

Reference Books :

1. J.S.Rao and R.V.Dukkipati - Mechanism and Machine Theory, New Age International, 2004.
2. Thomas Bevan - Theory of Machines, CBS Publishers & Distributors, 2004.
3. P.L.Ballaney - Mechanics of Machines, Khanna Publishers, 2005.

MET43 FLUID MACHINERY (3 1 0 3)

Unit - I

Principles of Turbo Machinery: Fluid Machines – Classification – Impact of Fluid Jet on Stationary plates, Moving Plates and Vanes – Unit and Specific Quantities. (12 hours)

Unit – II

Hydraulics Turbines: Classification – Impulse Turbine – Pelton Wheel – Reaction Turbines – Francis and Kaplan Turbines – Draft Tube Theory – Velocity Triangle – Estimation of force, Power and efficiency – General Characteristics of Turbine – Similarity Study – Governing of Turbine – Cavitation in Turbine. (12 hours)

Unit - III

Hydraulic Pumps: Classification - Centrifugal Pump – Velocity Triangle – Estimation of Power Required and efficiency – General characteristics - Similarity study – Cavitation in Pump – Reciprocating Pump – Air Vessels – Ideal and Actual Indicator Diagram – Estimation of Power Required, percentage Slip and Efficiency – Cavitation in Reciprocating pump. (12 hours)

Unit – IV

Air Machines: Classification – Compressor – Centrifugal Compressor – Reciprocating Compressor – Axial Flow Compressor – Single Stage compressor with and without Clearance – Multistage Compressor with perfect inter Cooling.
Fans - Centrifugal Fans – Axial Flow Fans – Multi Flow Fans – Blowers.
Work done, Efficiency and losses in Compressors, Fans and Blowers – General Characteristics.
(12 hours)

Unit – V

Special Purpose Fluid Pumps and Machines**:** Gear Pump – Vane Pump – Screw Pump – Vacuum Pump – Self Priming Pump – Diaphragm Pump – Turbine Pump – Jet Pump – Multistage Pump – Rotary Pump – Pneumatic Pump – Submersible Pump – Hydraulic : Pump, Press, Jack, Accumulator, Intensifier Crane, and Lift - Hydraulic coupling – Torque Converter - Theory and Applications. (12 hours)

Text Books :

1. N.S.Govinda Rao, Fluid Flow Mechanics, Tata McGraw Hill Publishing Company, New Delhi, 1986.
2. V.Kadambi and Manohar Prasad, Introduction to Energy Conversion, Wiley Eastern, Publishers, 1991.

Reference Books :

1. R.K.Bansal, Fluid Mechanics and Hydraulic Machinery, Lakshmi Publications, NewDelhi, 2002.
2. P.N.Modi and Seth, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 1989.

MET44 HEAT AND MASS TRANSFER (3 1 0 3)

Unit – I

Heat Transfer by Conduction: Concept of heat conduction – Law of heat conduction – heat conduction equations; solution for steady state conduction; conduction with heat sources; extended surfaces – transient heat conduction, solution using Heisler's charts – measurement of thermal conductivity – effects of temperature on thermal conductivity – electrical analogy.

(12 hours)

Unit – II

Heat Transfer by Convection and with Phase Change: Convection – forced convection, external flow, laminar and turbulent flow over flat plate, cylinder and sphere – internal flow, laminar and turbulent flow through circular tubes – free convection, laminar flow over plates and tubes.

Condensation – concept of condensation – types - Nusselt's theory – heat transfer during condensation.

Boiling – pool boiling; regimes – nucleate boiling, film boiling, critical heat flux – flow boiling, pattern, heat flux.

(12 hours)

Unit – III

Heat Transfer by Radiation: Nature of thermal radiation-concept of black body, Stefan-Boltzman law, Kirchoff's law, intensity of radiation -radiative heat exchange between surfaces – shape factors – concept of grey body radiation between surfaces separated by non-absorbing medium-electrical analogy. (12 hours)

Unit – IV

Double pipe heat exchangers, parallel and counter flows – Log Mean Temperature Difference (LMTD) – multi pass heat exchangers, analysis using correction factors – heat exchanger effectiveness – effectiveness expressed in terms of NTU for different configurations – effectiveness Vs NTU charts. (12 hours)

Unit – V

Similarity between phenomena of heat transfer and mass transfer – diffusion mass transfer, Fick's Law of diffusion, species conservation equation-initial and boundary conditions, steady state molecular diffusion-diffusive mass transfer and convective mass transfer– momentum, heat and mass transfer analogies, convective mass transfer correlations, evaporation of water into air.

(12 hours)

Text Books :

1. F.P.Incropera and D.P.Dewitt, Fundamentals of Heat and Mass Transfer, IV Edition, John Wiley &Sons,
2000.
2. J.P.Holman, Heat Transfer, X Edition, McGraw Hill Book Company, NY, 2009.

Reference Books :

1. A.Bejan, Heat Transfer, John Wiley & Sons, 1993,
2. M.N.Ozisik, Heat Transfer: A Basic Approach, McGraw Hill Book Company, New York, 1985.
3. R.C.Sachdeva , Fundamentals of Engineering Heat and Mass Transfer, Wiley Eastern Ltd., 1997.

MET45 MACHINE DRAWING (2 0 3 3)

UNIT -I

Conventions for sectioning and dimensioning, screw threads, rivets, bolts, nuts, pins, keys, cotter, gear, springs and welds.

Component drawing assigning fits and tolerance machine symbol, surface finish geometrical tolerance.

L – 6 Hours + P – 9 Hours

UNIT – II

Preparation of drawings of parts and assembly of:-

Joints

riveted joints - butt joints and lap joints

pin joints - knuckle joints

cotter joints -sleeve, socket and spigot joints

Couplings:-

Split muff couplings, flexible type flange coupling, universal coupling

Bearing:-

pedestal bearing, swivel bearing, Plumber block

Screw jack

Connecting rods

Tail stock

Four way tool post

Stop valve – steam

Centrifugal pump

.

L – 24 Hours + P – 36 Hours

Text books

1. Bhatt, N.D "Machine Drawing", Charotar Publishing House.2008
2. Gopalakrishnan, K.R, "Machine Drawing", SUBHAS Publications, VIII edition,2004

Reference books:

1. Gupta, R.B, "Machine Drawing" , Satya Prakasham,1998
2. Sidheswar, "Machine Drawing" Tata Mc Graw Hill edition, 2006
3. Sadhu Sing and P.L. Sah, Fundamentals of Machine Drawing, PHI 2005

MET46 ELECTRICAL AND ELECTRONICS ENGINEERING (3 1 0 3)

Unit – I : Transformers

EMF Equation – Equivalent circuit – Voltage regulation - OC and SC Test – Efficiency – condition for maximum efficiency – All day efficiency – Autotransformer – introduction to three phase Transformer. (9 hours)

Unit – II : AC Machines

Theory and operation of 3 phase Induction motor - constructional details – starting methods – speed control methods – principle of operation of single – phase Induction motor – stepper motor – AC series motor – Applications. (9 hours)

Unit – III : Alternators

Alternators - construction - Operating principle - alternators on No load – Alternators on Load - Phasor diagram - voltage regulation – Losses – Efficiency – Parallel operation of alternators. (9 hours)

Unit – IV : Electronics

Op. amp. – Characteristics – Inverting amplifier - Non-inverting amplifier – differentiation integration I/V converter - V/I converter - Instrumentation amplifier – adder – substractor – First order low pass filter and High pass filter using op. Amp. (9 hours)

Unit – V

Advantages of ICs - pin configurations of 555 IC - Design of astable and mono-stable multi-vibrator using 555 IC - design of counters using FF-UP/DOWN counters BCD counters shift Registers – simple applications. (9 hours)

Text Books :

1. I.J.Nagrath & D.P.Kothari, Electric Machines, V Edition RMH Pub Co., Ltd., New Delhi, 1990.
2. Ramakant A Gayakward, Operational Amplifiers and Linear Integrated circuits, Person Education (Singapore) Pvt. Ltd., Delhi, 2003.

Reference Books :

1. A.Malvino and P.Leach, Digital principles and Applications, IV edition, Tata McGraw Hill, 1998.
2. B.L.Theraja & A.K.Theraja , Electrical Technology, Vol. - II, Nirja Construction & Development Co. (P) Ltd., New Delhi, 1995

MEP41 COMPUTATIONAL METHODS LAB (2 0 3 3)

Introduction to Fortran 95: Comparison with C. – Variables declarations, Handling of Arrays, Data Files handling, Input/Output statements, Functions and Subroutines (Explanation only)

Finding roots of an equation using Newton Raphson Method and secant method of a given equation.

Solution of an simultaneous algebraic equations using LU decomposition / Gauss elimination / Gauss Seidel methods

Obtaining the temperature distribution in a fin with tip insulation through Runge-Kutta method and compare with the theoretical solution.

Solving Eigen value by simple iterative method like Power Method.

Obtain the shear force and bending moment diagrams for a simply supported beam or Cantilever beam subjected to multiple pointed loads and uniform distributed loads.

Introduction to FDM/FEM/FVM (Explaining the differences)

Using FDM obtain the solution of Fin Equation with insulated tip. Use Thomas Algorithm to solve the resulting algebraic equations

Using FDM obtain the solution for deflection for a simply supported beam with pointed loads and uniform distributed loads.

Solving one dimensional transient heat conduction equations for a plate when it is subjected to convection. Compare with Hesiler Charts.

Solving two dimensional heat conduction equation prescribed temperature on the boundary and obtain isothermal lines. Compare the solution with theoretical solution. (Explicit Implicit and semi-implicit methods)

Introduction to Optimization: Difference between minimization and root finding, Golden section method to find minimum of a single variable objective function (Explanation only)

Obtain the minimum of a multi dimensional objective function using steepest descent method / Conjugate gradient method / Variable matric method

Solving a sparse matrix equations using conjugate gradient method / bi-conjugate gradient method (2D Conduction equation).

Reference Books:

1. E Balagurusamy, Numerical Methods, Tata Mcgraw Hill Publishing Company, 1999
2. William H.Press et al, Numerical Recipes in Fortran, Cambridge University Press, 1992

MEP42 FLUID MACHINERY LABORATORY (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

Study and performance test of the following hydraulic machines

1. Centrifugal Pump
2. Self-Priming Pump
3. Reciprocating Pump
4. Jet – Pump
5. Submersible Pump
6. Vertical Turbine Pump
7. Parallel & Series Pump
8. Gear Pump
9. Vacuum Pump
10. Pelton Wheel Turbine
11. Francis Turbine
12. Kaplan Turbine

MEP43 ELECTRICAL AND ELECTRONICS LABORATORY (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

1. OC and SC Test on Single Phase Transformer
2. Load Test on Single Phase Transformer
3. Load Test on 3 Phase Transformer
4. Load Test on Single Phase Induction Motor
5. Two Wattmeter Method of Power Measurement
6. OCC of Alternator
7. Inverting and Non-Inverting Amplifier Using 741 IC
8. Astable Multivitbrator Using 555 IC
9. Counter Using 7490 IC
10. Adder / Substractor Using 741 IC

SPP44 Physical Education

Physical Education is compulsory for all the Undergraduate students

Physical Education is compulsory for all the Undergraduate students

1. The activities will include games and sports / extension lectures.
2. Two Hrs. / Week will be allocated for physical education in the third and fourth semesters. Minimum of 75% attendance is mandatory.
3. These activities will be monitored by the Director of Physical Education.
4. Pass /Fail will be determined on the basis of participation, attendance, and performance. If a candidate Fails, he/she has to repeat the course in the subsequent years
5. Pass in this course is mandatory for the award of degree.

MET51 Dynamics of Machinery (3 1 0 4)

Unit - I

D'Alembert's Principle-Inertia forces of reciprocating parts, Dynamic analysis of four link and slider-crank mechanisms, Engine force Analysis Turning moment on crankshaft, Dynamically Equivalent system, Inertia forces in a reciprocating engine , Turning Moment diagrams, Fluctuations of Energy and speed, Flywheel.

(12 hours)

Unit - II

Basic concepts of S.H.M, Causes and effects of vibration and degrees of freedom. Natural frequency of free oscillations – equivalent system – energy method – simple problems, Damped free vibration of single degree of freedom system, forced vibration. Basic of vibration isolation, Transmissibility and vibration absorbers. (12 hours)

Unit - III

Transverse vibrations of beams-Natural frequency by energy method, Dunkerly's method, Whirling of shafts- calculation of whirling speed for loaded shafts. Torsional vibrations-causes of Torsional vibration. Torsional Vibration of two and three rotor systems. Equivalent shaft system, Geared system. (12 hours)

Unit - IV

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors –Characteristics - Effect of friction - Controlling Force - other Governor mechanisms.
Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes (12 hours)

Unit - V

Static and dynamic balancing of rotating masses in different planes - partial balancing of reciprocating masses of inline, V, W and radial engines. (12 hours)

Text Books :

1. J.E.Shigley and J.J.Uicker - Theory of Machines & Mechanisms, McGraw Hill International Edition, 2006.
2. Rattan - Theory of Machines, Tata McGraw Hill, 2009.

Reference Books :

1. J.S.Rao and R.V.Dukkipati - Mechanism and Machine Theory, New Age International, 2004.
2. Thomas Bevan - Theory of Machines, CBS Publishers & Distributors, 2004.
3. P.L.Ballaney - Mechanics of Machines, Khanna Publishers, 2005.
4. Robert F.Steidel Jr. - An introduction to Mechanical Vibrations, John Wiley & Sons Inc.,New York, 2003.

MET52 DESIGN OF MACHINE ELEMENTS (3 1 0 4)

Unit – I

Fundamentals of machine design - Design philosophy- Engineering Materials- Brief overview of design and manufacturing – Principal Stresses -Failure Theories - Design of Welded Joints -Types – Strength – Eccentric loaded welded joints – Welded joints subjected to fluctuating load.

