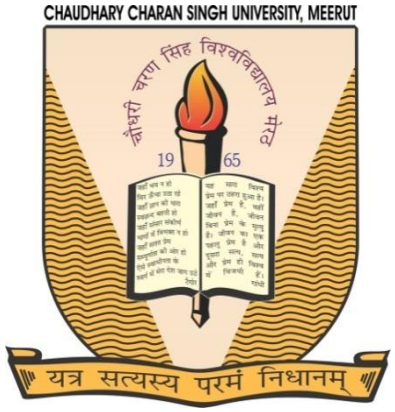
SIR CHOOTU RAM INSTITUTE OF ENGINEERING & TECHNOLOGY
CH. CHARAN SINGH UNIVERSITY, MEERUT



Program: B.TECH
Course :(Mechanical Engineering)

Session: 2018-19

Program: B.TECH

Program: B.TECH
Program (Specific):B.TECH(M.E)
Program Code:
Year of Implementation:

Program Outcomes:

After successful completion of B.Tech(ME) program, the students would be able -

PO1-Establish a career in Mechanical and interdisciplinary areas.

PO2- Evolve engineering solution to the problems of Design, Manufacturing, Thermal and Industrial engineering domains.

PO3- Apply the acquired knowledge in Mechanical Engineering for the betterment of society.

PO4- Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO5- Identify, formulate research literature and analyze complex engineering problems reaching sustainable conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO6- Design solutions for complex engineering problems and design components or processes that meet specified needs with appropriate consideration for public health and safety, and cultural, societal and environmental considerations

PO7-Use research based – knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions

PO8- Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

Semester	Course and Course Code	Course Outcome
1st	Engineering Maths-I	After completion of this course the students will be able to- CO1. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitztheorems CO2. Identify the application of partial differentiation and apply for evaluatingmaxima, minima, series and Jacobians. CO3. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity. CO4. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals. CO5 Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
1st	Engineering Physicss-I	CO1. After completion of this course the students will be able to- To determine the wavelength of sodium light by Newton‟s ring experiment CO2.To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism CO3.To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil. CO4.To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
1st	Basic Electrical Engg/ Elements of Mechanical Engg	CO1.After completion of this course the students will be able to- Conduct experiments illustrating the application of KVL/KCL and network theorems toDC electrical circuits. CO2.Demonstrate the working of various measuring instruments like ammeter, voltmeter, wattmeter, energy meter etc. CO3. Conduct experiments illustrating the working of magnetic circuits, single phase transformers and auto-transformers. CO4.Conduct experiments illustrating the behavior of DC and AC machines and identify thetype of electric machine used for a particular application.

1st	Basic Electronics/ Engineering Chemistry	After completion of this course the students will be able tounderstand- CO1.Conduct experiments illustrating the application of KVL/KCL and network theorems toDC electrical circuits. CO2.Demonstrate the working of various measuring instruments like ammeter, voltmeter, wattmeter, energy meter etc. CO3.Conduct experiments illustrating the working of magnetic circuits, single phasetransformers and auto-transformers. CO4.Conduct experiments illustrating the behavior of DC and AC machines and identify the type of electric machine used for a particular application.
2nd	Engineering Maths-II	After completion of this course the students will be able to- CO1.Understand the concept of differentiation and apply for solving differential equations. CO2.Remember the concept of definite integral and apply for evaluating surface areas andvolumes. CO3.Understand the concept of convergence of sequence and series. Also evaluate Fourierseries CO4.Illustrate the working methods of complex functions and apply for finding analyticfunctions. 1. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals.
2nd	Engineering Physicss-II	After completion of this course the students will be able to- CO1. To determine the wavelength of sodium light by Newton‟s ring experiment CO2.To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism CO3.To determine the variation of magnetic field with the distance along the axis of acurrent carrying

		coil and estimate the radius of the coil. CO4.To draw hysteresis (B-H curve) of a specimen in the form of a transformer and todetermine its hysteresis loss.
2nd	Elements of Mechanical Engg/ Basic Electrical Engg	After completion of this course the students will be able to- CO1. Understanding of the visual aspects of engineering design CO2. Understanding of engineering graphics standards and solid modelling CO3. Effective communication through graphics CO4. Applying modern engineering tools necessary for engineering practice CO5. Appling computer-aided geometric design CO6. Analysis of Isometric.
2nd	Computer System & Programming in C/ Professional Communication	After completion of this course the students will be able to- CO1.To write programs for arithmetic and logical problems. CO2.To translate the algorithms to programs & execution (in C language). CO4.To write programs for conditional branching, iteration and recursion. CO5.To write programs using functions and CO6. synthesize a complete program using divide andconquer approach. 1. write programs using arrays, pointers and structures.
2nd	Engineering Chemistry/ Basic Electronics	After completion of this course the students will be able to- CO1.Use of different analytical instruments CO2.Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water. CO3. Measure hardness of water. CO4.Estimate the rate constant of reaction. .

Semester	Course	Course Outcome
SEMESTER III	Thermodynamics	CO 1-After completing this course, the students will be able to apply energy balance to systems andcontrol volumes, in situations involving heat and work interactions. CO2-Students can evaluate changes in thermodynamic properties of substances. CO3-The students will be able to evaluate the performance of energy conversion devices. CO4-The students will be able to differentiate between high grade and low-grade energies.
	Materials Science	CO1-students will be able to identify crystal structure and defects in crystal structure CO2-Understand how to tailor material properties of ferrous and non-ferrous alloys. CO3-How to quantify mechanical integrity and failure in materials.
	Strength Of Material	CO1-Understand the concept of stress and strain under different conditions of loading CO2-Determine the principal stresses and strains in structural members CO3-Determine the stresses and strains in the members subjected to axial, bending and torsional loads CO4-Apply the concepts of stresses and strain in solving problems related to springs, column and pressure vessels Calculate the slope, deflection and buckling of loaded members
	Environmental Science	CO1-Gaining in-depth knowledge on natural processes that sustain life and govern economy. CO2-Predicting the consequences of human actions on the web of life, global economy and quality of human life. CO3-Developing critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development. CO4- Acquiring values and attitudes towards understanding complex environmentaleconomic-social challenges, and participating actively in solving current environmental problems and preventing the future ones. CO5-Adopting sustainability as a practice in life, society and industry.
	Fluid Mechanics	CO1-Upon completion of this course, students will be able to mathematically analyze simple flowsituations.
	Maths III	CO1-The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.
	Machine Drawing Lab	CO1- Upon completion of this course, the students can use computer and CAD software formodelling mechanical components.