(12 hours)

Unit – II

Strength and Stability Criteria, Design of Power Screws. Threaded Joints – Bolted Joints under fluctuating load, Combined Stresses, and eccentric loading. (12 hours)

Unit - III

Design of Couplings – Design of Rigid and flange Couplings – Types of Clutches and Design of Clutches. Types of Brakes – Design of Brakes. (12 hours)

Unit - IV

Introduction to Design of Helical Springs-Design of Helical Springs for Variable Load-Design of Leaf Springs- Design of Pipe Joints – Cotter and Knuckle joints (12 hours)

Unit - V

Design of Shafts under static load: members subjected to Eccentric loading – stresses in curved beams. Design of Shafts under Fluctuating Load: Design for Finite and Infinite life – Soderberg and Goodman equations – combined stresses. (12 hours)

Text Books :

1. V.B.Bhandari -Design of Machine Elements, Tata McGraw Hill publishing Co., 1997.
2. Sharma and Purohit, ., Design of Machine Elements, PHI, 2006
3. Ganesh Babu, K. and Srithar, K., Design of Machine Elements, McGraw Hill Education (India) Pvt. Ltd., Noida, 2009

Reference Books :

1. J.Shigley, Mechanical Engineering Design, McGraw Hill International Edition, 1997.
2 Abdul Mubech, Machine Design, III Edition, Khanna Publishers, 1998.
3. Sadhu Singh, Machine Design, III Edition, Khanna Publishers, 2001.

MET53 METROLOGY AND QUALITY CONTROL (4 0 0 3)

UNIT 1:
Standards of Measurement**:** Definition and Objectives of metrology, Standards of length – International prototype meter, Imperial Standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), slip gauges, wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges.
System of limits, Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian Standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances.

UNIT 2:
Fits, Tolerances and gauging & Comparators**:** Definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional – tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges – Plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials. Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators – Johnson Mikrokator, Sigma Comparators, dial indicator, Optical comparators – principles, Zeiss ultra optimeter, Electric and Electronic comparators – principles, LVDT, Pneumatic comparators, back pressure gauges, Solex comparators.

UNIT 3:
Angular measurement, Interferometer and Screw thread gear measurement**:** Angular measurements, Bevel Protractor, Sine Principle and use of Sine bars, Sine center, use of angle gauges, (numericals on building of angles) Clinometers. Interferometer Principle of interferometery, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer.

Unit – IV :
Objectives of Statistical Quality Control – inspection and its importance – differences between inspection and quality Control – Causes and types of variations – Concept of zero defect – theory of control charts, control charts for attributes – p, np, c and u charts.

Unit – V :
Control charts for variables, x and R charts, standard deviation charts, median chart and mid range chart -Moving range chart. Acceptance sampling: Fundamental concepts and terms, OC curves, sampling plan, BIS Codes.

TEXT BOOKS
R.C.Gupta, Statistical Quality Control, Khanna Publishers, 1995
Gupta, I.C., "Engineering Metrology", Dhanpat Rai Publications (P) Ltd., 2003.

REFERENCE BOOKS:
Thomas, G.G., "Engineering Metrology", Butterworth Publishing & Co., 1974.
D.C.Montgomery, Introduction to statistical quality Control, John Wiley, 1994.

MET54 Thermal Engineering (3 1 0 4)

UNIT I

Fuels: solid, liquid and gaseous fuel and their charactaristics – Combustion of fuel – flash point, fire point, calorific value, Combustion reaction; heat of formation, heat of combustion – combustion analysis. combustion process in IC engines – Flame propagation, normal and abnormal combustion , delay period, knocking and detonation, knocking rate of fuel, cetane number, octane number, supercharging and turbo charging – combustion chamber and types.

(12 hours)

UNIT II

Classification of IC engines – petrol and diesel engines; two stroke and four stroke engines – scavenging in two stroke engines - port and valve timing diagram - – fuel supply system in SI and CI engines - ignition system and its types – cooling system and its types – lubrication system and its types -lubricants - governing of IC engines – performance test on IC engines – heat balance test for IC engines.

(12 hours)

UNIT III

Engine emission – emission standards - measuring instruments - emission control methods- after treatment – catalytic converter – chemical methods – EGR – alternate fuel – developement in IC engines – MPFI – CRDI.

(12 hours)

UNIT IV

Basic principles – stagnation properties – sonic velocity – Mach number – and mack waves – Isentropic flow through variable area - Mach number variation – stagnation and critical states – area ratio as a function of Mach number, mass flow rate, flow through nozzles and diffusers. Normal shocks – development of a shock wave, governing equations, Mach number after the shock, pressure and temperature across the shock. Oblique shocks – Nature of flow through Oblique shock waves, fundamental relaters and equaters, flow in constant area ducts with friction. flow in constant area ducts with heat transfer.

(12 hours)

UNIT -V

Principle of jet propulsion – jet propulsion engines – jet engine cycle – turbo- jet engine – turbo-jet engine operation – thrust, thrust power, propulsion power, propulsion efficiency and thermal efficiency.

(12 hours)

TEXT BOOKS:

V. Ganesan – Internal Combustion Engines, Tata McGraw Hill, 1999.

Yahya s.M., Fundamentals of Compressible Flow, Wiley Eastern Limited, New Delhi, 1989.

REFERENCE BOOKS

Willard W. Pulkrabek – Internal Combustion Engines, Prentice Hall of India, 2002.

Collin R. Ferguson – Internal Combuistion Engines, Applied thermoscience, II Edition Wiley & Sons Inc., 1986.

J.B. Heywood – Internal Combustion Engines – fundamentals, McGraw Hill, 1988.

Cambel, A.B. and Jennings, 'Gas dynamics and Compressible Flow", Tata McGraw Hill, 1958.

MET55 Manufacturing Processes – II (4 0 0 3)

Unit – I

Turning operations: Lathe – Types, Designation, Work holding devices – Cutting Speed, Feed and Depth of Cut, MRR - Operations, Machining Time. (12 hours)

Unit – II

Drilling and Allied Operations: Drilling Machines - Types, Operations, MRR, Machining Time - Boring, Reaming and Tapping (Definition of operations only) (12 hours)

Unit – III

Basic Machining Operations: Shaper, Types, Shaping Operations, MRR, Planner, Types, Planning Operation, MRR, Slotting Machine Operations. (12 hours)

Unit – IV

Advanced Machining Operations – II Milling Machine, Types, Milling Process, Milling Operations, MRR, Machining Time (12 hours)

Unit - V

Cutting Tools/Fluids: Tool Materials, Nomenclature and Geometry of Cutting Tools, Tool Failure Mechanisms, Tool - Life Criteria. Cutting Fluids - Categories, Desirable Properties, Selection of Cutting Fluids. (12 hours)

TEXT/REFERENCE BOOKS:

1. B.S.Nagendra Parashar, R.K.Mittal. "Elements of Manufacturing Processes" - Prentice - Hall of India Pvt. Ltd; New Delhi - 1.
2. R.K.Singal, Mridul Singal, Rishi Singal. "Fundamentals of Machining and Machine Tools" - I.K.International Publishing Home Pvt. Ltd; New Delhi.
3. Roy.A.Lindberg, "Process and Materials of Manufacture", Prentice Hall India Pvt. Ltd, 2002.

MEP51 MANUFACTURING PROCESS LAB-II (0 0 3 2)

1. Drilling and Boring
2. Turning between centers
3. Drilling and Tapping
4. Square and multi start thread cutting
5. Eccentric turning
6. Shaping and V-slot grooving
7. Study of Grinding machine
8. Cylindrical grinding operation
9. Spline Milling
10. Spur Gear Milling
11. Keyway milling

MEP52 DYNAMICS OF MACHINES LABORATORY (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

1. Demonstration of four bar inversion mechanism
2. Natural frequency of single mass, single helical spring system.
3. Natural frequency of combination of springs – springs in parallel, springs in series
4. Natural frequency of undamped torsional single rotor, double rotor system. Effect of inertia (I) and stiffness (k_t).
5. Determination of radius of gyration of a given compound pendulum
6. Determination of radius of gyration, moment of inertia – bifilar suspension method – trifilar suspension method
7. Damping coefficient of torsional single rotor system – Effect of depth of immersion in oil and damping ratio
8. Resonance frequency of equivalent spring mass system – undamped and damped condition. To plot amplitude Vs frequency graph for different damping.
9. Determination of characteristic curves of Watt, Porter, Proell and spring loaded governors.
10. Static and Dynamic balancing.
11. Whirling of shafts/ determination of critical speed with and with out Rotors.
12. Gyroscopic couple verification.
13. Journal bearing – pressure distribution of different loads at different Speeds.
14. Cam motion analysis.
15. Generation of involute gear profile.
16. Tracing of coupler curves.
17. Determination of error in straight line drawn by watt chain mechanism.

MEP53 COMPUTER AIDED MACHINE DRAWING (0 0 3 2)

Using Auto CAD Script file, draw the orthographic views for the given simple 3D blocks

Preparation of Drawings for Parts and Assembly of the following by using AutoCAD.

1) Joints : Riveted Joints - Butt & Lap joints, Knuckle joint,
2) Couplings : flexible type flange coupling, Universal coupling.
3) Bearing : Pedestal bearing.
4) Screw jack
5) Connecting rod
6) Tail stock
7) Steam Stop valve
8) Ramsbottom Safety Valve

Text Books:

1. N.D. Bhatt - Machine Drawing, Charotar Publishing House.
2. K.R. Gopalakrishnan - Machine Drawing, Subshas Publications, XII edition, 1988.
3. R.B.Gupta - Machine Drawing, Satya Prakasham, 1988
4. Sidheswar - Machine Drawiing, Tata McGraw Hill edition, 1998
5. Auto CAD user Manual

MEP54 GENERAL PROFICIENCY-I (0 0 3 2)

UNIT -I : ART OF COMMUNICATION

Verbal and Non-verbal Communication – Barriers to Communication – Importance of Body Language – Effective Listening – Feedback

UNIT - II : INTRODUCATION TO SOFT SKILLS

Attitude – Self-Confidence – Leadership Qualities – Emotional Quotient – Effective Time Management Skills – Surviving Stress – Overcoming Failure – Professional Ethics – Interpersonal Skills

UNIT – III : WRITING

Importance of Writing – Written Vs Spoken Language – Formal and Informal Styles of writing – Resources for improving writing – Grammar and Usage – Vocabulary Building – SWOT analysis

UNIT – IV : SPEAKING PRACTICE

Dialogue – Telephone Etiquette – Public Speaking – Debate – Informal Discussions – Presentations

UNIT – V : APTITUDE

Verbal and Numerical aptitude

REFERENCES :

1. Nicholls, Anne. Mastering Public Speaking. Jaico Publishing House,2003.
2. Aggarwal, R.S. Quantitative Aptitude. S.Chand &Co.,2004.
3. Leigh, Andrew and Michael Maynard. The Perfect Leader. Random House Business Books,1999.
4. Whetton .A.David and Kim S. Cameron. Developing Management Skills. Pearson Education, 2007.
5. K.R. Lakshminarayan. Developing Soft Skills. Scitech, 2009.
6. Sherfield M Robert. Developing Soft Skills Pearson Education, 2005.
7. Hair O' Dan, Friedrich W. Gustav and Lynda Dee Dixon. Strategic Communication in Business and the Professions. Pearson Education,2008.
8. Chaney Lilian and Jeanette Martin. Intercultural Business Communication, Fourth Edition. Pearson Education, 2008.

MET61 OPERATIONS RESEARCH (3 1 0 4)

Unit – I

Linear Programming Problems - Formulation and Duality concepts. Methods of solving LPP - Graphical Method, Simplex method (Computational Procedure) - Two Phase, Dual Simplex - Sensitivity analysis.

Integer Programming : Introduction - Cutting plane method. (12 hours)

Unit – II

Revised Simplex method - Transportation problem - optimal solution - MODI method - Transshipment problem. Assignment problem - various types.

Dynamic programming - Solving General allocation, Investment, Stagecoach, Equipment replacement problems. (12 hours)

Unit – III

Inventory Control Fundamentals-Inventory concepts and costs, Deterministic Inventory models - Single item models-Classic EOQ and gradual replacement / manufacturing models with and without shortages, EOQ with price breaks, Introduction to inventory control applications.

Game theory- Two persons zero sum games- Pure strategies, Mixed strategies, Dominance property, Graphical solution of (2xn) and (mx2) games. (12 hours)

Unit – IV

PERT and CPM - Network diagram, Critical path, Crashing, probability considerations, Resource leveling and allocation. (12 hours)

Unit – V

Waiting line problems - Poisson arrivals and exponential service times, single channel and single stage problems. Logical flow charts for single server and Parallel server Queuing Models. (12 hours)

Text Books :

1. R Pannerselvam, Operations Research, PHI Learning Private Ltd., New Delhi, 2008
1. Hamdy A.Taha, Operations Research - An Introduction, Prentice Hall of India, 1995.
2. P.K.Gupta and D.S.Hira, Operations Research, S.Chand & Sons Ltd., New Delhi, 1999.

Reference Book :

1. Harvey M.Wagner, Principles of Operations Research with applications to managerial decisions, Prentice Hall of India, 2001.

MET62 DESIGN OF TRASMISSION SYSTEMS (3 1 0 4)

Unit-I

Theory of hydrodynamic bearing – Design of Journal bearing - Heat dissipation - Elementary ideas of hydrostatic bearings - bearing materials and lubricants.

Rolling contact bearings - Load capacity and Life - Selection of rolling contact bearings for radial and axial loads. (12 hours)

Unit – II

Belt Drives – Types – Selection and Design of Flat and V-Belts

Chain Drives – Roller Chains – Polygonal effect – Sprocket Wheels – Silent Chain (12 hours)

Unit- III

Advantage of Gear drives over other drives, Nomenclature, failures of gear tooth, Design of gears - based on bending and wear criteria - based on Lewis and Buckingham equation. (12 hours)

Unit – IV

Bevel Gears – Nomenclature - Design of gears-based on bending and wear criteria- based on Lewis and Buckingham equation, Worm and Worm Wheel – Nomenclature – Design procedure .

(12 hours)

Unit – V

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box. Speed reducer – Design of Speed reducer using spur and helical gears

(12 hours)

Text Books :

1. T.J.Prabhu, Design of Transmission Elements, Madras Book House, Chennai,1997.
2. T.J.Prabhu, Fundamentals of Machine Design, Madras Book House, Chennai,1997.

Reference Books :

1. J.E.Shigley, Mechanical Engineering Design, I Metric Edition, McGraw Hill International Edition, 1997.
2. S.K.Basu, Design of Machine Tools, Oxford & IBH., 1990.
3. Sadhu Singh, Machine Design, Khanna Publishers, 1997.
4. R.B.Gupta , Auto Design, Satya Prakashan, 1990.

MET63 POWER PLANT ENGINEERING (3 1 0 4)

Unit – I

Rankine Cycle:Classification – Reheat cycle – Regenerative cycle – Reheat – regenerative cycle. Binary vapour cycle. Steam generators:Classifcation – modern high pressure generators
Accessories : Feed water Pump, feed water heaters / economiser, air-preheaters, Superheaters, separators, Separator drums, scale cleaners, soot blowers – Fuels : method of firing – Fluidised bed boilers. (12 hours)

Unit – II

Air handling system:forced dranght fans, primary and secondary air system for solid fuels – flue gas path; method of producing draught : natural, induced draughts – induced draught fans – flue gas treatment for pollution:cyclone separator, electro-static precipitator – chimney – calculation of chimney height - Bottom ash handling system. Feed water treatment: demineralised water, treatment processes : mechanical, chemical processes – Duration – fuel handling system: solid fuels – pulveriserd fuels, liquid and gaseous fuels – supply system. (12 hours)

Unit – III

Steam injectors – steam nozzles – flow through nozzles – nozzle efficiency – Effect of super heating – supersaturated (or) metastable expansion of steam in a nozzle – steam turbines – classification – velocity diagrams – Compounding impulse turbine – Reaction turbine - Blade profiles of impulse and reaction turbines – Calculation of blade height, width – leakage prevention. (12 hours)

Unit – IV

Gas turbine plant cycle – classification – simple cycle – regenerative cycle – reheat cycle – regenerative – reheat cycle – inter-cooling. Steam and gas turbine Power plants – cycle analysis.
Nuclear fuels – coolants – moderators – radiation shield – Nuclear reactor: different types – Nuclear Power Plant Layout – Waste disposal. (12 hours)

Unit –V

Fluctuating loads – terms and definitions, load curves, effect of variable load, methods to meet variable load – pea load plants: demand, requirements and load analysis. Power plant economics: Estimation of cost of electrical energy, selection of type of generation and equipment, economic analysis of performance and operating characteristics, methods of tariff for electrical energy.
(12 hours)

Text Books :

1. P.K.Nag, Power Plant Engineering, Tata McGraw Hill, 2000.
2. P.C.Sharma, Power Plant Engineering, Dewan Sanjeev Kumar Kataria, 1994.

Reference Books :

1. Frederick T.Morse, Power Plant Engineering, Affiliated East-west Press Ltd., 1953.
2. William A.Vapert, Power Station Engineering and Economy, Tata McGraw Hill, 1972.
3. M.D.Burghardt, Engineering Thermodynamics with Applications, Harper Row, 1986
4. El Wakil M M, Power Plant Technology, McGraw-hill Publications, 2002

MET64 ADVANCED MANUFACTURING TECHNOLOGY (4 0 0 3)

Unit – I :

Introduction to unconventional machining – EDM, ECM, ECG, AJM and USM.

Hard Automation – I : Introduction to Automation in Manufacturing – Study of the principles of working of automates – Applications.

(12 hours)

Unit – II

Hard Automation – II : Automated flow lines – Types. Transfer machines – types, mechanisms, applications, Transfer, Handling, Location, Orientation and Parts Feeding devices – Types and principles of working only. Buffer storage.

NC machines – Introduction, Types, Economics, Advantages and Applications. CNC, DNC (Direct and Distributed), and Adaptive Control. (12 hours)

Unit – III

Turning and Machining Centers – Description and types of ATC, Applications.

NC Part Programming – Types – Introduction to programing languages , APT Programming. Examples on CNC Turning, Milling & Drilling operations. Preliminary study on simulation of CAD based NC programming.

(12 hours)

Unit – IV :

Robot Anatomy and Configurations, Work Volume, End effectors – Types of grippers, tool as end effectors. Robot Sensors – External and Internal, Types – Position sensors, Velocity sensors, Tactile, Proximity and Range sensors, Machine vision - Applications.

Automated Material Handling and Storage Systems – Types, Design and Interfacing Preliminaries.

(12 hours)

Unit – V :

Group Technology : Part Families – Parts Classification and Coding, Examples.

ROC Algorithm. Applications.

Flexible Manufacturing Systems: Types, Components, Planning and Implementation Issues.

Introduction to Lean and Agile Manufacturing Systems – Comparison. (12 hours)

Text Books :

1. Mikel P.Groover, Automation, Production Systems and Computer Integrated Manufacturing, PHI Ltd., New Delhi, 2003.
2. P.Radhakrishnan,NC Machine Tools, Dhanpat Rai & Sons, New Delhi, 2000.
3. G.Boothroyd et al, Automatic Assembly, Marcel Dekker Inc., New York, 1993.

Reference Books :

1. P.N.Rao et al, Computer Aided Manufacturing, Tata McGraw Hill Publishers, 1993.
2. P.Radhakrishnan and, CAD / CAM / CIM, Wiley Eastern Ltd., 2000. S.Subramanian

MET65 MECHANICAL MEASUREMENTS (3 1 0 3)

UNIT-I (12 hours)

Basic detector transducer elements, intermediate modifying systems, terminating devices and methods. Classification of instruments as indicators, recorders and integrators- their working principles, precision and accuracy, measurement of error and analysis, properties of errors.

UNIT-II (12 hours)

Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, measurement of high and low pressure, dynamic characteristics of pressure measuring devices.
Strain measurement: Strain gauges, types, Wheatstone circuit, temperature compensation, Gauge rosettes, Calibration.

UNIT-III (12 hours)

Measurement of displacement-LVDT-Hall effect devices.
Vibration-characteristics, analysis of vibration sensing devices, accelerometer-types-signal conditioner-voltage and charge amplifiers-vibration exciters-calibration.
Speed Measurement – Stroboscope

UNIT-IV (12 hours)

Force measurement: scales and balance, elastic force meter, strain gauge, load cells, hydraulic and pneumatic load cells.

UNIT-V (12 hours)

Temperature measurement: Bimetallic, pressure and resistance thermometers, thermocouples, pyrometers and thermistors, calibration.
Fourier transform analysis – FFT Analyser-concepts and techniques.

Text Books :

Thomas G Beckwith, N Lewis Buck and Roy D Marargoni, "Mechanical Measurements", Narosa publishing house, 1989.
Harshavardhan, "Measurements – Principles and Practice", Macmillan India Limited, 1993

Reference Books :

Turner, J.D., "Instrumentation for Engineers", Springer – Verlag, New york inc., 1988.
B.C.Nakra and Chaudhry, K.K.,"Instrumentation and Analysis",TMH, 1985.

MEP61 MANUFACTURING PROCESS LAB-III (0 0 3 2)

FOUNDRY

1. Study of Foundry tools
2. Mould preparation using solid- patterns
3. Mould preparation using split- patterns

GEAR CUTTING

4. Helical gear milling
5. Study of gear hobbing machine
6. Spur gear hobbing

TOOL GRINDING

7. Study of tool and cutter grinder
8. Grinding of single point cutting tool

CNC PROGRAMMING

9. Study of CNC turning and milling machines
10. Programming and TPG of CNC turning
11. Programming and TPG of CNC milling

MEP62 MECHANICAL MEASUREMENTS AND METROLOGY LAB (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

1. Calibration of Micrometer.
2. Measurement of taper using Sine Bar.
3. Calibration of Plain Plug Gauge.
4. Straightness and Flatness Measurement using Autocollimator.
5. Surface Roughness Measurement (Talysurf method)
6. Inspection of Screw Threads (Effective Diameter).
7. Calibration of Inclined Tube Manometer.
8. Measurement of Pressure using Strain Gauges.
9. Determination of the Time Constant of Thermocouples.
10. Measurement of Force using Transducers.
11. Measurement of Strain using Strain Gauges.
12. Study of Displacement using LVDT and RVDT.
13. Vibration Measurement using Accelerometer.
14. Measurement of speed using stroboscope
15. Inspection of gear tooth profile using profile projectors
16. Tool Maker Microscope (inspection of screws)
17. Inspection of internal and external surfaces (C M M)

MEP63 THERMAL ENGINEERING LABORATORY – I (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

1. Determination of Kinematic Viscosity using Redwood viscometer
2. Determination of Flash and Fire Points using Cleaveland Apparatus.
3. Determination of Calorific value of Solid Fuel using Bomb Calorimeter
4. Determination of Calorific value of Gaseous Fuel using Junker's Gas Calorimeter
5. Performance test on Reciprocating Air Compressor
6. Performance test on Centrifugal Air Blower
7. Study on the composition of Exhaust gas of an IC engine using Orsat Appratus under various loads.
8. Determination of Thermal Resistance and Conductivity of a Composite Wall
9. Heat Transfer from Cylindrical Surface by Natural Convection
10. Heat Transfer from Cylindrical Surface by Forced Convection
11. Heat Transfer from Pin Fin by Forced Convection
12. Performance of Parallel Flow/Counter Flow Heat Exchanger

MEP64 GENERAL PROFICIENCY – II (0 0 3 2)

UNIT – I : COMPOSITION ANALYSIS

Technical and Non-Technical Passages (GRE Based) – Differences in American and British English – Analyzing Contemporary issues – Expanding Terminology

UNIT – II : WRITING

Job Application Letter Writing – Resume Writing

UNIT – III : ORAL SKILLS

Group Discussion – Introduction and Practice – Team Work – Negotiation Skills – Organizing and Attending Meetings – Facing Interviews

UNIT – IV : ADAPTING TO CORPORATE LIFE

Corporate Etiquette – Grooming and Dressing

UNIT – V : APTITUDE

Verbal and numerical aptitude

REFERENCES

1. Pushplata and Sanjay Kumar. Communicate or Collapse : A Handbook of Effective Public Speaking, Group Discussions and Interviews. Prentice-Hall, Delhi,2007.
2. Thorpe, Edgar. Course in Mental Ability and Quantitative Aptitude. Tata McGraw-Hill, 2003.
3. Thorpe, Edgar. Test Of Reasoning. Tata McGraw-Hill,2003.
4. Prasad,H.M. How to prepare for Group Discussion and Interview. Tata McGraw-Hill,2001.
5. Career Press Editors.101 Great Resumes. Jaico Publishing House,2003.
6. Aggarwal, R.S. A Modern Approach to Verbal & Non-Verbal Reasoning. S. Chand & Co.,2004.
7. Mishra Sunita and Muralikrishna, Communication Skills for Engineers, First Edition. Pearson Education, 2004.

MET71 COMPUTER AIDED DESIGN (3 1 0 4)

Unit – I

Design process - Morphology of design, Types of design models, Application of design models, concurrent Engineering – CAD system architecture.

CAD Hardware: workstation – CPU, mass storage, input devices (keyboard, light pen, thumb wheel joy stick, mouse, digitizer etc.,) and output devices (printers, plotters) Display Devices : storage tube – raster scan , vector refresh, plasma panel and LCD.

(12 hours)

Unit – II

Bresenham's line and circle algorithms. Transformation in Graphics: co-ordinate system used in Graphics and windowing and view port transformations, Clipping , hidden line elimination, 2D transformations – rotation, scaling, translation, mirror, reflection and shear - homogeneous transformations – concatenation, 3D Transformation – orthographic and Perspective Projections.

(12 hours)

Unit – III

Classification of Geometric Modeling – Wire frame, Surface and Solid Modeling, applications – representation of curves and surfaces – Parametric form – Design of curved shapes- Cubic spline – Bezier curve – B-spline – Design of Surfaces - features of Surface Modeling Package - Solid Primitives, CSG, B-rep and description of other modeling techniques like Pure primitive instancing, cell decomposition, spatial occupancy enumeration, Boolean Operations (join, cut, intersection), Creating 3D objects from 2D profiles (extrusion, revolving etc)

(12 hours)

Unit – IV

Standards for computer graphics (GKS) and Data exchange standards – IGES, STEP. Data structures for Entity storage – Data structures for interactive modelling- Relational databases – introduction to SQL language . Role of OOPS in CAD. (12 hours)

Unit – V

Expert Systems –strategies for Knowledge Acquisition, representation of knowledge – Inference schemes.

Parametric and variational modeling, Feature based modeling, Design information system

An overview of modeling software like PRO-E, CATIA, IDEAS, SOLID EDGE etc.

(12 hours)

Text Books :

1. Chris Mcmahon and Jimmie Browne - CAD/CAM – Principle Practice and Manufacturing Management,
2nd Edition, Addision Wesley England, 2000.
2. Sadhu Singh - Computer Aided Design and Manufacturing, II Edition, KhannaPublishers, New Delhi, 2008.

Reference Books:

1. P.Radhakrishnan et al - CAD/CAM/CIM, New Age International P Ltd., New Delhi, 2006.
2. M.P.Groover and E.W.Zimmers - CAD/CAM; Computer Aided Design and Manufacturing, Tata McGraw Hill
Publishing Co. Ltd., New Delhi, 2006.
3. Ibrahim Zeid - CAD/CAM Theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2005.

MET72 COMPUTER INTEGRATED MANUFACTURING (4 0 0 4)

Unit – I

CIM: Introduction to CIM, CIM Wheel, Evolution, Benefits, Trends.

Computers in Manufacturing: Factory tasks for Computer Integration – Needs of CIM, CIM Hardware and Software, Workstations.

Fundamentals of Communication: Communications Matrix – Types. Representation of data, Coding, Transmission, Medium, Types of Communication Lines and Hardware. Network Architectures : The seven layers – OSI Model, LAN, MAP and Network Topologies.

(12 hours)

Unit – II

Data base: Introduction – Manufacturing data- Data base models, Data base Management - Data base required for a shop floor control (Fundamentals only)

Product Design: Design Process , Design for Manufacturability, CAD – areas of Application, Benefits, CAD to CAM, CAE (Fundamentals only) (12 hours)

Unit – III

Concurrent / Simultaneous engineering: Introduction, Design for manufacturing and assembly, and other product design objectives. Advanced Manufacturing Planning.

Introduction to Reverse Engineering.