	Fluid Mechanics Lab	CO1- The students who have undergone the course will be able to measure various properties of fluids andcharacterize the performance of fluid/thermal machinery.
	Material Science Lab	CO1- Students will study the crystal structure of the materials CO2-Understand the different types of defects
SEMESTER V	Heat and Mass Transfer	CO1-Understand the fundamentals of heat and mass transfer. CO2-Apply the concept of steady and transient heat conduction. CO3-Apply the concept of thermal behavior of fins. CO4-Apply the concept of forced and free convection. CO5-Apply the concept of radiation for black and non black bodies. CO6-Conduct thermal analysis of heat exchangers.
	Heat and Mass Transfer Lab	CO1 Conduct experiments on conduction, convection and radiation of heat; collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures CO2 Determine thermal properties and performance of heat exchanger, vapour compression refrigerator and air conditioner
	Internal Combustion Engine	CO1-Explain the working principle, performance parameters and testing of IC Engine. CO2-Understand the combustion phenomena in SI and CI engines and factors influencing combustion chamber design. CO3-Understand the essential systems of IC engine and latest trends and developments in IC Engines. CO4-Understand the effect of engine emissions on environment and human health and methods of reducing it. CO5-Apply the concepts of thermodynamics to air standard cycle in IC Engines CO6-Analyze the effect of various operating parameters on IC engine performance.

	MANUFACTURING SCIENCE II	CO1-Student will be able to choose machining processing to manufacture any component CO2-Student will be able to Estimate machining time for milling and drilling process. CO3-Student will be able to understand finishing processes CO4-Student will be able to calculate forces during orthogo0l metal cutting. CO5-Student will be able to explain principle and applications of advanced machining processes
	MACHINE DESIGN I	CO1- Recall the basic concepts of Solid Mechanics to understand the subject. CO2- Classify various machine elements based on their functions and applications CO3- Apply the principles of solid mechanics to machine elements subjected to staticand fluctuating loads. CO4- Design the machine elements to meet the required specification.
	MANAGERIAL ECONOMICS	CO1-Apply the knowledge of the mechanics of supply and demand to explain working of markets CO2-Describe how changes in demand and supply affect markets Understand the choices made by a rational consumer CO3-Explain relationships between production and costs CO4-Define key characteristics and consequences of different forms of markets

	MACHINE DESIGN LAB	CO1-Creation of part drawings and 3D models using CAD techniques. CO2-Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.
	Manufacturing Technology II LAB	CO1- Understand the casting process CO2- Perform different types of welding processes-gas welding,arc welding ,spot welding
VII SEMESTER	OPERATION RESEARCH	CO1-Formulate and solve problems as networks and graphs. CO2-Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems. CO3-Solve the problems using special solution algorithms.
	COMPUTER AIDED DESIGN	CO1-Creation of part drawings and 3D models using CAD techniques. CO2- Generation of part programs for industrial components using CAM techniques.
	COMPUTER AIDED MANUFACTURING	CO1-Skills to program and operate CNC machines. CO2- Ability to develop a product from conceptualization to reality.
	MECHANICAL SYSTEM DESIGN	CO1-Students will understand how to prepare a needs-assessment for a given project 2. Students will learn how to define a deliverable and make a budget for a project 3. Students will learn successful group interaction for a project

	AUTOMOBILE ENGINEERING	CO1-Know the different types of automobiles, basic structure of automobile CO2-Understand the basic engine system working CO3-Understand the transmission of power in automobile. CO4-Familiarise with fuel supply to automobile and understand the cooling system CO5-Explain the steering and braking system employed in automobiles CO6-Explain the different suspension system of an automobile and selection of tyre for an automobile CO7-Explain the Electrical and ignition system employed in Automobile
	AUTOMOBILE ENGINEERING LAB	CO1- Understand the Construction, working and other details about Internal Combustion Engines used in automobiles CO2- Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems
	CAD/CAM LAB	CO1-To study design of machine components CO2- Understanding and use of 3-D Modelling Software CO3- To study the characteristic features of CNC machine.
	INDUSTRIAL TRAINING	CO1-Student is able to understand management of manufacturing CO2-Student is able to apply work improvement techniques in an organization where he undergoes for in-plant training. CO3-Student is able to find out and reduce work content of the job.
	PROJECT	CO1-Identify, visualize, formulate and solve engineering problems in the field of mechanical Engineering. CO2-Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for societal, and environmental constraints. CO3-Apply their fundamental field skills towards the understanding of the impact of engineering solutions on the society in a global and social context.

IV SEMESTER	NANO SCIENCE	CO1-Explain the fundamental principles of nanotechnology and their application to engineering. CO2-Apply engineering and physics concepts to the nano-scale and non-continuum domain. CO3-Identify and compare state-of-the-art nanofabrication methods and perform a critical analysis of the research literature. CO4-Design processing conditions to engineer functional nanomaterials
	APPLIED THERMODYNAMICS	C01-After completing this course, the students will get a good understanding of various practicalpower cycles and heat pump cycles. CO2-They will be able to analyze energy conversion in various thermal devices such as combustors,air coolers, nozzles, diffusers, steam turbines and reciprocating compressors. CO3-They will be able to understand phenomena occurring in high speed compressible flows.
	MANUFACTURING PROCESS I	CO1-Upon completion of This course, students will be able to understand the different conventionaland unconventional manufacturing methods employed for making different products
	MANUFACTURING PROCESS LAB	CO1-The studend will practice different manufacturing processes i.e drilling,millng,shaping,turning CO2- learn to work on lathe machine
	UNIVERSAL HUMAN VALUE	CO1-The students become sensitive towards human values. CO2-They understand commitment and responsibility. CO3-They gain the ability to bring harmony to the society they live.

	MATHS	CO1-The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.
	MEASUREMENT AND METALLURGY	CO1 - Understand the methods of measurement and selection of measuring instruments ,standards of measurement CO2 - Identify and apply various measuring instruments CO3 - Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design CO4 - Recommend the Quality Control Techniques and Statistical Tools appropriately CO5 - Analyze the Data collected CO6 - Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality improvement
	MACHINE DRAWING LAB	CO1-Upon completion of this course, the students can use computer and CAD software formodelling mechanical components

VI SEMESTER	Refregeration and Air-conditioning	CO1 - Illustrate the fundamental principles and applications of refrigeration and air conditioning system CO2 - Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems CO3 - Present the properties, applications and environmental issues of different refrigerants CO4 - Calculate cooling load for air conditioning systems used for various CO5 - Operate and analyze the refrigeration and air conditioning systems.

	Machine Design II	CO1-Classify various machine elements based on their functions and applications. CO2-Apply the principles of solid mechanics to machine elements subjected to staticand fluctuating loads. CO3-Analyze forces, bending moments, twisting moments and failure causes in variousmachine elements to be designed. CO4-Design the machine elements to meet the required specification.
	Theory Of Machine II	CO1-Determine the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism, CO2-Apply the fundamental principles of statics and dynamics to machinery, CO3- Understand and avoid/suppress certain common dynamical problems a machine may undergo, CO4- Understand the fundamentals of machine design for desired kinematic or dynamic performance. CO5-Understand the fundamentals of mechanical vibrations.
	THEORY OF MACHINE LAB	CO1- Perform the experiments to Understand the fundamentals of machine design for desired kinematic or dynamic performance. CO5-Understand the fundamentals of mechanical vibrations.