Process Planning: CAPP – Retrieval and Generative Model. (12 hours)

Unit – IV

Production Planning and Control: Computerized PPL, Aggregate Production Planning, MPS, MRP, MRP II, ERP and JIT. Automated Data Collection – Bar Codes, OCR, Image Processing, RF Identification, Magnetic Identification, Voice Technology, Comparison, Control Types – PLC.

(12 hours)

Unit – V

Quality : Modern Concepts, TQM, TPM – ISO Standards, CAQC – Contact & Non – Contact type Inspection – Description. Working Principle and Application of Various Techniques/Equipments. Interfacing inspection with CAD/CAM.

Introductory Study on Integration and Implementation issues in CIM – Indian Scenario.

(12 hours)

Text Books :

1. Mikell P.Groover, Automation Production Systems and CIM, PHI, New Delhi, 2003.
2. S.Kant Vajpayee, Principles of CIM, PHI, New Delhi, 1999.

Reference Books :

1. P.Radhakrishnan and S.Subramanian, CAD / CAM / CIM, Wiley Eastern Ltd., New Delhi, 1984.
2. P.N.Rao et al, Computer Aided Manufacturing, TMH Pvt. Ltd., New Delhi. 1993.
3. Ibrahim Zeid, CAD / CAM Theory and Practices, McGraw Hill International Edition, New York, 1991.

MET56 CONTROL SYSTEM ENGINEERING (3 1 0 3)

Unit – I

Basic Components of Control System – Open loop and Closed loop system – Automatic Control System.

Mathematical Modeling, Analogous Models – Mathematical modeling of fluid system and thermal systems – Transfer Function – Block diagram reduction Techniques. (12 hours)

Unit – II

Representation of Physical System – Linear approximation of non linear System – position Control system – Stepper motor – Hydraulic systems – pneumatic systems – Inertial navigation system – Applications.

Modes of Controls: Proportional, Integral, Derivative – proportional plus integral – proportional plus Derivative– proportional Plus integral plus derivative controls – examples from Mechanical system. (12 hours)

Unit – III

Standard test signals and transient response of first and second order systems. Sources of errors, static and dynamic error constants. (12 hours)

Unit – IV

Frequency Response – Bode Plot – Polar Plot.

Stability Analysis – Relative stability – Routh Hurwitz Stability Criteria. (12 hours)

Unit – V

Design Principles – an outline of Control System Design - Control of the A/F ratio in an Automotive Engine – Control of Read/Write Head Assembly of a Hard Disk.

Introduction to Fuzzy logic – Fuzzy set – Fuzzy Control – PLC – micro controler (12 hours)

Text Books :

1. F.H.Raven - Automatic Control Engineering, III Edition, McGraw Hill Students Edition.
2. Gene F.Franklin et al - Feedback control of Dynamic Systems, IV Edition, Pearson Education Asia, 2002.
3. Katsushiks Oguta - Modern Control Engineering, IV Edition, Prentice Hall of India, 2002.

Reference Books :

B.C.Kuo - Automatic Control System, VII edition, Prentice Hall of India, 2002.
I.J.Nagrath and M.Gopal - Control System Engineering, II edition, Wiley Eastern Ltd., 1992.
Timothy J.Ross - Fuzzy logic with Engineering Applications, McGraw Hill Inc., 1995.

MET73 REFRIGERATION, AIR-CONDITIONING AND CRYOGENICS (3 1 0 4)

Unit I (12 hours)

Basics of refrigeration – Methods of refrigeration: ice refrigeration, evaporative refrigeration, expansion cooling, throttling – Unit of refrigeration – Performance of refrigeration systems – Air refrigeration system, vapour compression refrigeration system, vapour absorption refrigeration system, vapour jet refrigeration system, thermoelectric refrigeration system, vortex tube refrigeration, pulse tube refrigeration and adiabatic demagnetization cooling – Refrigerants: primary and secondary refrigerants – Working pairs of absorption refrigeration system – Properties of refrigerants – Selection of refrigerants.

Unit I (12 hours)

Psychrometry and psychrometric properties – Psychrometric relations: Dalton's law of partial pressures – Wet bulb temperature and measurement – Adiabatic saturation temperature – Psychrometric processes – Air-conditioning systems: summer air-conditioning and winter air-conditioning – Requirement for comfort air-conditioning – Factors governing human comfort – Comfort chart.

Unit III (12 hours)

Sources of heat load – Conduction load – Sun load – Load from occupants – Equipment load – Infiltration air-load – Load from moisture gain – Fresh air load – ASHRAE standards – Calculation of load on air-conditioning system – Methods of air-conditioning system: Centralized air-conditioning system, unitary air-conditioning system and direct air-conditioning system – Air-conditioning devices and equipment: air cleaners, air filters, humidifiers, dehumidifiers, fans and blowers – cooling towers.

Unit IV

(12 hours)

Introduction to cryogenics – Applications involving cryogenic engineering – Cryogenic fluids and properties – Low-temperature properties of solids: mechanical, thermal, electrical and magnetic properties – Superconductivity – Production of low temperature: Joule-Thomson effect – Inversion curve – Adiabatic expansion – Cryogenic liquefaction systems: Linde-Hampson system, pre-cooled Linde-Hampson system, Linde dual pressure system, Claude system, pre-cooled Claude system, Kapitza system, Heylandt system, Collin's helium-liquefaction system and Simon helium-liquefaction system.

Unit V (12 hours)

Joule-Thomson refrigeration system – Cascade Joule-Thomson refrigeration system – Expansion-engine refrigeration system – Cold gas refrigeration system – Philips refrigerator – Solvay refrigerator – A.D. Little refrigerator – Vuilleumier refrigerator – Refrigerators using solids as working media – Cryogenic fluid storage vessels – Insulations – Cryogenic fluid transfer systems.

Text books:

1. Arora, C. P., Refrigeration and Air conditioning, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2000
2. Stoecker, W. F. and Jones, J. W., Refrigeration and Air conditioning, McGraw Hill Book Publishing Co. Ltd., New York, 1995

Reference: Books:

1. ASHRAE Equipment Handbook, The American Society of Heating, Refrigerating and Air-conditioning Engineers Inc., Atlanta, Georgia, 2001
2. Randall Barron, Cryogenic Systems, McGraw Hill Book Publishing Co. Ltd., New York, 1966
3. Timmerhaus, K. D. and Flynn, T. M., Cryogenic Process Engineering, Plenum Press, New York, 1989
4. Haselden, G. G., Cryogenic Fundamentals, Academic Press, 1971

MEP71 THERMAL ENGINEERING LABORATORY - II (0 0 3 2)

SUGGESTED LIST OF EXPERIMENTS

1. Valve and port timing diagrams of 4 stroke and 2 stroke IC engines respectively
2. Tests on single cylinder pertrol engine:
   (a) Load test (b) finding air-fuel ratio
3. Tests on multi-cylinder petrol engine:
   (a) Load test (b) Morse test (c) heat balance test
4. Tests on single cylinder 4 stroke diesel engine:
   (a) Load test (b) Finding air-fuel ratio (c) Retardation test
5. Test on multi-cylinder diesel engine:
   (a) Load test (b) Heat balance test
6. Engine exhausts gas analysis using Gas analyzer/ Gas Chromatograph
7. Performance test on cooling tower.
8. Performance test on refrigeration system.
9. Performance test on air-conditioning system.
10. Performance test on a boiler.
11. Performance test on steam turbine.
12. Determination of dryness fraction of steam using calorimeter.

MEP72 CAD Lab (0 0 3 2)

PART – A

Computer aided design of machine components:

Transmission shafts,
Journal bearings,
Flange couplings etc.
1. Using solvers namely
TK SOLVER
(Ref: "Machine Design: An integrated approach", Norton, R. L. 2nd Ed., Pearson Education Asia, 2001, appendix F, p.no:1001.)
And
2. Autolisp
[Minimum of three exercises using TK SOLVER and two exercises using Autolisp.]

PART-B

I. Generation of **Auto lisp** file to draw the orthographic views of a given isometric diagram.
II. 3D Modelling:
Introduction to 3-D modelling – sketcher, part design, assembly and drafting workbenches. Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relationships. Feature based and Boolean based modeling surfaces.
Assembly modelling of components having a minimum of six machine elements.
[Minimum of two exercises in part modelling and one exercise in assembly]
(Use of ANY ONE of these packages such as CATIA, ProE, SOLIDWORKS, IDEAS is recommended)
III. FE Analysis:
Using any FEA software packages like ANSYS / NISA etc., solve for
1) Plane Stress Analysis on Plate with Central hole
2) SF and BMD diagrams for all kinds of beams
3) 1-D heat transfer analysis of a simple plate.
[Minimum of three exercises]
Note: In university practical examination, students has to answer one question each from part A and part B.

MEP73 COMPREHENSIVE VIVA - VOCE

The student will be tested for his understanding of basic principles of the core Mechanical Engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective or short questions type from all the core subjects. The external university examination, which carries a total of 50 marks, will be a Viva Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

MEP74 INDUSTRIAL VISITS / TRAINING REPORT

During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.

MEPW7 PROJECT WORK (PHASE I)

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Mechanical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee. The internal assessment marks for Phase I will be carried over to Phase II.

MET81 INDUSTRIAL ENGINEERING AND MANAGEMENT (4 0 0 3)

Unit I :

Plant Location : influencing factors – rural and urban locations – evaluation of location alternatives for Single facility location problems – solving simple problems.

Plant Layout : classification of production systems – principles of layout – basic types of layout – line balancing – simple problems in line balancing using Ranking Positional Weight Method.

Material Handling : functions – principles – classification of material handling equipments (only classification and no description) - factors to be considered in selection of material handling equipment. (9 hours)

Unit II :

Method Study : objectives - basic procedure - various recording techniques – process charts, multiple activity charts, SIMO chart, Flow diagram, string diagram, cyclegraph and chronocyclegraph - principles of motion economy – Therbligs - micromotion study & memomotion study. Work Measurement : purpose - basic procedure – various techniques of work measurement – stop watch time study – time study equipments – different systems of performance rating – time allowances – PMTS - work sampling – simple problems involving the determination of standard time and compensation. (9 hours)

Unit-III :

Production Planning and Control : functions – qualitative and quantitative techniques of forecasting – simple problems in forecasting using moving average, weighted moving average, simple exponential smoothing and regression methods - routing – loading and scheduling – different methods of scheduling – expediting – dispatching – functions and objectives of materials management – Introduction to inventory control and ABC analysis. (9 hours)

Unit IV :

Management : Basic Concepts – Scientific management – Fayol's principles - functions of management. Financial Management : fixed and working capital - sources of finance - evaluation of investment alternatives using present worth / future worth / annuity / rate of return methods – different methods of determining depreciation - Elements of cost & cost ladder - break-even analysis – simple problems. (9 hours)

Unit V :

Marketing Management : Concepts of Marketing - products and markets – pricing - channels of distribution - sales promotion - advertising - basics of market research.

Human Resources Management : individual and group behaviour – Maslow's hierarchy of needs – motivation and morale – fatigue : causes & remedy – accidents : causes and prevention - manpower planning – job analysis – job evaluation and merit rating - management by objectives (MBO). (9 hours)

Text Books :

1. R .Panneerselvam - Production and Operations Management, Prentice Hall of India Pvt. Ltd., 2003.
2. O.P.Khanna - Industrial Engineering and Management, Dhanpat Rai Sons (P) Ltd., 1999.
3. Martand Telsang - Industrial and Business Management, S.Chand & Co., 2001.

Reference Books :

1. Joseph Monks - Operations Management, McGraw Hill, New York, 1986.
2. R.M.Barnes - Motion and Time Study, John Wiley Eastern, New York, 1985.
3. Roger G.Schroeder - Operations Management, III Edition, McGraw Hill, New York, 1989.

MET82 MAINTENANCE AND SAFETY ENGINEERING (3 0 0 3)

Unit – I

Objectives of maintenance - types of maintenance – Breakdown, preventive and predictive maintenance - Repair cycle - Repair Complexity, Lubrication and Lubricants. Maintenance of Mechanical transmission systems and process plants.

(12 hours)

Unit – II

Predictive Maintenance - vibration and noise as maintenance tool - wear debris analysis - Condition monitoring concepts applied to industries - Total Productive Maintenance (TPM) - Economics of Maintenance- Computer aided maintenance.

(12 hours)

Unit – III

Reliability: Definition, concept of reliability based design, failure rate, MTTF, MTBF, failure pattern, system reliability: Series, Parallel and Mixed configurations - Availability and Maintainability concepts- Applications.

(12 hours)

Unit – IV

Safety and productivity - causes of accidents in industries – accident reporting and investigation - measuring safety performance - Safety organizations and functions - Factories act and rules.

(12 hours)

Unit – V

Safety Codes and Standards - General Safety considerations in Material Handling equipments - Machine Shop machineries-pressure vessels and pressurized pipelines – welding equipments – operation and inspection of extinguishers – prevention and spread of fire – emergency exit facilities. (12 hours)

Text Books :

1.P.Gopalakrishnan - Maintenance and Spare parts Management, Prentice Hall of India Pvt. Ltd., New Delhi, 1990.

2.L.S.Srinath - Reliability Engineering, Affiliated East West press, 2003

3. Rolland P.Blake - Industrial Safety, Prentice Hall of India Pvt. Ltd., New Delhi, 1973.

Reference Books :

1. R.C.Mishra and K.Pathak, Maintenance Engineering and Management, Prentice Hall of India Pvt. Ltd.,New Delhi, 2002.

2. H.P.Garg, Industrial Maintenance, S.Chand & Co Ltd., New Delhi, 1990.

3. E.Balagurusamy, Reliability Engineering, Prentice Hall of India P Ltd., New Delhi, 2003.

MET83 ENERGY & ENVIRONMENTAL MANAGEMENT (3 0 0 3)

Unit – I

Energy conversion – global energy scenario – Indian context of energy – environmental aspects of fossil, nuclear, hydro and biomass energy conversion – gaseous emissions – solid waste – liquid waste. (9 hours)

Unit – II

Energy management – need for energy conservation – energy auditing – role of energy manager – energy audit instruments – first and second law approach towards energy conservation.

(9 hours)

Unit – III

Energy conservation in boilers – procedure for efficiency calculation – energy conservation in industries: pumps, fans, compressed air systems, refrigeration and air conditioning systems, DG sets, electrical motors, variable speed motors.

(9 hours)

Unit – IV

Pollutants – types – physical and chemical properties of air pollutants – behavior and fate of air pollutants – air pollutants and global climate – air pollutant effects. Pollution control laws and regulation – national and international – role of environmental monitoring in environmental management systems – continuous emissions monitoring systems.

(9 hours)

Unit – V

Pollution Control – review of pollution control methods in thermal power plants – industrial – nuclear – automobiles – disposal/treatment of solid and liquid wastes – alternate fuels.

(9 hours)

Text Books :

1. A.W.Culp, Principles of Energy Conversion, McGraw Hill Book Co., 1991.
2. Noel de Nevers, Air Pollution Control Engineering, McGraw Hill Book Co., 2000.

Reference Books :

1. C.S.Rao, Environmental Pollution Control Engineering, New Age International Pvt. Ltd., 1995.
2. P.O.Callaghan, Energy Management, McGraw Hill Book Co., 1993.

MEPW8 PROJECT WORK (PHASE II)

Project work phase II will be an extension of the project work started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal assessment committee for 50 marks. Out of these 50 marks 15 marks are based on Internal assessment marks obtained in Phase I The external university examination, which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

MEP81 SEMINAR

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

MEP82 PROFESSIONAL ETHICS AND INDIAN CONSTITUTION

The course should cover the following topics by way of Seminars, Expert Lectures and Assignments:

1. Engineering Ethics – Moral issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer's responsibility for safety
4. Responsibilities and rights
5. Global issues of engineering ethics
6. Fundamental Rights and Constitution of India

Reference Book

1. Charles D.Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999

MEE61 INDUSTRIAL CASTING TECHNOLOGY (4 0 0 3)

Unit – I

Patterns and Moulding Sands:Introduction to casting - pattern making – requirements, pattern materials, machines and tools for pattern making – pattern allowances - metal and consumable type of patterns - life expectancy, storage and repair of patterns - moulding sands and sand conditioning – testing of moulding sands – cores – types of cores - core sands and core making - machine moulding. (12 hours)

Unit – II

Melting equipment for foundries – crucible furnace – open hearth furnace – air furnace – rotary furnace – cupola furnace – electric furnaces – refractories for melting units - metallurgical characteristics of cast metals – Solidification of metals. (12 hours)

Unit – III

Gating and Risering of castings – gating systems – different types of gates – calculation of gating system dimensions - risering of castings - open and blind risers - design and positioning of risers – directional solidification – methods to achieve directional solidification - form design of castings. (12 hours)

Unit – IV

Moulding Processes : special sand moulding processes - Permanent mould casting – Pressure die casting – Low pressure die casting – Squeeze casting – Centrifugal casting – continuous casting – Electro slag casting – Vacuum moulding process - plastic moulding processes : compression moulding, transfer moulding, injection moulding, extrusion and blow moulding.

(12 hours)

Unit – V

Cleaning and inspection – Fettling and repair of castings - Heat treatment of castings, Defects in castings, Inspection and testing of castings – Pollution control in foundries – Plant layout for foundries – Areas of mechanization.

(12 hours)

Text Books :

1. P.L.Jain, Principles of Foundry Technology, Tata McGraw Hill, 1997.
2. O.P.Khanna, Foundry Technology, Khanna Publishers, 2000
3. Serobe Kalpakjian and Steven R.Schmid, Manufacturing Engineering &Technology, Pearson Education Asia, 2000 (For Plastic Moulding Processes only)

Reference Books :

1. Richard W.Heine et al, Principles of Metal Casting, Tata McGraw Hill Edition, 1996.

MEE62 TOTAL QUALITY MANAGEMENT (4 0 0 3)

Unit – I

Introduction to TWM – Strategies concepts and objectives – Total quality model – TQM as applied to Indian Industries – Quality circle concepts – concepts, objectives and functions of quality circles – Benefits of the organization – Training of quality Circle members – Implementation.

(12 hours)

Unit – II

Tools and Techniques – The seven management tools =- Technique for analyzing a quality process – Statistical process Control – Introduction to S-S concepts (12 hours)

Unit – III

Cost of quality – Taquchi's quality loss function – House keeping concepts for industries, tool room, production shop – processing industries.

(12 hours)

Unit – IV

Quality based product and process Design – Design for reliability – Design for maintainability – Quality Function Deployment (QFD) – QFD and Quality Assurance – QFD Principles, Concepts and applications – case studies.

(12 hours)

Unit – V

KAIZEN Concepts – Kaizen by TQC – POKA YOKE ISO 9000 certification system – 9001 to 9004 systems – procedures, audits and reviews – case studies.

(12 hours)

TEXT / REFERENCE BOOKS

1. S.M.Sundara Raja, Total Quality Management Tata Mc Graw Hill, 1998.
2. Patrick.J.Sweeney(editor), TQM for Engineering, Quality Resources, Newyork, 1993.
3. John Bank, The Essence of Total Quality Management, Prentice Hall of India, 1998.
4. James I Bossert, Quality Function Deployment, ASQC quality press, Wisconsin, 1994.

MEE63 DESIGN OF HEAT EXCHANGERS (3 1 0 3)

Unit – I : Basics of Heat Exchangers

Definition – Classfication – Application – Parallel Flow, Counter Flow – Single Pass and Multi Pass – Overall Heat Transfer Coefficient – Fouling Factor – Temperature Distribution – LMTD – LMTD Method and LMTD Correction Factor – Effectiveness – NTU Method – Methodology of Heat Exchanger & Calculation. (12 hours)

Unit – II : Double Pipe Heat Exchangers

Double Pipe Heat Exchanger – Application and Design Parameters – Film Coefficient for Fluids in Pipes and Tubes – Caloric Temperature and wall Temperature – Series and Parallel Arrangement – Design Procedure – Pressure Drop Calculation.

(12 hours)

Unit – III : Shell and Tube Heat Exchangers

Shell and Tube Heat Exchanger – Tubes, Shells, Baffles – Types and Application – Exchanger using Water, Oil Solutions, Steam as Heating Medium – Design Procedure – Flow Arrangement for increased Heat Recovery.

(12 hours)

Unit – IV : Condensor, Evaporator and Re-Boiler

Types of Condensor and their selection – Design Procedure – types of Evaporators – Shell and Tube Re-Boilers – Types and Thermal Design.

(12 hours)

Unit – V : Heat Exchanger Network

Energy Recovery - Definition of HEN – Pinch point – Pinch Technology – Cascade Diagram – Pinch and its implication - Minimum number of Heat Exchangers – Design – above and below the Pinch – Synthesis of HEN.

(12 hours)

Text Books :

1. D.Q.Kern, Process Heat Transfer, McGraw Hill Book Co., New York, 1957.
2. W.M.Kays and A.L.Londown, Compact Heat Exchangers, III Edition, McGraw Hill, New York, 1984.

Reference Books :

1. E.U.Schlunder,(Editor-in-chief) Heat Exchanger Design Hand Book, Vols.1-5, Hemisphere Publishing Corporation, New York, 1983

MEE64 FINITE ELEMENT METHODS (3 1 0 3)

Unit – I

Basic Concept of FEM, discretisation, comparison with finite difference method, advantages and disadvantages, history of development, application. Variational and Weighted Residual Formation : Boundary value problems, approximated methods of solution, review of variational calculus, geometric and natural boundary condition, method of Weighted residuals, Rayleigh Ritz and Galerkin methods of finite element formulations and convergence criteria, weak formulation - simple problems. (12 hours)

Unit – II

Classification of C^0, C^1 continuous problems-Parameter functions, its properties- completeness and compatibility condition, One-dimensional elements, Global coordinates, Two-dimensional elements, three noded triangular elements and four noded quadrilateral elements.

Natural co-ordinate systems –Lagrangian Interpolation Polynomials- Serendipity Formulation- Difference between Superparametric, Subparametric and Isoparametric Elements, Isoparamatric Elements Formulation, length coordinates– 1D bar elements, C^0 continuous shape function, beam elements, C^1 continuous shape function - 2D Triangular elements, Rectangular elements. – Area coordinates- Numerical integration – simple Problems using Gauss quadrature Technique.

(12 hours)

Unit – III

One dimensional second order equations, discretisation of domain into elements, derivation of element equations, assembly of element equation, imposition of boundary conditions, solution of equations - post processing, extension of fourth order equations and their solutions – examples from solid mechanics, heat transfer. (12 hours)

UNIT – IV

Basic Boundary Value Problems in 2 Dimensions – Introduction to Theory of Elasticity – Plane Stress – Plain Strain and Axisymmeteric Formulation – Principle of virtual work – Weak Formulation – Triangular, Quadrilateral elements - Element matrices using energy approach. - Simple problems using three noded triangular elements only – Frontal Solution Method - Static condensation. (9 hours)

Unit – V

Green-Gauss Theorem-Element equation formulation – Variational calculus approach- Galerkin approach – General Two-Dimensional Heat Conduction – Axisymmetric Heat conduction - Triangular, Quadrilateral elements - Simple problems using three noded triangular elements (generalized approaches only). Finite Element Analysis Software : Pre- and Post –Processors - General Requirements, Method of FE model generation- Graphical Output facilities – FEA software Packages, Recent trends – Error Estimates and Adaptive Meshing.

(12 hours)

Text Books :

1. Frank L.Stasa,Applied Finite Element Analysis for Engineers, CBS International, Edition, 1985.
2. J.N.Reddy, An Introduction to Finite Element Method, McGraw Hill International Edition, 1993.

Reference Books:

1. S.S.Rao, Finite Element Method in Engineering, Pergamon Press, 1989.
2. Cook Robert Devis et al, Concepts and Application of finite Element Analysis, Wiley John & Sons, 1999.
3. G.Buchaman, Schaum's Outline of finite Element Analysis, McGraw Hill,

MEE65 IT APPLICATIONS IN MANUFACTURING (4 0 0 3)

Unit – I

Introduction to IT – Definition of IT – Application of IT in day to day design and manufacturing, Data base – Classification.

(12 hours)

Unit – II

Introduction to transaction processing – basics of a network – LAN, WAN, MAN – network topology – connecting devices – concepts of client – server computing.

(12 hours)

Unit – III

Multimedia – details on hardware, Software and its application, introduction to Internet-Internet Service providers – naming and addressing – Email and browsing - Intranet and extranet: introduction and applications.

(12 hours)

Unit – IV

Application of IT in – supply chain management, Inventory, Manufacturing resource Planning, Decision Support system and logistics.

(12 hours)

Unit – V

Enterprise Computing, Introduction to ERP, Activities under ERP, Benefits of ERP.

(12 hours)

Text Books :

1. S.Jaiswal, Information Technology – Today, Galgotia Publications, 2000.
2. Dennis P.Curtin et al., Information Technology – The breaking wave, Tata McGraw Hill, 2001.

MEE66 THEORY OF METAL CUTTING (4 0 0 3)

Unit – I

Tool geometry – cutting tool geometry for turning, drilling and milling tools – tool signature – tool designation: ASM, DIN – their relationship.

(12 hours)

Unit - II

Mechanism of chip formation – continuous, discontinuous and built up edge chips – deformation of chips – single shear plane theory – chip formation in drilling and milling. Introduction to oblique and orthogonal cutting. Mechanics of metal cutting, force system, Merchant's Circle – velocity relationship, relationship between forces, cutting speed, feed and depth of cut – experimental determination of cutting forces – tool dynamometers.

(12 hours)

Unit – III

Thermodynamics of chip formation: Sources of Heat – Mathematical modeling of sources of heat in affecting the rise of temperature – The shear plane temperature – average chip-tool interface temperature – distribution of shear plane temperature – non-iterative method for determining chip-tool and tool-work interface temperature – experimental determination of chip-tool interface temperature – experimental observation of metal cutting temperature – hot machining – theoretical estimation of work-piece temperature (12 hours)

Unit – IV

Machinability – mechanisms of tool wear – Taylor's tool life equation – tool failure criteria (direct and indirect) – effect of cutting variables on tool life, maintainability index.

(12 hours)

Unit – V

Cutting fluids – types, different methods of application, economics of machining – basic concepts, tool materials (HSS, carbide and coated tools, CBN and ceramics) – Chatter in machining.

(12 hours)

Note : Simple problems wherever applicable.

Text Books :

1. A.Bhattacharya, Metal Cutting – Theory and Practice, Central Book Publishers, 1989.
2. B.L.Juneja & G.S.Sekhon, Fundamentals of Metal Cutting and Machine Tools, New Age International (p) Ltd., 1998.

Text / Reference Books :

1. G.Kuppusamy, Principle of Metal Cutting, University Press, 1992.
2. M.C.Shaw, Metal Cutting Principles, IBH Publishers, 1991.
3. G.Boothryd, Fundamentals of Metal Machining, Tata McGraw Hill, 1983.

MEE67 ENGINEERING TRIBOLOGY (3 0 0 3)

Unit – I

Introduction to Tribology – Objectives of Tribology - Surfaces - Nature of metal surfaces, surface properties, surface parameters and measurements – Fundamental of Contact between Solids –Surface Treatment – modification - coatings (12 hours)

Unit – II

Physical Properties of Lubricants – Viscosity measurements – Viscosity Shear Rate – Viscosity Pressure Relationships – Classification – Thermal- Optical Properties – Additives in Lubricants – and its composition – Lubricant Classification - Introduction to friction, friction measurement, theories of friction, adhesion and ploughing friction -Types of wear, wear mechanisms, factors affecting wear, material selection for different wear situations. (12 hours)

Unit – III

Theory of hydrodynamic lubrication, Reynolds equation, assumptions and simplifications, variable density and compressibility, hydrodynamic journal bearings, pressure equation for short and finite bearings, journal bearing parameters, friction in journal bearings.