	INDUSTRIAL MANAGMENT	CO1: Understand the concepts related to Business. CO2: Demonstrate the roles, skills and functions of management. CO3: Analyze effective application of PPM knowledge to diagnose and solve organizational problems and develop optimal managerial decisions. CO4: Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.
	MECHATRONICS	CO1 - Identification of key elements of mechatronics system and its representation in terms of block diagram CO2 - Understanding the concept of signal processing CO3 - Interfacing of Sensors, Actuators
	FLUID MACHINERY	CO1-Student will be able to understand the working of different types of turbine CO2- Student will be able to understand the working of different types of pump
	FLUID MACHINERY LAB	CO1-Student will perform experiments tounderstand the working of different types of turbine CO2- Student will perform experiments tounderstand the working of different types of turbine

VIII SEMESTER	PLANT LAYOUT AND MATERIAL HANDLING	CO1- Students will be able to use appropriate tools to generate and evaluate layout alternatives during the facilities planning process. CO2- Students will be able to solve facility location problems using relevant techniques. CO3- Students will be able to design and analyze material handling systems. CO4- The students will be able to understand how changes in one facilities planning and material handling system impact the integrated production system
	NON CONVENTIONAL ENERGY RESOURCES	Co1-Understand of renewable and non-renewable sources of energy CO2-Gain knowledge about working principle of various solar energy systems CO3- Understand the application of wind energy and wind energy conversion system. CO4- Develop capability to do basic design of bio gas plant. CO5-Understand the applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc.
	QUALITY CONTROL	CO1. To realize the importance of significance of quality CO2. Manage quality improvement teams CO3. Identify requirements of quality improvement programs
	SEMINAR	CO1-Students will be able to show competence in identifying relevant information, defining and explaining topics under discussion. CO2-They will demonstrate depth of understanding, use primary and secondary sources; they will demonstrate complexity, insight, cogency, independent thought, relevance, and persuasiveness. CO3-They will be able to evaluate information and use and apply relevant theories. CO4-Students will be able to show competence in working with a methodology, structuring their oral work, and synthesizing information.
	PROJECT	CO1-Identify, visualize, formulate and solve engineering problems in the field of mechanical Engineering. CO2-Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for societal, and environmental constraints. CO3-Apply their fundamental field skills towards the understanding of the impact of engineering solutions on the society in a global and social context

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : 1st SEMESTER YEAR -: 2018-19

Branch: - ME

S. No.	Subject Name	Subject Code	PERIODS			EVALUATION SCHEME				END SEMESTER		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
3 WEEKS COMPULSORY INDUCTION PROGRAM													
1.	Mathematics – I	BT – 105	3	1	0	30	20	50	-	100	-	150	4
2.	Physics / Chemistry	BT – 104/ BT - 103	3	1	0	30	20	50	-	100	-	150	4
3.	Basic Electrical Engineering / Programming for Problem Solving	BT – 101/ BT – 102	3	1	0	30	20	50	-	100	-	150	4
4.	Physics / Chemistry	BT – 154/ BT – 153	0	0	3	-	-	-	25	-	25	50	1.5
5.	Basic Electrical Engineering / Programming for Problem Solving	BT – 151/ BT – 152	0	0	2	-	-	-	25	-	25	50	1
6.	Engineering Graphics & Design / Workshop Practices	BT – 155/ BT – 156	1	0	4	-	-	-	25	-	25	50	3
	(For B. Tech. Hons. Degree)*												0
	Total											**600**	**17.5**

Grand Total of Theory & Practical = 600

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : 2nd SEMESTER YEAR -: 2018-19

Branch: -ME

S. No.	Subject Name	Subject Code	PERIODS			EVALUATION SCHEME				END SEMESTER		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
3 WEEKS COMPULSORY INDUCTION PROGRAM													
1.	Mathematics – II	BT – 205	3	1	0	30	20	50	-	100	-	150	4
2.	Physics / Chemistry	BT – 204/ BT - 203	3	1	0	30	20	50	-	100	-	150	4
3.	Basic Electrical Engineering / Programming for Problem Solving	BT – 201/ BT – 202	3	1	0	30	20	50	-	100	-	150	4
4.	Professional English	BT – 206	2	0	2	30	20	50	-	100	-	150	3
5.	Physics / Chemistry	BT – 254/ BT – 253	0	0	3	-	-	-	25	-	25	50	1.5
6.	Basic Electrical Engineering / Programming for Problem Solving	BT – 251/ BT – 252	0	0	2	-	-	-	25	-	25	50	1
7.	Engineering Graphics & Design / Workshop Practices	BT – 255/ BT – 256	1	0	4	-	-	-	25	-	25	50	3
	(For B. Tech. Hons. Degree)*												0
	Total											**750**	**20.5**
Mini Project or Internship(3-4 weeks) shall be conducted during summer break after II semester and will be assessed during III Semester													

Grand Total of Theory & Practical = 750

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : 3rd SEMESTER YEAR -: 2018-19

Branch: - Mechanical Engineering

S. No.	Subject Name	Subject Code	L – T - P	ESE Marks	Sessional		Total	Credit
					CT	TA		

1.	Fluid Mechanics	BT – 311	3-0-0	70	20	10	100	3
2.	Material Science	BT – 312	3-0-0	70	20	10	100	3
3.	Mechanics of Solids	BT – 313	3-0-0	70	20	10	100	3
4.	Thermodynamics	BT – 314	3-1-0	70	20	10	100	4
5.	Science Based Open Elective/ Mathematics – III	BT – / BT – 305	3-1-0	70	20	10	100	4
6.	Universal Human Values & Professional Ethics / Environment & Ecology	BT – 326 / BT – 322	3-0-0	70	20	10	100	3
7.	Fluid Mechanics Lab	BT – 361	0-0-2	50	30	20	100	1
8.	Material Science & Testing Lab	BT – 362	0-0-2	50	30	20	100	1
9.	Computer Aided Machine Drawing – I Lab	BT – 363	0-0-2	50	30	20	100	1
10.	Thermodynamics Lab	BT – 364	0-0-2	50	30	20	100	1
11.	Elements of Mechanical Engineering*	BT – 106*	3-1-0	70	20	10	100*	-
12.	Computer Aided Engineering Graphics*	BT – 158*	0-0-3	50	30	20	100*	-
	Total						**1000**	**24**

CT : Class Test **TA** : Teacher Assessment **L/T/P** : Lecture / Tutorial / Practical

***Science Based Open Electives:**

1. Neno Science - BT – 325
2. Polymer Science & Technology - BT – 321

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : 4th SEMESTER YEAR -: 2018-19