(12 hours)

Unit – IV

Introduction to Computation Hydrodynamics – Non - dimensionalization of Reynolds Equation - Hydrostatic Lubrication – Basics of Elasto-hydrodynamic Lubrication, boundry and extreme pressure lubrication (12 hours)

Unit – V

Tribo Measurement and Instrumentation – Surface topography measurements – AFM and SFA – Friction and Wear Measurements – Bearing performance and Vibration Measurements

(12 hours)

Text Books :

1. Gwidon W. Stachowiak Andrew W. Batchelor Engineering Tribology, Butterworth Heinemann, UK,2005
2. Prasanta Sahoo Engineering Tribology, Printice-Hall of India Pvt Ltd, New Delhi,2005

Reference Books :

1. Bharat Bhusan Modern Tribology Handbook , Vol-1 and 2, CRC Press, Washington D.C, 2001
2. F.P.Bowden and D.Tabor Friction and Lubrication, Heinemann Educational Books Ltd.,1974.
3. B.Pugh, Friction and Wear, Newnes, Butter Worths Limited, London, 1973.
4. M.J.Neale, Hand Book of Tribology, Butter Worths , U.K.
5. D.D.Fuller, Theory and Practice of Lubrication for Engineers, John Wiley & Sons, New York.
6. A.Cameron, Basic Lubrication Theory, Ellis Harwood Ltd., U.K. 1981.
7. O.Pinkus and B.Sternlicht, Theory of Hydrodynamic Lubrication, McGraw Hill, New York,1961.

MEE71 AUTOMOBILE ENGINEERING (4 0 0 3)

Unit I

Classification of vehicles – drives - general layout. Engine - Diesel and Petrol engines for automobiles - two stroke and four stroke engines - comparison of performance - factors affecting choice - power requirements of an automobile - rolling, wind and gradient resultant-factors affecting resistance and power requirement. (12 hours)

Unit – II

Power transmission system - requirement of transmission system – clutches - plate clutches - semi automatic & automatic clutches - Gear box: manual shift four speed and positive speed gear boxes - synchromesh devices -fluid transmission - fluid flywheel and torque converter-automatic transmission - drive line - differential, conventional and non-slip types - drive axle.. (12 hours)

Unit – III

Suspension system – requirements - rigid axle and independent suspension - types of suspension - leaf spring - coil spring - torsion rod and air suspension - shock absorbers. Front axle : types - front wheel geometry - conditions for true rolling. Steering geometry - Ackerman and Davis steering - steering linkages - steering gear box-power and power assisted steering.
Wheel alignment - Tyres: materials and types static and rolling properties of pneumatic tyres.
(12 hours)

Unit – IV

Braking system - hydraulic braking systems - drum type and disc type brakes - power and power assisted brakes - factors affecting brake performance - tests on brakes - skid and skid prevention. Chassis - types of bodies - chassis frame - integral body - vehicle stability.
(12 hours)

Unit – V

Battery: types - Chemical reaction – charging - battery rating - battery life - battery testing. Starting motor : constructional features and operation - series wound motor - drive arrangements: types, Ignition: types - ignition coil - contact breaker – distributor - firing order - spark plug. Generator - constructional features of D.C.generator and Alternator – Rectifier - Generator regulation - Automotive lighting - Electronics in automobile.
(12 hours)

Text Books :

1. W.H.Crouse, Automotive Mechanics, Tata McGraw Hill Publishing Co., 1995.
2. V.L.Maleev, Internal Combustion Engines, McGraw Hill, 1987.

Reference Books :

1. Newton Steeds & Garret, The Motor Vehicle.
2. Joseph Heitner, Automotive Mechanics, CBS Publishers & Distributors, 1987.
3. R.B.Gupta , Automobile Engineering, Satya Prakashan, New Delhi, 1997.
4. R.B.Gupta., Auto Design, Satya Prakashan, New Delhi, 1995.

MEE72 FUZZY LOGIC AND NEURAL NETWORKS (4 0 0 3)

Unit – I

Knowledge Representation and processing - Knowledge and Intelligence – logic – Frames – production systems. Fundamentals of Fuzzy logic – Fuzzy sets – Fuzzy Relation – composition and Inference. (12 hours)

Unit – II

Membership Function Estimation – Importance – Fuzzy to crisp conversion – methods – Fuzzy extension principle – Fuzzy tautologies – Implication operation Composition operation.

(12 hours)

Unit – III

Basics of Fuzzy Control – Architectures of Fuzzy Control – examples of Fuzzy Control system Design – Robotic Control system – Industrial applications.

(12 hours)

Unit – IV

Hybrid Intelligence – Basic concepts of neural network – Inference and learning – Classification Models – Association models, Optimization models – Neural Network learning.

(12 hours)

Unit – V

Rule Based Neural Networks – Network Training – Application of Neural Network in Mathematical Modeling – knowledge based approaches - applications in Mechanical Engineering – Fuzzy-Neural, examples, Neuro-Fuzzy examples – Intelligence in Automation.

(12 hours)

Text Books :

1. Clarence W.de Silva, Intelligent Control Fuzzy Logic Applications, CRC Press, 1995.
2. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw Hill Inc., 1995.
3. Limin Fu, Neural Networks in Computer Intelligence, Tata McGraw Hill, Publishing Company Ltd., 2003.

Reference Books :

1. Stamations and V.Kartalopoulos, Understanding Neural Networks and Fuzzy Logic, Basic Concepts, Applications, IEEE Neural Networks Council Prentice Hall of India Pvt. Ltd., 2001.
2. James A.Freeman and David M.Skapura, Neural Networks Algorithms, Applications & Programming Techniques, Pearson Education Asia, 2001

MEE73 INTEGRATED MATERIALS MANAGEMENT (4 0 0 3)

Unit – I

Importance of materials management – need for integrated concept – advantages – organization and control – materials research - materials planning and budgeting.

Quality specification – source selection - creative purchasing - purchase systems – price forecasting and price calculation – negotiation –delivery conditions. (12 hours)

Unit – II

Timing of purchases – Make or Buy - Buying seasonal commodities – purchasing under uncertainty – purchasing of capital equipment – international purchasing – import substitution – public buying – legal aspects - contracts – vendor rating – buyer-seller relationship and ethics. (12 hours)

Unit – III

Stores Management – stores systems and procedures – incoming materials control – stores accounting and stock verification – obsolete, surplus and scrap management – codification and standardization - value analysis – material handling – storing and material handling equipments.

Inventory Management – various costs – lead time, safety stock and reorder point – Basic EOQ model – quantity discounts - P & Q systems of inventory replenishment - ABC analysis – simple problems on inventory and ABC analysis - Materials Requirement Planning (MRP). (12 hours)

Unit – IV

Concepts of Physical distribution – need, importance and management – Warehouses - location and layout types - receiving and shipping procedures - Application of OR techniques (Transportation problems only).

Common carriers – Insurance coverage – Transportation documents – railway / lorry receipts – Bill of lading – clearing, forwarding and demurrage - evaluation of materials management performance – computers in materials management. (12 hours)

Unit – V

Creating the logistics vision – problems with conventional organizations – developing logistics organizations - need for integration – managing supply chain as a network – process integration and ECR – comakership and logistics partnerships – supplier development.

New organizational paradigm – managing supply chain of the future – role of information in the virtual supply chain – route map to integrated supply chain. (12 hours)

Text Books :

1. P.Gopalakrishnan and M.Sundaresan, Materials Management – An integrated approach, Prentice Hall of India Pvt. Ltd., 2000.
2. Donald M Dobler et al., Purchasing and Materials Management – Texts and Cases, Tata McGraw Hill Publishing Co. Ltd., 1985.
3. Martin Christopher, Logistics and Supply Chain Management, Pitman Publishing, 2000.

(For Unit V Logistics and Supply Chain Management)

Reference Books :

1. J.R.Tony Arnold et al, Introduction to Materials Management, IV Edition, Pearson Education Asia Ltd., 2001.
2. A.K.Dutta, Materials Management – Procedures, Text and Cases, II Edition, Prentice Hall of India Pvt. Ltd., 2001

MEE74 METAL FORMING PROCESSES (4 0 0 3)

Unit – I

Classification of forming processes – flow curves and their significance in forming – Effect of temperature, speed and metallurgical structure on forming processes – Effect of friction on forming processes. Basic concepts of yield criteria – types. (12 hours)

Unit – II

Classifications of forging processes - Forging equipment – forging die design procedure for simple products – forging defects – determination of forging load – concept of P/M forging – Applications. (12 hours)

Unit – III

Rolling mills – Estimation of rolling load and power – rolling defects – Applications.
Direct extrusion equipment - hydrostatic extrusion - extrusion of tubes – determination of extrusion stress - extrusion defects – Applications.
(12 hours)

Unit – IV

Drawing of rods, wires and tubes-Determination of drawing loads through conical dies, sheet metal forming: Shearing, blanking, bending, punching, piercing, stretch forming, deep drawing, rubber pad forming –Applications.
(12 hours)

Unit – V

High rate energy forming processes : Introduction - Effect on mechanical properties and microstructures – Explosive forming, Electro hydraulic forming – Electro magnetic forming, Water hammer forming. (12 hours)

Note : Elementary treatment with simple problems only.

Text Books :

1. Dieter, Mechanical Metallurgy, McGraw-Publishing Co., New York, 1998.
2. P.C.Sharma, Production Engineering, S.Chand & Co., New Delhi, 1995.

Text / Reference Books :

1. G.W.Rowe, An Introduction to the Principles of Metal Working", Edward, Arnold Publications, 1973.
2. Gyril Donaldson, Tool Design, Tata McGraw Hill Publishing Co. Ltd., 1989.
3. ASTME, Hand Book – Fundamental of Tool Design, Prentice Hall of India, Pvt. Ltd., New Delhi, 1976

MEE75 NUCLEAR POWER ENGINEERING (3 1 0 3)

Unit – I

Nuclear fuels-occurrence and extraction, fissile characteristics, enrichment, fission process - thermal and fast fission - energy released from fission - chain reaction - reaction control.
Neutron balance - fast fission - resonance capture – thermalisation - geometric effects - burn-up – introduction to reactor kinetics. (12 hours)

Unit – II

General components of nuclear reactor - Fuel cladding - fuel assembly – moderators – coolants - control rods -Different types of reactors - Pressurized Water Reactor - Boiling Water Reactor - Heavy Water cooled Reactor -Gas cooled Reactor - Liquid metal cooled reactor - Organic moderated and cooled reactors - Fast Breeder Reactors - Reactor safety - Neutron Population growth - assurance of safety -emergency core cooling and containment. (12 hours)

Unit – III

The nuclear fuel cycle - Waste classification - Spent fuel storage – Transportation – Reprocessing - High-Level waste disposal - low-level waste generation and treatment - Low-level waste disposal - Nuclear power plant decommissioning. (12 hours)

Unit – IV :

Biological effects of radiation - radiation dose - Basic for limits and exposure - Sources of radiation dosage -Gas counters - Neutron detectors - Scintillation counters - Solid state detectors - Statistics of counting - Pulse height analysis - Protective measures - calculation of dose - effects of distance and shielding - Internal exposure - The Radon problem - Environmental radiological impact - radiation standards. (12 hours)

Unit – V

Reactors for naval propulsion - Space reactors - Space isotopic power generator - Energy economics -Components of electrical power – cost forecast versus Reality - Challenges and opportunities - Technical and institutional improvements – Developments in nuclear reactor. (12 hours)

Text Books :

1. W.Marshall, Nuclear Power Technology, Vol. I &II, Clarendon press, Oxford, 1985.
3. Samual Glasstone, Principle of Nuclear Reactor Engineering, Van Nostrand ReinholdCo. Inc., New York, 1963.

Reference Books :

1. Margulova, Nuclear Power Station, Mir Publishers, Moscow, 1978.
2. Archie W.Culp, Principle of Energy Conversion, McGraw Hill Kogakusha Ltd., 1984.
3. Domkundwar, A Course in Power Plant Technology, Dhanpat Rai Sons, 1993

MEE76 PLASTICS ENGINEERING (4 0 0 3)

Unit – I

Evolution of Plastics and composites - Reinforced Plastics - Polyester and epoxy resins – Phenolics and Silicones - High temperature Resistant polymers - Glass fibers - Manufacturing, Chemistry, Properties, Applications. (12 hours)

Unit – II

Hand Lay-up Techniques: simple, complex, spray-up, Wet Lay-up, Dry Lay-up, Mouldless Lay-ups and Direct Lay-ups techniques. Bag Molding Process: Materials, Properties, Processing specifications, Production and Quality control Procedures and curing Operation. Matched Molding: Mat Materials for Molding, Molding with Fabrics, Preform Process, Screens and Binders, Vacuum Injection Molding, Matched metal Dies molding and different types of molds. (12 hours)

Unit –III

Continuous Production methods, joining and machining techniques of composites, winding process, molding compounds, prepregs, ablation, Tooling for composite production, Thermal expansion, density of tool weight, thermal mass. (12 hours)

Unit – IV

Design of Composite materials- Analytical methods – micro mechanics and macro mechanics, Boron- epoxy air craft structure- structural analysis and design. Testing of reinforced Plastics and Advanced Composites – Tension, compression, shear, Flexture, elevated temperature test, shear modulus and void content test and Non-destructive evaluation for quality check. (12 hours)

Unit – V

Application – General, structural, marine structure, automotives, aircraft and aerospace.
Future Trends and Scope for advanced composites. (12 hours)

Text Books :

1. Premamoy Ghosh, Polymer Science & Technology of Plastics & Rubber, VI Edition, Tata McGraw Hill, 1998
2. V.Dominick & P.E.Rosato -Plastics Processing Data Hand Book, II Edition, Chapman & Hall, 1997.

Reference Books :

1. Luben, Handbook of Composite Materials, II Edition, Chapman Hall, 1997.
2. Georgre Lubin, Handbook of Fiber glass and Advanced Plastics Composites,

MEE77 PRODUCT DESIGN & DEVELOPMENT (4 0 0 3)

Unit – I

Definition – Design by Evolution and by Innovation - factors to be considered for product design – Production-Consumption cycle – The morphology of design – Primary design Phases and flow-charting. Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly Product strategies, Market research – identifying customer needs – Analysis of product – locating ideas for new products, Selecting the right product, creative thinking, curiosity, imagination and brain storming - product specification. (12 hours)

Unit – II

Task - Structured approaches – clarification – search – external and internal – systematic exploration – conception, selection - methodology benefits. The value of appearance - principles and laws of appearance – incorporating quality, safety, and reliability into design. Man-machine considerations – Designing for ease of maintenance. (12 hours)

Unit – III

Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing process – Needs for industrial design-impact – Industrial design process – Technology driven products - user driven products – assessing the quality of the product. (12 hours)

Unit – IV

Methodologies and tools - Design axioms - Design for assembly and evaluation - Minimum part assessment - Taguchi Method - Robustness assessment - Manufacturing process rules - Designer's tool kit - Computer aided group process rules - Designer's tool kit - Computer aided group technology - Failure Mode Effective Analysis – Design for minimum number of parts – Development of modular design – Minimising part variations – Design of parts to be multi-functional, multi-use, ease of fabrication – Poka Yoka principles. (12 hours)

Unit – V

Estimation of manufacturing cost – cost procedures – Value Engineering - reducing the component cost and assembly cost – minimizing the system complexity – Basics and Principals of prototyping – Economic Analysis: Break even analysis.

Classes of exclusive rights – Patents – Combination versus aggregation – Novelty and Utility – Design patents – Paten disclosure – Patent application steps - Patent Office prosecution - Sales of paten rights - Trade marks – copy rights. (12 hours)

Text Books :

1. Karl.T.Ulrich, Steven D.Eppinger, Product Design and Development, McGraw Hill International Edition, 2004.
2. Benjamin W.Niebel and Alanb.Draper Product Design and Process Engineering, McGraw Hill Book Co., 1985.
3 A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, Prentice Hall of India Private Limited, New Delhi, 2002

MEE78 SYSTEM DESIGN AND OPTIMIZATION IN THERMAL ENGINEERING (3 0 0 3)

Unit – I

Steps in design process – thermal system design aspects – workable – optimal – near optimal designs – regression analysis and equation fitting – importance of modeling in design – types of models – selection.

(12 hours)

Unit – II

Modeling of thermal equipment – heat exchangers – evaporators – condensers – turbo machines – distillation columns – System simulation – different classes – methods used in simulation – examples of energy systems.

(12 hours)

Unit – III

Optimization of thermal systems – analytical and numerical optimization techniques – unconstrained and constrained multivariable optimization using Lagrange Multipliers and search methods – application to energy systems.

(12 hours)

Unit – IV

Optimization of heat exchanger networks – concepts of pinch technology – temperature enthalpy rate difference diagram – composite curves and process pinch – maximum energy recovery – calculation of utility loads – grand composite curve – estimation of the required total heat transfer surface area – HEN design – integration of HEN with other components.

(12 hours)

Unit – V

Applications of second law analysis in heat and fluid flow – relationship between entropy generation and viscous dissipation – local entropy generation in convective heat transfer – fluid friction vs. heat transfer irreversibility – entropy generation minimization in extended surfaces and heat exchangers subject to constraints.

(12 hours)

Text Books :

1. W.F.Stoecker, Design of Thermal Systems, McGraw Hill Book Co., 1989.
2. A.Bejan et al , Thermal Design and Optimization, John Wiley & Sons, 1996.

Reference Books :

1. Y.Jaluria, Design and Optimization of Thermal Systems, McGraw Hill, 1998.
2. A.Bejan, Entropy Generation Minimization, CRC Press, 1995.
3. B.Linhoff et al, User Guide on Process Integration for Efficient use of Energy, IChE, 1984.

MEE79 COMPUTATIONAL FLUID DYNAMICS (3 1 0 3)

Unit – I

Governing equations: Continuity, momentum & energy equations applied to viscous & inviscid flows. Mathematical properties of equations of fluid dynamics – Classification of partial differential equations: linear & non-linear equations – second –order equations: elliptic equations, parabolic equations, hyperbolic equations, system of first order equations, system of second order equations – initial and boundary conditions.(12 hours)

Unit – II

Taylor series expansion – finite difference by polynomials – finite difference equations – finite difference approximation of mixed partial derivatives – application of finite difference methods – parabolic partial difference equations: explicit methods; forward time/central space method – implicit methods: Crank–Nicolson method – parabolic equations in two space dimensions – approximate factorization – fractional step methods. Elliptic equations. Hyperbolic equations – solution methods: implicit and explicit formulations. (12 hours)

Unit – III

Structured grid generation – Transformation of partial differential equations – Metrics and the Jacobian transformation – Grid generation technique: algebraic grid generation techniques, elliptic grid generation techniques, - Co-ordinate system control – hyperbolic grid generation techniques, Parabolic grid generation techniques: Stability analysis – discrete perturbation stabillity analysis – Von Neumann stability analysis – multi dimensional problems – error analysis modified equation – artificial viscosity. (12 hours)

Unit – IV

Strong and weak formulation of a boundary value problem: Strong formulations, weighted residual formulation, Galerkin formulation, weak formulation, variational formulation – shape function in two dimensions: Finite element interpolation triangular elements, quadrilateral Lagrange elements, quadrilateral serendipity elements, isoparametric elements – implementation of FEM; Analysis, numerical integration, solution procedure – case studies applied to incompressible and compressible flows. (12 hours)

Unit – V

Introduction to FVM – Grids in FVM – FVM through finite difference techniques: central type discretization, upwind type discretization. FVM through finite element techniques: Cell – centred formulation; single stage time stepping, multistage time stepping – accuracy – cell-vertex formulation: single stage time stepping with non-overlapping control volumes, multistage time stepping with over lapping control volumes – MAC formulation – FLIC formulation – Case studies applied to heat and fluid flow. (12 hours)

Text Books :

1. John F.Wendt, Computational Fluid Dynamics - An Introduction, Springer-Verleg, 1992.
2. K.Muralidhar and T.Sundararajan,Computational Fluid Flow and Heat Transfer, Narosa Publishing House, 1995.

Reference Books :

1. D.A.Anderson et al, Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, 1984.
2. T.J.Chung , Computational Fluid Dynamics, Cambridge University Press, 2002.
3 G.D.Smith , Numerical Solution of Partial Differential Equations; Finite Difference Methods, Oxford University Press, 1985.
4. O.C.Lienkiewicz, The Finite Element Method, McGraw Hill, 1977.
5. O.C.Lienkiewing& Morgan - Finite Elements and Appreciation, John Wiley & Sons, 1983.
6. J.N.Reddy, An Iintroduction to the Finite Element Method, McGraw Hill, 1984.
7. T.Arts, Cascade Flow Calculations using a Finite Volume Method, UKI Lecture Series, 1982 – 05, 1982.
8. M.Cousten, The Time Marching-Finite Area Method, UKI Lecture series 84, 1976.

MEE710 MECHATRONICS (3 1 0 3)

Unit – I

Introduction to Mechatronics – Mechatronics in Products – Mechatronics in Engineering Design – Measurement Systems – Electronics for Mechanical – Mechanical System for Electronics. System Response – Dynamic Characteristics of Systems – zero order - First order – Second order – System Modeling and analogies.

(12 hours)

Unit – II

Amplifier – Operational amplifier – Instrumentation amplifier – comparator. Digital Representations – Boolean algebra – Design of logic Network – Flip flops – Application of flip flops – Special purpose Digital integrated circuits.

(12 hours)

Unit – III

Microprocessors and micro Computers – Micro Controllers – Numeric key board – LCD Display – Method to Design a Micro controller based system. Data acquisition – quantizing theory – Analog to Digital conversion – Digital to Analog conversion.

(12 hours)

Unit – IV

Performance Terminology – Semi conductor Sensors and micro electro mechanical Devices - Actuators – Hydraulics Actuators – pneumatic Actuators.
Programmable Logic Controllers (PLC) – basic structure – input / output processing – programming – Mnemonics Timers – relays and counters – data handling – selection of PLC.

(12 hours)

Unit – V

Control architecture – Analog – Digital – Micro Controller – Single Board Computer – personal Computer designing. Case studies of Mechatronic system. Introduction to design of Mechatronic systems - Coin counter - Robotics - Magnetic Bearings etc..

(12 hours)

Text Books :

1. David G.Alciatore and Mecheal.B.Histand, Introduction of Mechatronics and Measurement Systems, McGraw Hill International Edition, 1999.
2. HMT, Mechatronics, Tata McGraw Hill Publishing Company Ltd., 1998.
3. Lawrence J.Kamm, Understanding Electro – Mechanical Engineering, An Introduction to Mechatronics, Prentice Hall, 2000.

MEE711 RENEWABLE ENERGY (4 0 0 3)

Unit – I

Solar Radiation – Components of solar radiation – diffuse, beam & global – solar constant-estimation of average solar radiation – solar thermal energy conversion systems – solar photovoltaic systems.
Introduction to Geothermal energy – types of geothermal resources – geothermal power plants – vapour and liquid dominated power plants.
(12 hours)

Unit – II

Introduction to Wind Energy – Application and Background – Mean wind velocity – wind power density – site selection – wind generators – types – wind mills – wind energy conversion systems – wind farms. (12 hours)

Unit – III

Biomass energy resources : urban solid waste, agriculture waste and aquatic waste – conversion processes : direct combustion, thermo chemical, biochemical, incineration, pyrolysis and fermentation process – biogas from land fills. (12 hours)

Unit – IV

Off-shore & On-shore energy resources – advantages and limitations of ocean energy – Ocean energy conversion technologies : OTEC, Ocean wave energy conversion systems and Tidal energy conversion systems. (12 hours)

Unit – V

Magneto Hydro Dynamics (MHD) – Fuel cells – Natural Gas – Methanol – Bio-fuel – Hydrogen energy – Nuclear energy – Hydro energy – combined cycle power plants. (12 hours)

Text Books:

1. G.D.Rai, Non Conventional Energy Sources, Khanna Publishers, 2003.
2. N.K.Bansal et al, Renewable Energy Sources and Conversion Technology, Tata McGraw Hill Publishing Co., 1990.

Reference Books:

1. S.P.Sukhatme, Solar Energy – Principles of Thermal Collection and storage, Tata McGraw Hill Publishing Co., New Delhi, 1996.
2. S.Rao & B.B.Parulekar, Energy Technology, Khanna Publishers, Delhi, 1999.
3. Ashok V.Desai, Non-Conventional Energy, Wiley Eastern Ltd., 1990.
4. Ashok V.Desai, Bio-Energy, Wiley Eastern Ltd., 1990.

MEE712 ADVANCED WELDING TECHNIQUES (4 0 0 3)

Unit – I

Introduction to different types of welding – Welding Symbols – Weld Joint selection – Preparation of weld Joints – Welding Metallurgy – Structure of Welded metals.
Gas Welding : Theory of ionization of Gas Welding Systems – Ferrous and Non – Ferrous Welding, Gas Cutting – Safety Precautions – Applications. (12 hours)

Unit – II

Arc Welding : Introduction – Electrodes , Transfer of Metal from electrode- Power Supplies , Operation - Carbon Arc Welding, Metal Arc Welding, Gas Shield Arc Welding and Submerged Arc Welding Process – Arc Cutting Process – Applications. (12 hours)

Unit – III

Plasma Arc welding – Electrogas and Electroslag Welding – Solid State Bonding.
Electron Beam Welding – Laser Welding – Thermit Welding – Metal Flame Spraying.
Introduction to Under water Welding - Applications. (12 hours)

Unit – IV

Resistance Welding : Types , Process, Applications.
Welding of Plastics: Ultrasonic – Friction – Hot plate – Hot gas – High Frequency Welding of Plastics, Welding of plastic Pipes and other Applications. (12 hours)

Unit – V

Testing of Welds: Introduction to Testing and Inspection of Welds – Destructive and Non Destructive Tests – Advantages and Limitations. Distortion in welds – Prevention. (12 hours)

Text Books :

1. Little, Principles of Welding Technology, Tata McGraw Hill, 1985.

Reference Books :

1. P.T.Hould Croft, Welding Process Technology, Cambridge University Press, 1983.
2. L.Carl Love, Welding Procedures and Applications, Prentice Hall Inc., 1993.
3. M.N.Watson, Joining Plastics in Production, Welding Institute, Cambridge,1990.

MEE81 AUTOMOTIVE FUELS, POLLUTION AND CONTROL (4 0 0 3)

Unit – I

Liquid Fuels : Gasoline and Diesel - Physical and chemical properties. Fuel rating – octane rating and cetane rating - Fuel additives. Gaseour Fuels : LPG and CNG – Alternative Fuels : sources – Liquid fuels – vegetable oil and its derivatives – methanol and ethanol Gaseous fuels : methane and producer gas – physical and chemical properties. (12 hours)

Unit – II

Pollutants from automobiles - carbon, nitrogen and sulfur compounds – aldehydes – particulate matter and smoke – odour – Influence of fuel constituents on pollutant emissions. Impact of pollutants on health and environment. (12 hours)

Unit – III

Formation of hydrocarbons, oxides of nitrogen, sulphur and carbon monoxide in SI and CI engines. Formation of particulate emission from CI engine – Formation of aldehydes – Effect of operating parameters on the formation of pollutants. (12 hours)

Unit – IV

Chassis Dynamometer tests – CVS methods – Sampling techniques – Emission measurement – Chemiluminescence and NDIR Analyzers – Flame ionization detector – smoke measurement : Comparison and obscurations methods – Bosch smoke meter-measurement of particulate matter. (12 hours)

Unit – V

Influence of operating parameters in the control of pollutants – changes in the design of combustion chamber – Fuel modification – Exhaust gas recirculation - Catalytic convertors for spark ignition engines - NO_x reduction methods – Fuel additives to control emission - particulate traps. (12 hours)

Text Books :

1. John B.Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Edition, 1988.
2. V.Ganesan, Internal Combustion Engines, Tata McGraw Hill, New Delhi, 1995.

Reference Books :

1. Paul Degobert, Automobiles & Pollution, Society of Automotive Engineers, 1995.
2. Obert, Edward, Internal Combustion Engines and Air Pollution, Harper and Row

MEE82 COMPOSITE MATERIALS (4 0 0 3)

Unit – I

Definition of Composite materials – Classification of composites, Need and General characteristics – advantages and limitations. (12 hours)

Unit – II

Matrices – Polymers – thermo set – thermo plastics, metal matrix – types, ceramics, reinforcement – Types, continuous, whiskers and particles – reinforcing materials. (12 hours)

Unit – III

Primary processing – Bag moulding, compression moulding – Pultrusion and Filament winding, Solid state processing, Liquid state processing, In situ methods. Secondary processing and heat treatment of MMCs. (12 hours)

Unit – IV

Introduction to Physical Properties, mechanical properties, fatigue, creep and damping properties – Effects of environment on the properties. (12 hours)

Unit – V

Selection of constituents for end application, Design considerations, Applications – case studies. (12 hours)

Text Books :

1. P.K.Mallick - Fiber reinforced Composites, Marcel Decker Inc., USA, 1993.
2. S.C.Sharma - Composite Materials, Narosa Publishing House, 2000.