Branch: - Mechanical Engineering

S. No.	Subject Name	Subject Code	L – T - P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	Electrical Machines & Controls	BT – 411	3-0-0	70	20	10	100	3
2.	Measurement and Metrology	BT – 412	3-0-0	70	20	10	100	3
3.	Manufacturing Science & Technology – I	BT – 413	3-0-0	70	20	10	100	3
4.	Applied Thermodynamics	BT – 414	3-1-0	70	20	10	100	4
5.	Science Based Open Elective/ Mathematics – III	BT – / BT – 405	3-1-0	70	20	10	100	4
6.	Universal Human Values & Professional Ethics / Environment & Ecology	BT – 426 / BT – 422	3-0-0	70	20	10	100	3
7.	Electrical Machines & Controls Lab	BT – 461	0-0-2	50	30	20	100	1
8.	Measurement and Metrology Lab	BT – 462	0-0-2	50	30	20	100	1
9.	Manufacturing Science & Technology - I Lab	BT – 463	0-0-2	50	30	20	100	1
10.	Computer Aided Machine Drawing - II Lab	BT – 464	0-0-2	50	30	20	100	1
11.	Elements of Mechanical Engineering*	BT – 206*	3-1-0	70	20	10	100*	-
12.	Computer Aided Engineering Graphics*	BT – 258*	0-0-3	50	30	20	100*	-
	Total						**1000**	**24**

CT : Class Test **TA** : Teacher Assessment **L/T/P** : Lecture / Tutorial / Practical

***B. Tech IInd year lateral entry students belonging to B. Sc. Stream, shall clear the subjects BT-158/BT-258 and BT-106/BT-206 of the first year Engineering Programme along with the second year subjects.**

NOTE: Practical summer training – 1 of 4-weeks after IV semester or Minor fabrication project will be evaluated in VII semester.

***Science Based Open Electives:**

1. Neno Science - BT – 425
2. Polymer Science & Technology - BT – 421

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : Vth SEMESTER **YEAR -: 2018-19**

Branch: - Mechanical Engineering

S. No.	Subject Name	Subject Code No.	L – T - P	Theory/ Lab Marks ESE	Sessional CT	Total TA	Credit	
1.	Managerial Economics	BT – 501	3--0--0	70	20	10	100	3
2.	Machine Design – I	BT – 517	3--0--0	70	20	10	100	4
3.	Manufacturing Science & Technology – II	BT – 518	3--0--0	70	20	10	100	3
4.	Heat & Mass Transfer	BT – 519	3--1--0	70	20	10	100	4
5.	I. C. Engines & Compressors	BT – 520	3--1--0	70	20	10	100	4
6.	Sociology/ Cyber Security	BT – 506/ BT – 515	3--0--0	70	20	10	100	3
7.	Design and Simulation Lab I	BT – 567	0--0--2	50	-	50	100	1
8.	Manufacturing Technology - II Lab	BT – 568	0--0--2	50	-	50	100	1
9.	Heat & Mass Transfer Lab	BT – 569	0--0--2	50	-	50	100	1
10.	Seminar – I	BT – 570	0--0--2	50	-	50	100	1
				620	120	260	1000	24

Grand Total of Theory & Practical = 1000

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : 6th SEMESTER YEAR -: 2018-19

Branch: - Mechanical Engineering

S. No.	Subject Name	Subject Code	L – T - P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	Industrial Management	BT – 601(N)	3-0-0	70	20	10	100	3
2.	Fluid Machinery	BT – 616(N)	3-0-0	70	20	10	100	3
3.	**Departmental Elective – II** Refrigeration & Air-conditioning	BT – 617(N)	3-1-0	70	20	10	100	4
4.	Theory of Machines	BT – 618(N)	3-1-0	70	20	10	100	4
5.	Machine Design – II	BT – 619(N)	3-0-0	70	20	10	100	3
6.	Sociology / Cyber Security	BT – 606(N) / BT – 615 (N)	3-0-0	70	20	10	100	3
7.	Fluid Machinery Lab	BT – 666(N)	0-0-2	50	-	50	100	1
8.	Theory of Machines Lab	BT – 668(N)	0-0-2	50	-	50	100	1
9.	Design and Simulation Lab II	BT – 669(N)	0-0-2	50	-	50	100	1
10.	Refrigeration & Air-conditioning Lab	BT – 667(N)	0-0-2	50	-	50	100	1
	Total						**1000**	**24**

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : VIIth SEMESTER YEAR -: 2018-19

Branch: - Mechanical Engineering

S. No.	Subject	Code No.	Theory			Code No.	Practical		
		Theory	Max. Marks	External	Internal	Practical	Max. Marks	External	Internal
1.	Operation Research	BT – 701	150	100	50	-	-	-	-
2.	Computer Aided Manufacturing	BT – 721	150	100	50	-	-	-	-
3.	Mechanical System Design	BT – 722	150	100	50	-	-	-	-
4.	CAD	BT – 723	150	100	50	-	-	-	-
5.	Automobile Engineering	BT – 724	150	100	50	-	-	-	-
6.	CAD/CAM Lab	-	-	-	-	BT – 773	50	30	20
7.	I. C. Engine And Automobile Lab	-	-	-	-	BT – 771	50	30	20
8.	Industrial Training	-	-	-	-	BT – 772	50	-	50
9.	Project	-	-	-	-	BT – 774	50	-	50
10.	General Proficiency	-	-	-	-	GP	50	-	50

Grand Total of Theory & Practical = 1000

Examination Co-ordinator

TEACHING SCHEME AND EXAMINATIONS MARKS FOR : VIIIth SEMESTER **YEAR -: 2018-19**

Branch: - Mechanical Engineering

S. No.	Subject	Code No.	Theory			Code No.	Practical		
		Theory	Max. Marks	External	Internal	Practical	Max. Marks	External	Internal
1.	Non-Conventional Energy Resources **Open Elective – II ****	BT – 801	150	100	50	-	-	-	-
2.	Advance Welding Technology **Departmental Elective – V**	BT – 821	150	100	50	-	-	-	-
3.	Plant Layout and Material Handling **Departmental Elective – VI**	BT – 822	150	100	50	-	-	-	-
4.	Quality Control	BT – 824	150	100	50	-	-	-	-
5.	Seminar	-	-	-	-	BT – 871	50	-	50
6.	Project	-	-	-	-	BT – 872	300	200	100
7.	General Proficiency	-	-	-	-	GP	50	-	50

Grand Total of Theory & Practical = 1000

Examination Co-ordinator

Engineering Mathematics - I

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Unit - 1: Differential Calculus – I

Successive Differentiation, Leibnitz's theorem, Limit , Continuity and Differentiability of functions of several variables, Partial

derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 2: Differential Calculus - II

Taylor's and Maclaurin's Theorem, Expansion of function of several variables, Jacobian, Approximation of errors, Extrema of functions of several variables, Lagrange's method ofmultipliers (Simple applications).

Unit - 3: Matrix Algebra

Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex and Unitary Matrices and its properties

Unit - 4: Multiple Integrals

Double and triple integrals, Change of order of integration, Change of variables, Application ofintegration to lengths, Surface areas and Volumes – Cartesian and Polar coordinates. Beta and Gamma functions, Dirichlet's integral and its applications.

Unit - 5: Vector Calculus

Point function, Gradient, Divergence and Curl of a vector and their physical interpretations, Vector identities, Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals, Applications of Green's, Stoke's and Gauss divergence theorems (without proof).