Reference Books :

1. P.K.Mallick & S.Newsman, Composite Materials Technology – Processes and Properties, Hansen Publisher, Munich, 1990.
2. Krishan K.Chawla, Composite Materials – Engineering and Science, Springer Verlag, UK, 1998.
3. Sanjay K.Mazumdar, Composites Manufacturing, CRC Press, UK, 2002.

MEE83 DIRECT ENERGY CONVERSION SYSTEMS (3 1 0 3)

Unit – I

Energy: Types and classification – Energy sources – Energy conversion processes.
Direct and Indirect energy conversion – Fuels for Energy conversion – Introduction to irreversible thermodynamics. (12 hours)

Unit – II

Basic ideas of quantum physics – Pauli Exclusion Principle – Shell structure of electrons – Fermi Energy – Energy levels – Bonding in crystals – Energy bands –Intrinsic and Extrinsic semiconductors – junctions – types. (12 hours)

Unit – III

Photovoltaic conversion – solar cell configurations – characteristics of solar cells- performance of solar cells - Thermoelectric converters – Thermoelectric refrigerators – Thermionic converters and other thermal – electric conversion systems. (12 hours)

Unit – IV

Introduction to plasma physics – Temperature and ionization – confinement of plasma: Magnetic confinement and inertial confinement – Principles of Magneto hydrodynamic conversion-Ideal and practical MHD generators performance – MHD technology. (12 hours)

Unit – V

Fuel cells and Batteries – Principles of EMF generation – Description of fuel cells – Applications of fuel cells – Description of batteries: Primary, Secondary, Reserve and advanced battery system – Types – Characteristics – applications. (12 hours)

Text Books :

1. S.W.Angrist, Direct Energy Conversion, Allyn and Bacon, Boston, 1982
2 W.Culp Archie, Principles of energy conversion, Tata McGraw Hill Publishing Co.Ltd., New Delhi-2000.

Reference Books :

1. K.Messerle Hugo, Magneto hydrodynamic Electric Power Generator, John Wiley & Sons, 1995.
2. D.Lindon, Handbook of Batteries and Fuel Cells, McGraw Hill Book Co., 1984.
3 M.A.Greem, Solar Cells, Prentice Hall Inc, Englewood Cliffs, 1982.
4. Rakosh Das Begamudre, Energy Conversion System, New Age International (P) Ltd., New Delhi, 2000.

MEE84 FLUID POWER AUTOMATION (4 0 0 3)

Unit – I

Introduction to fluid Power – Advantages – Filters – Seals – Hydraulic Pumps – Classification – Selection factors – Hydraulic Actuators – Linear – Rotary fluid Motors.
(12 hours)

Unit – II

Pressure – Direction – Flow Control valves, relief valves, non return and safety valves – Accumulators – Linear Circuits – Regenerative Circuits – Intensifier Circuits – Metering –in-out Circuits. (12 hours)

Unit – III

Reciprocation operation of multicylinder – Quick return – sequencing – Accumulator Circuits – use
of pressure switches & limit switches – Hydrostatic transmission Circuits – Fluid Power maintenance and safety. (12 hours)

Unit – IV

Basic Principles of Pneumatics – Types of Compressors – Elements of Pneumatic Systems – Filter, Lubricator, Muffler – Types of Directional control valve – air motors – air Cylinders.
(12 hours)

Unit – V

Basic Pneumatic Circuits – Speed Control – Sequencing of Motion – Hydro Pneumatic Circuits – Cascade Methods – Automation and Principle of Circuit design – Pneumatic Control applications in
Machine Tool and other Mechanical fields – Maintenance.
(12 hours)

Text Books :

Anthony Esposeto - Fluid Power with application, IV Edition, Prentice Hall, 1980.
S.R.Majumdar - Pneumatic Systems - Principles and Maintenance, Tata McGrawHill Publishing Company Ltd.,
1995.

Reference Books :

Dudley A.Pease and - Basic Fluid Power, II Edition, Prentice Hall, 1998.
John J.Pippinger and Andrew Parr - Hydraulic and Pneumatics, Jaico Publishing House, 1999.

MEE85 INDUSTRIAL ROBOTICS (4 0 0 3)

Unit – I

Fundamentals of Robotics – classification of robots – robot anatomy – robot motions – work volume – robot driven system – types – dynamic performance – precision of movements – limited sequence robots – playback robot with PTP control – continuous path control – intelligent robots. (9 hours)

Unit – II

Robot control systems and components – basic control systems and models – concepts – control system analysis – robot activation and feed-back components – power transmission system – robot joint control design (9 hours)

Unit – III

Method of robot programming – lead through programming methods – capabilities and limitations – Textual robot languages – generations of robot programming language, robot language structure, constants, variables, and other data objects, motion comments, end effectors and sensor commands, computations and operations, program control and subroutines, communications and data processing, monitor mode commands.
(Simple Problems in Programming). (9 hours)

Unit – IV

Robot cell layouts – multiple robots and machine interface, consideration in work cell design, work cell control, interlocks, error detection and recovery, Robot cycle time analysis – graphical simulation of Robot work cells – AI and robotics.
(9 hours)

Unit – V

Robot applications in manufacturing – Robot material handling, material transfer applications, loading and unloading – processing operation – spot welding, continuous arc welding, spray coating – assembly and inspection – parts presentation methods, assembly operations, compliance & the remote center compliance device, assembly system configuration, designing for robotic assembly, inspection automation – futureapplications. (9 hours)

Text Books :

1. Richard D.Klafter et al, Robotic Engineering – An Integrated Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Mikell P.Groover et al, Industrial Robotics – Technology, Programming and applications, McGraw Hill International Edition.

Reference Books :

1. K.S.Fu et al, Robotics Controls Sensing : Vision Intelligence, McGraw Hill Book Co., 1987.
2. Shimon Y.Nof, Hand Book of Robotics, John Wiley & Sons, 1985

MEE86 PRESSURE VESSEL DESIGN (3 1 0 3)

UNIT - I

Pressure vessels - introduction – functional requirements, size and shape, fluid contained, method of support, location of attachment and penetrations, operational requirements and limitations, loading, severity of duty, principal design codes, safety devices, pressure testing. (9 hours)

Unit - II

Stresses in pressure vessels – stresses in a circular ring, cylinder and sphere – Dilation of pressure vessels – Intersecting spheres – Membrane stresses in vessels under internal pressures – stresses in thick cylinders and spheres - Built up cylinders – Auto frettage of thick cylinders – Thermal stresses due to thermal gradients – Ultra-high pressure vessel design principles. (9 hours)

Unit - III

Design codes and usage – design preliminaries – design loads – failure criteria – factor of safety. Selection and design of heads and enclosures – opening and compensation – Non standard flanges – Supports – Welded, bolted and gasketed joints - Long life design philosophy – vessel construction codes and usage. (9 hours)

Unit - IV

Fatigue and crack growth – causes – dynamic loading, stress concentration , surface effects and material properties – creep effects at elevated temperatures – thermal stress fatigue – embrittlement – fracture control. (9 hours)

Unit - V

Buckling of pressure vessels under external pressure (cylinders and spheres) – Effect of supports and imperfections on buckling – economics of pressure vessel fabrication – modern trends in pressure vessel construction - use of codes. (9 hours)

Text Books :

1. J.F.Harvey, Theory and Design of Pressure Vessels, CBS Publishers & Distributors, 1987.
2. B.C.Bhattacharya, Introduction to Chemical Equipment Design – Mechanical Aspects, CBS Publishers & Distributors, New Delhi, 1991.

Reference Books :

1. Henry H.Bednar Pressure Vessel Design Hand Book, CBS Publishers & Distributors, 1987.
2. L.E.Brownell and E.H.Young - Process Equipment Design, Wiley Eastern Ltd., 1986
3. IS: 2825 – 1969 -Code for Unfired Pressure Vessels, Bureau of Indian Standards,

MEE87 PROJECT MANAGEMENT (4 0 0 3)

Unit – I

Indian project management scenario, Projects - Project ideas and preliminary screening. Developments - Project planning to Project completion - Pre-investment phase, Investment phase, operational phase - Governmental Regulatory framework. Capital Budgeting : Capital cost-time-value (CTV) system, managing project resources flow. (12 hours)

Unit – II

Stages - Opportunity studies - General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study expansion projects, data for feasibility study.

Market and Technical Appraisal : Market and Demand analysis, Market Survey, Demand forecasting. Technical analysis- Materials and inputs, Choice of Technology, Product mix, Plant location, capacity, Machinery and equipment. (12 hours)

Unit – III

Appraisal process, Concepts and Techniques, Cost and Benefit from Financial angle - Basic principles for measuring costs and benefits, components of cash flow. Time value of money - Present and future value. Appraisal criteria - Urgency, Payback period, Rate of return, Debt service coverage ratio, Net present value, Benefit cost ratio, Internal rate of return, Annual capital charge, Investment appraisal in practice. (12 hours)

Unit – IV

Cost of capital - Cost of different sources of finance, Cost of debt, preference capital, and Equity capital, Weighted average Cost of capital, Marginal cost of capital. Risk analysis- Measures of risk, Sensitivity analysis, and Decision tree analysis. Social cost benefits analysis (SCBA) - Rationale for SCBA, UNIDO approach.

Cost of Capital. Means of financing, Term Loans, Financial Institutions. Profitability - Cost of Production, Break-even analysis. Assessing the tax burden and financial projections.

(12 hours)

Unit – V

Forms of Project Organization, Project Planning, Implementation, and Control - Network construction, CPM, PERT, Development of Project schedule, Crashing of Project Network, Scheduling based on the availability of Resources (Manpower and Release of Funds).

Introduction to Foreign collaboration projects - Governmental policy framework, Need for foreign technology, Royalty payments, Foreign investments and procedural aspects.

(12 hours)

Text Books :

1. P.Gopalakrishnan and V.E.Rama Moorthy Project Management, Macmillan India Ltd., New Delhi, 1993.
2. Prasanna Chandra, Projects - Preparation, Appraisal, Budgeting and Implementation, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1980.

Reference Books :

1. B.B.Goel, Project Management - Principles and Techniques, Deep & Deep Publications, New Delhi, 1986.
2. UNIDO Series on Project Management

MEE88 MODELING AND SIMULATION IN MANUFACTURING (3 1 0 3)

Unit – I

Introduction to Simulation - areas of applications - systems – Components – discrete and continuous systems – types of models - simulation study steps – simulation examples – simulation of queuing systems, inventory systems and reliability problem. (9 hours)

Unit – II

General Principles – concepts in discrete event simulation - buildings blocks - world view – manual simulation using event scheduling and operations - List processing – basic properties.
Introduction to programming languages – simulation in FORTRAN, GPSS, SIMAN, SLAM and MODSIM – Comparison. (9 hours)

Unit – III

Simulation of manufacturing systems – models, goals and performance measures issues - some preliminary case studies of simulation of manufacturing - study of Softwares available in the market – SIM FACTORY II.5, ProModel, AutoMod, Arena, AIM, Witress, Taylor - II. (9 hours)

Unit – IV

Mathematical and statistical models in Simulation – review of terminology and concepts – useful statistical models – discrete distributions – continuous – empirical distribution - Poisson process.
Basic concepts of queuing models and estimation of performance measures. (9 hours)

Unit – V

Analysis of simulation data - nput data models, Collection of data, identification of statistical distribution, estimating parameters and testing for goodness of it.
Verification and validation of simulation models - Face validity, Validation of assumptions, Input - Output validation. (9 hours)

Text Books :

1. Jerry Barks et al, Discrete Event System Simulation, Prentice Hall, New Jersey, 1996.
2. A.M.Law and W.D.Kelton, Simulation Modeling and Analysis, II edition, McGraw Hill, New York, 1991.

Reference Books :

1. Shannon and E.Robert, Systems Simulations -The Art and Science, Prentice Hall, Englewood Cliffs, New Jersey, 1975.
2. Irwin R.Miller et al, Probability & Statistics for Engineers, PHI Pvt. Ltd, New Delhi, 1992.
4. Barry L.Nelson, Stochastic Modeling - Analysis & Simulation, McGraw Hill Inc., New York, 1995.

MEE89 SOLAR POWER ENGINEERING (4 0 0 3)

Unit – I

Solar radiation - radiation at the earth's surface – measurement of solar radiation - solar radiation data geometry – solar radiation on tilted surfaces – relationship among absorption and emittance and reflectance – Selective surfaces. (12 hours)

Unit – II

Flat plate collectors – transmissivity of cover system – collector efficiency – liquid plate collector – performance of flat Plate collector. Concentrating collectors – flat plate collector with plane reflector – cylindrical parabolic collector – compound parabolic collector – central receiver collector. (12 hours)

Unit – III

Solar heating – air heating system – solar energy heat pump system – solar water heating system: forced and natural circulation system – passive solar heating system – green house effect.
Solar cooling – absorption cooling – vapour absorption refrigeration – solar desiccant Cooling-Solar drier and dehumidifier – solar pond – domestic, commercial and industrial applications of solar heating / cooling systems. (12 hours)

Unit – IV

Photovoltaic Principle –materials for photovoltaic cells – design and fabrication of photovoltaic cells – performance analysis of photovoltaic cells – Thermoelectric generator solar cell – photochemical solar cells – solar cells in terrestrial and space applications. (12 hours)

Unit – V

Solar power systems – electrical power generation – solar thermal power plants – low, medium and high temperature power generation systems: using flat plate collectors or solar ponds, concentrating collectors, central receiver and solar chimneys – solar energy process economics. (12 hours)

Note : Simple problems wherever applicable.

Text Books :

1. S.P.Sukhatme, Solar Energy – Principles of Thermal Collection and storage, Tata McGraw Hill Publishing Co., New Delhi, 1996.
2. J.A.Duffie & W.Beckmann, Solar Thermal Processes, John Wiley, 1980.

Reference Books :

1. N.K.Bansal et al, Renewable Energy Sources and Conversion Technology, Tata McGraw Hill Publishing Co., New Delhi, 1990.
2. Jiu Sheng Hsieh, Solar Energy Engineering, Prentice Hall, 1991