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics,John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill PublishingCompany Ltd.
3. R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa PublishingHouse.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmangadachari, Engineering Mathematics – I, Pearson Education.

A.C.Srivastava & P.K.Srivastava, Engineering Mathematics, Vol.I, PHI Learning Pvt. Limited, New Delh

ENGINEERING PHYSICS-I

Unit – I: Relativistic Mechanics **08 Hrs.** Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Einstein's postulates, Lorentz transformation equations, Length contraction & Time dilation, Relativistic addition of velocities; Variation of mass with velocity, Mass energy equivalence, Concept of rest mass of photon.

Unit – II: Modern Physics **10 Hrs.**

Black body radiation spectrum, Weins law and Rayleigh-Jeans law, Assumption of quantum theory of radiation, Planck's law. Wave-particle duality, de-Broglie matter waves, Bohr's quantization rule, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger's wave equation (Time dependent and time independent) – particle in one dimensional potential box, Eigen values and Eigen function.

Unit – III: Wave Optics **10 Hrs.**

Interference: Coherent sources, Interference in thin films (parallel and wedge shaped film), Newton's rings and its applications..
Diffraction: Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

Unit – IV: Polarization and Laser **08 Hrs. Polarization**: Phenomena of double refraction, Nicol prism, Production and analysis of plane,circular and elliptical polarized light, Retardation Plate, Optical Activity, Fresnel's theory,Specific rotation.

Laser: Spontaneous and stimulated emission of radiation, population inversion, Einstein's Coefficients, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers and laser applications.

Unit – V: Fiber Optics and Holography **06 Hrs.Fiber Optics:** Fundamental ideas about optical fiber, Propagation mechanism, Acceptanceangle and cone, Numerical aperture, Single and Multi Mode Fibers,

Dispersion and Attenuation. **Holography:** Basic Principle of Holography, Construction and reconstruction of Image onhologram and applications of holography.

Reference Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wielly)
3. Optics –Ajoy Ghatak (Tata McGraw Hill Education Private Ltd. New Delhi)
4. Optics - Brijlal & Subramanian (S. Chand)
5. Engineering Physics- C. Mani Naidu(Pearson)
6. Lasers Principles, Types and Applications- K R Nambiar (New Age)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New

ENGINEERING PHYSICS LAB

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List of Experiments

Any ten experiments, at least four from each group.

Group -A

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position ofcardinalpoints.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To study the polarization of light by simple reflection using laser.
7. Measurement of Wavelength of a laser (He- Ne) light using single slit diffraction.

Group – B

8. To determine the specific resistance of a given wire using Carey Foster's bridge.
9. To study the variation of magnetic field along the axis of current carrying - Circular coil andthen to estimate the radius of the coil.
10. To verify Stefan's Law by electrical method.
11. To calibrate the given ammeter and voltmeter by potentiometer.
12. To study the Hall effect and determine Hall coefficient, carrier density and - mobility of agiven semiconductor using Hall effect set up.
13. To determine the energy band gap of a given semiconductor material.
14 To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
15. To draw hysteresis curve of a given sample of ferromagnetic material and from - this todetermine magnetic susceptibility and permeability of the given specimen.
16. To determine the ballistic constant of a ballistic galvanometer.
17. To determine the coefficient of viscosity of a liquid.
18. Measurement of fiber attenuation and aperture of fiber.
19. High resistance by leakage method.
20. Magnetic Susceptibility of paramagnetic solution.

ENGINEERING CHEMISTRY

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Unit	Content	Hours
Unit-1	Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications	**8**
Unit-2	Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradablepolymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Grignard Reagent) and their applications in polymerization.	**8**
Unit-3	Electrochemistry: Galvanic cell, electrode potential, Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants-Classification, mechanism and applications..	**8**
Unit-4	Hardness of water. Disadvantage of hard water. Boiler troubles, Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin, Reverse osmosis. Phase Rule and its application to water system.	**8**
Unit-5	Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter & Dulong's method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H^1NMR spectral Techniques.	**8**

Textbook

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill

3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India
5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education
11. Atkins' Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press

ENGINEERING CHEMISTRY PRACTICALS

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA ..
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in water sample.
5. Determination of iron content in the given solution by Mohr's method.
6. pH- metric titration.
7. Viscosity of an addition polymer like polyester by viscometer.
8. Determination of iron concentration in sample of water by colorimetric method. The methodinvolves the use of KCN as a chelating agent and the measurements are carried out at 480nm.
9. Element detection and functional group identification in organic compounds.
10. Preparation of Bakelite and Urea formaldehyde resin.

Note: Institute can replace two experiments from the aforesaid experiments as per

BASIC ELECTRONICS

Unit	Topics	Lectures
I	PN junction diode**: Introduction of Semiconductor Materials** Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Zener Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series , Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits Special Purpose two terminal Devices **:**Light-Emitting Diodes, Varactor (Varicap) Diodes, Tunnel Diodes, Liquid-Crystal Displays.	12
II	Bipolar Junction Transistors and Field Effect Transistor: Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration.Collector Feedback, Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (r_e Model). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic,	10
III	Operational Amplifiers : Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits, Practical Op-Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator). **OPAMP Parameters: Input offset voltage, Output offset voltage, Input biased current, Input offset current** Differential and Common-Mode Operation	6
IV	Electronic Instrumentation and Measurements: Digital Voltmeter : Introduction, RAMP Techniques Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, CRT , Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, **Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.**	6

V	Fundamentals of Communication Engineering: Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, **Introduction of various analog modulation techniques**, Fundamentals of amplitude modulation, Modulation and Demodulation Techniques of AM.	6

Text Books:

1. Robert L. Boylestand / Louis Nashelsky *"Electronic Devices and Circuit Theory*", LatestEdition, Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication,.
3. George Kennedy, "Electronic Communication Systems", Latest Edition, TMH,

Reference Books:

1. David A. Bell, "*Electronic Devices and Circuits",* Latest Edition, Oxford UniversityPress.
2. Jacob Millman, C.C. Halkias, Staya brataJit, "*Electronic Devices and Circuits*", LatestEdition , TMH.
3. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, OxfordUniversity Press India.

UNIT-I:

Force System: Force, Parallelogram Law, Lami's theorem, Principle of Transmissibility of forces. Moment of a force, Couple, Varignon's theorem, Resolution of a force into a force and a couple. Resultant of coplanar force system. Equilibrium of coplanar force system, Free body diagrams, Determination of reactions.
Concept of Centre of Gravity and Centroidand Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem

9

UNIT-II:

Plane Truss: Perfect and imperfect truss, Assumptions and Analysis of Plane Truss by Method of joints and Method of section.
Beams: Types of beams, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear andbending moment.

8

UNIT-III:

Simple stress and strain: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials, Elasticconstants, Strain energy.
Bending (Flexural) Stresses: theory of pure bending, neutral surface and neutral axis, stresses in beams of different cross sections.

Engineering Materials: Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

8

UNI-IV:

Basic Concepts and Definitions of Thermodynamics: Introduction and definition of thermodynamics, Microscopic and Macroscopic approaches, System, surrounding and universe, Concept of continuum, Thermodynamic equilibrium, Thermodynamic properties, path, process and cycle, Quasi static process, Energy and its forms, Work and heat. Thermodynamic definition of work.
Zeroth law of thermodynamics: Temperature and its' measurement.

First law of thermodynamics: First law of thermodynamics, Internal energy and enthalpy. First law analysis for non-flow processes. Non-flow work Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process, Pumps etc.

8

UNIT-V:

Second law: Thermal reservoir, Kelvin Planck statement, Heat engines, Efficiency; Clausius' statement Heat pump, refrigerator, Coefficient of Performance. Carnot cycle, Carnot theorem and it's corollaries.Clausius inequality, Concept of Entropy.
Properties of pure substances: P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

Internal Combustion Engines: Classification of I.C. Engines and their parts, working principle and comparison between 2 Stroke and 4 stroke engine , difference between SI and CI engines. P-v and T-s diagramsof Otto and Diesel cycles, comparison of efficiency.

Books & References:

1. Engineering Mechanics: Statics by J.L Meriam , Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Thimoshenko& Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Engineering Thermodynamics by P.K.Nag, McGraw Hill
6. Thermodynamics An Engineering Approach by Cengel& Boles, McGraw Hill
7. Engineering Thermodynamics by P. Chattopadhyay, OXFORD Publication
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. An Introduction to Mechanical Engineering by Wickert& Lewis, Cengage Learning
10. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
11. Engineering Mechanics by R K Bansal, Laxmi Publications
12. Fundamentals of Mechanical Engineering by Sawhney, PHI
13. Basic Mechanical Engineering by Pravin Kumar, Pearson
14. Basic Mechanical Engineering by Agrawal&Agrawal, Wiley
15. Elements of Mechanical Engineering by Singh, Anne Books Pvt Ltd
16. Elements of Workshop Technology by Hajra Choudhary Media Promoter

ELEMENTS OF MECHANICAL ENGINEERING LAB LTP: 0-0-0-2

Note: Any 10 experiments (Minimum of 3 from each module) are to be conductedModule 1:

1. To conduct the tensile test and determine the ultimate tensile strength, percentageelongation for a mild steel specimen.
2. To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find theImpact Strength of the specimen.
3. To determine the hardness of the given specimen using Vicker/Brinell/Rockwellhardness testing machine.
4. To conduct experiment on Torsion of Rod/wire.

Module 2:

1. To Study the working of 2 stroke Diesel/Petrol engine.
2. To Study and working of 4 stroke Petrol/Diesel engine.
3. To Study the model of Babcock and Wilcox and Lancashire boiler.
4. To Study various types of Mounting and Accessories of Boilers.

Module 3:

1. To verify the parallelogram, and Triangle law.
2. To verify the polygon law of force.
3. To determine the coefficient of friction on inclined surface.
4. To determine the efficiency and Mechanical Advantage of Worm & Worm-wheel.
5. To conduct experiment on Force Analysis on simple truss and Jib-crane Apparatus.
6. To conduce friction experiment on screw-jack.

BASIC ELECTRICAL ENGINEERING

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DETAILED SYLLABUS

Unit-I : Electrical Circuit Analysis:

Introduction, Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation,

AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltageand current.

Unit-II: Steady- State Analysis of Single Phase AC Circuits:

Analysis of series and parallel RLCCircuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

Network theorems (AC & DC with independent sources): Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems)

Unit-III : Three Phase AC Circuits:

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers)

Unit-IV: Magnetic Circuit: Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

Single Phase Transformer: Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit-V: Electrical Machines:

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text Books:

1 .“Basic Electrical Engineering”, S N Singh; Prentice Hall International

2. “Basic Electrical Engineering”, Kuldeep Sahay, New Age International Publishers3.“Fundamentals of Electrical Engineering”,

B Dwivedi, A Tripathi; Wiley India 4.“Principles of Electrical Engineering”, V. Del Toro,; Prentice Hall International

5. “Electrical Engineering”, J. B. Gupta, Kataria and Sons

Reference Books:

1.“Electrical and Electronics Technology”, Edward Hughes; Pearson 2.“Engineering Circuit Analysis”, W.H.

Hayt& J.E. Kimerly; Mc Graw Hill3.“Basic Electrical Engineering”, C L Wadhwa; New Age International

4.“Basic Electrical Engineering”, T.K. Nagsarkar,M.S. Shukhija; Oxford University Press

ELECTRICAL ENGINEERING LABORATORY

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LIST OF EXPERIMENTS

Note: A minimum of ten experiments from the following should be performed

1. Verification of Kirchhoff's laws
2. Verification of Superposition theorem
3. Verfication of Thevenin's Theorem and Maximum Power Transfer Theorem.
4. Measurement of power and power factor in a single phase ac series inductive circuit and studyimprovement of power factor using capacitor
5. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
6. Connection and measurement of power consumption of a fluorescent lamp (tube light).
7. Measurement of power in 3- phase circuit by two wattmeter method and determination of itspower factor for star as well as delta connected load.
8. Determination of parameters of ac single phase series RLC circuit
9. To observe the B-H loop of a ferromagnetic material in CRO.
10. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a singlephase transformer
11. Determination of efficiency of a dc shunt motor by load test
12. To study running and speed reversal of a three phase induction motor and record speed inboth directions.

Computer System and Programming in C

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Unit1: (10 Lectures)

Basics of Computer: Introduction to digital computer, basic operations of computer, functionalcomponents of computer, Classification of computers.

Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function,services and types.

Number system: Binary, octal and hexadecimal number systems, their mutual conversions,Binary arithmetic.

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts, Types of computer languages:- Machine Language, Assembly Language and High LevelLanguage, Concept of Assembler, Compiler, Loader and Linker.

Unit2: (8 Lectures)

Standard I/O in "C", **Fundamental data types-** Character type, integer, short, long, unsigned,single and double floating point, Storage classes- automatic, register, static and external, Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.

Fundamentals of C programming: Structure of C program, writing and executing the first Cprogram, Components of C language. Standard I/O in C.

Unit3: (10 Lectures)

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops,multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing values to functions,recursive functions.

Unit 4: (6 Lectures)

Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays.Structure, union, enumerated data types

Unit 5: (8 Lectures)

Pointers: Introduction, declaration, applications File handling, standard C preprocessors,defining and calling macros, conditional compilation, passing values to the compiler.

Reference:

1. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .

2. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited –2015.
3. Programming in C by Kochan Stephen G. Pearson Education – 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication .

5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, PearsonAddison-Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

Computer Programming Lab

1.WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtainedbythe student.
2.WAP that calculates the Simple Interest and Compound Interest. The Principal , Amount, RateofInterest and Time are entered through the keyboard.
3.WAP to calculate the area and circumference of a circle.
4.WAP that accepts the temperature in Centigrade and converts into Fahrenheit using theformula C/5=(F-32)/9.
5.WAP that swaps values of two variables using a third variable.
6.WAP that checks whether the two numbers entered by the user are equal or not.7.WAP to find the greatest of three numbers.
8.WAP that finds whether a given number is even or odd. 9.WAP that tells whether a given year is a leap year or not.
10.WAP that accepts marks of five subjects and finds percentage and prints grades according tothe following criteria:
Between 90-100%---------- Print 'A'
80-90%..... Print 'B'
60-80%..... Print 'C'Below 60% Print 'D'
11.WAP that takes two operands and one operator from the user and perform the operation andprints the result by using Switch statement.
12.WAP to print the sum of all numbers up to a given number.13.WAP to find the factorial of a given number.
14.WAP to print sum of even and odd numbers from 1 to N numbers.15.WAP to print the Fibonacci series.
16.WAP to check whether the entered number is prime or not.17.WAP to find the sum of digits of the entered number.
18.WAP to find the reverse of a number.
19.WAP to print Armstrong numbers from 1 to 100.
20.WAP to convert binary number into decimal number and vice versa.
21.WAP that simply takes elements of the array from the user and finds the sum of theseelements.
22.WAP that inputs two arrays and saves sum of corresponding elements of these arrays in athird array and prints them.
23.WAP to find the minimum and maximum element of the array.

24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array inascending order using Bubble Sort technique.26.WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of a mxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.23
29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time : aggregate type TIME Startstation: string End station : string The structure type Time contains two integer members: hourand minute. Maintain a train
timetable and implement the following operations:
(i)List all the trains (sorted according to train number) that depart from a particular section.(ii)List all the trains that depart from a particular station at a particular time.
(iii)List all he trains that depart from a particular station within the next one hour of a given time.(iv)List all the trains between a pair of start station and end station.
30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not. 32.WAP to check whether a given word exists in a file or not. If yes then find the number oftimes it occurs.

Professional Communication

S.No.	Unit	Contents
1	**Unit-1 Fundamentals of Communications**	Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group) : Importanceof technical communication; Barriers to Communication.
2	**Unit-II Written Communication**	Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods-Inductive, Deductive, Spatial , Linear, Chronological etc.
3	**Unit-III Business Communication**	Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.
4	**Unit-IV Presentation Strategies and Soft Skills.**	Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills : Types; Methods for improving Listening Skills.
5	**Unit –V Value- Based Text Readings**	Following essays from the prescribed text book with emphasis onMechanics of writing. **(i)** Humanistic and Scientific Approaches to Human Activity by Moody E. Prior **(ii)** The Language of Literature and Science by A. Huxley **(iii)** Man and Nature by J. Bronowski **(iv)** Science and Survival by Barry Commoner **(v)** The Mother of the Sciences by A.J. Bahm.

6	**Text Book**	1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi. 2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi. 3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.
7	**Reference Books**	1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi. 2. Business Correspondence and Report Writing by Prof. R.C.,Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd. , 2001, New Delhi. 3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub.& Distributors, 2009, Delhi.

		4. Developing Communication skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi. 5. Manual of Practical Communication by L.U.B. Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi. 6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi. 7. Spoken English- A manual of Speech and Phonetics by R.K. Bansal & J.B. Harrison Orient Blackswan, 2013, New Delhi.

PROFESSIONAL COMMUNICATION LABORATORY PRACTICALS

Interactive and Communicative Practical with emphasis on Oral Presentation/SpokenCommunication based on International Phonetic Alphabets (I.P.A)

LIST OF PRACTICALS

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational skills for Interviews under suitable Professional Communication Labconditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis onParalinguistics / Kinesics.
4. Presentation Skills of Technical Paper/Project Reports/Professional Reports based onproper Stress and Intonation Mechanics.
5. Official /Public Speaking based on Rhythmic Patterns.
6. Theme-Pressentation /Key-Note Presentation based on correct argumentationmethodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehensions Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

Reference Books

1. Bansal R.K.& Harrison: Phonetics in English, Orient Longman , New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, NewDelhi.
3. L.U.B. Pandey & R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub.India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

WORKSHOP PRACTICE **L T P:0 0 3**

1. Carpentry Shop:

(a) Study of tools & operations and carpentry joints.
(b) Simple exercise usingjack plane.
(c) To prepare half-lap corner joint, mortise &tennon joints.
(d) Simple exercise onwoodworking lathe.

2. Fitting (Bench Working) Shop:

(a) Study of tools & operations
(b) Simple exercises involving fitting work.
(c) Make perfect malefemalejoint.
(d) Simple exercises involving drilling/tapping/dieing.

3. Black Smithy Shop:

(a) Study of tools & operations
(b) Simple exercises based on black smithyoperations such as upsetting, drawing down,punching, bending, fullering& swaging.

4. Welding Shop:

(a) Study of tools & operations of Gas welding & Arc welding
(b) Simple butt andLap welded joints.
(c) Oxy-acetylene flame cutting.

5. Sheet-metal Shop:

(a) Study of tools & operations.
(b) Making Funnel complete with 'soldering'.
(c) Fabrication of tool-box, tray, electric panel box etc.

6. Machine Shop:

(a) Study of Single point cutting tool, machine tools and operations.
(b) Planeturning.
(c) Step turning
(d) Taper turning.
(e) Threading

7. Foundry Shop:

(a) Study of tools & operations
(b) Pattern making.
(c) Mould making with the use ofa core.
(d) Casting

Computer Aided Engineering Graphics

L T P
0 0 3

Introduction

Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selectionof drawing size and scale. Commands and creation of Lines,Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim,extend, break, chamfer, fillet, curves, constraints.

2 – Sheets Orthographic Projections Introduction, Definitions - Planes of projection, referenceline and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes

2 – Sheets Orthographic Projections of Plane Surfaces (First Angle Projection Only)

Introduction, Definitions–projections of plane surfaces–triangle, square, re

ctangle, rhombus, pentagon, hexagon and circle, planes in different positions by change ofposition method only.

1 – Sheet Projections of Solids (First Angle Projection Only) Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders andcones in different positions.

2-Sheets Sections And Development of Lateral Surfaces of Solids Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of rightregular prisms, pyramids, cylinders and cones resting with base on HP.

1 – Sheet Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms

, pyramids, cylinders, cones, spheres, cut spheres.1-Sheet

Text Books

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar PublishingHouse, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International PublishingHouse Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.

Reference Books

1. Engineering Graphics - K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.
2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphicsfor Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
Engineering Drawing – M.B. Shah, B.C.Rana, 2nd Edition,2

Engineering Mathematics - II

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Unit - 1: Ordinary Differential Equations

Linear differential equations of n^{th} order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second orderdifferential equations by changing dependent & independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions

Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform ofperiodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations

Periodic functions, Dirichlet's Conditions, Fourier series of arbitrary periods, Euler's Formulae,Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.

Solution of first order Lagrange's linear partial differential equations, Second order linear partialdifferential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations

Classification of second order partial differential equations, Method of separation of variables forsolving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill PublishingCompany Ltd.
3. R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa PublishingHouse.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. – II, PHI LearningPvt. Ltd.
5. Rukmangadachari, Engineering Mathematics – II, Pearson Education.

ENGINEERING PHYSICS- II

Unit – I: Crystal Structures and X-ray Diffraction **10Hrs.**

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Co-ordination number, Atomic radius and Packing factor of different cubic structures, Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Compton Effect.

Unit – II: Dielectric and Magnetic Properties of Materials **10Hrs.**

Dielectric Properties: Dielectric constant and Polarization of dielectric materials, Relationbetween E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One- Dimensional), Claussius-Mossotti equation, Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.
Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material, Phenomena of hysteresis and its applications.

Unit – III: Electromagnetic Theory **06 Hrs.**

Equation of continuity, Maxwell's Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

Unit – IV: Band Theory of Solids **06 Hrs.**

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory, Density of states, Fermi-Dirac distribution, Concept of effective mass, Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy, Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

Unit – V: Physics of some technologically important Materials **08Hrs.**

Superconductors: Temperature dependence of resistivity in superconducting materials, Effectof magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors.
Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes, Properties and Applications of nanotubes.

Reference books:

1. Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)

3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International)

5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

ME-III SEM Session: 2018-19

MATERIAL SCIENCE

UNIT I

Introduction: Importance of materials, historical perspective, Future aspects of engg. materials.

Crystal Structure: brief on BCC, FCC and HCP Structures, coordination number and atomic packing factors. Bravais lattices, Miller indices, crystal imperfections-point line and surface imperfections. Atomic Diffusion: Phenomenon, Ficks laws of diffusion, factors affectingdiffusion.

Ferrous and non- ferrous materials: Properties, Composition and uses of Grey cast iron, malleable iron, SG iron and steel, copper alloys-brasses and bronzes, Aluminium alloys. Introduction to BIS & ASTM codes and practice on material and testing.

UNIT II

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour ofmaterials, mechanical properties in plastic range, yield strength off set yield strength, ductility, ultimate tensile strength, toughness, Plastic deformation of single crystal by slip and twinning, Hardness Tests.

Fracture Creep Fatigue: Fracture: Type I, Type II and Type III. Creep: Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation. Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

UNIT III

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures. Phase Diagram I: Solid solutions Hume Rothary rule, substitutional and interstitial solid solutions, intermediate phases, Gibbs phase rule.

Phase Diagram: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

UNIT IV

Heat Treating of Metals: TTT curves, continuous cooling curves, annealing and its types. Normalizing, hardening, tempering, mastempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

Comparative study of microstructure of various Ferrous, nonferrous metals and alloys.

UNIT V

Composite materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP's and MMC's advantages and application of composites.

Ceramics: Structure types and properties and applications of ceramics. Mechanical/ Electricalbehavior and processing of Ceramics.

Plastics: Various types of polymers/ plastics and its applications. Mechanical behaviour and processing of plastics, Future of plastics. Introduction to Smart materials & Nano-materials and their potential applications.

Books and References:

1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adoptedby R. Balasubramaniam), Wiley India Pvt. Ltd

2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Material Science and Engineering by Smith, Hashemi and Prakash, MCGRAWHILL INDIA
4. The Science and Engineering of materials, by Askeland & Balani, Cengage Learning
5. Introduction to Materials Science for Engineers by Shackelford, Pearson
6. Material Science by Narula, MCGRAW HILL INDIA.
7. Materials Science and Engineering - A First Course by Raghavan, PHI
8. Material Science and Engineering Properties by Gilmore, Cengage Learning
9. Material Science for Engineering Students by Fischer, Academic Press
10. Technology of Engineering materials by Philip and Bolton, Butterworth-Heinamann

ME-III SEM Session: 2018-19

THERMODYNAMICS

UNIT I

Review of Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State,Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases. **Zeroth law of thermodynamics:** Concept of Temperature and its' measurement, Temperature scales.

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work, Displacement work for various non flow processes, Joules' experiment, First law analysis for closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer.

UNIT II

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnottheorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.

Entropy : Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

UNIT III

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.

Thermodynamic relations: Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic

and Isothermal compressibility.

UNIT IV

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T, P-V and P-h diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier chart, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Air-water vapour mixture and Psychrometry: Psychometric terms and their definitions, Psychometric chart, Different Psychometric processes and their representation on Psychometric chart.

UNIT V

Refrigeration Cycles: Reversed Carnot Cycle for gas and vapour. Refrigeration capacity,unit of refrigeration.Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle. Vapour compression refrigeration cycle; simple saturated cycle and actual vapour compression refrigeration cycle. Analysis of cycles, effect of superheating, sub-cooling and change in evaporator and condenser pressure on performance of vapour compression refrigeration cycle. Refrigerants; their classification and desirable properties. Vapour absorption refrigeration system.

Books and References:

1. Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA
2. Thermodynamics for Engineers by Kroos & Potter, Cengage Learning
3. Thermodynamics by Shavit and Gutfinger, CRC Press.
4. Thermodynamics- An Engineering Approach by Cengel, MCGRAW HILL INDIA.
5. Basic Engineering Thermodynamics, Joel, Pearson.
6. Fundamentals of Engineering Thermodynamics by Rathakrishnan, PHI.
7. Engineering Thermodynamics by Dhar, Elsevier.
8. Engineering Thermodynamics by Onkar Singh, New Age International.
9. Engineering Thermodynamics by CP Arora.
10. Engineering Thermodynamics by Rogers, Pearson.
11. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, &Bailey, John Wiley.
12. Engineering Thermodynamics by Mishra, Cengage Learning
13. Refrigeration and Air Conditioning by C P Arora, MCGRAW HILL INDIA

ME-III SEM

Session: 2018-19

MECHANICS OF SOLIDS

UNIT I

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses on inclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional stateof stress & strain, equilibrium equations, generalized Hook's law, theories of failure. Thermal Stresses.

UNIT II

Stresses in Beams: Pure Bending**,** normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams

Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thinwalled tubes.

UNIT III

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipments and machines.

UNIT IV

Thin cylinders & spheres: Introduction, difference between thin walled and thick walled pressure vessels, Thin walled spheres and cylinders, hoop and axial stresses and strain,volumetric strain.

Thick cylinders:

Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

UNIT V

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILLINDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Material by Rattan, MCGRAW HILL INDIA
12. Strength of Materials by Basavajaiah and Mahadevappa, University Press.

ME-III SEM Session: 2018-19

MATERIALS SCIENCE AND TESTING LAB

(A). Experiments on Material Science (at least 5 of the following):

1. Preparation of a plastic mould for small metallic specimen.
2. Preparation of specimen for micro structural examination-cutting, grinding,polishing, etching.
3. Determination of grain size for a given specimen.
4. Comparative study of microstructures of different specimens of different materials(mild steel, gray C.I., brass, copper etc.)
5. Experiments on heat treatment such as annealing, normalizing, quenching, casehardening and comparison of hardness before and after heat treatment.
6. Material identification of, say, 50 common items kept in a box.
7. Experiment on Faraday's law of electrolysis.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro & microexamination of the welded specimen.
10. Study of Magnetic/ Electrical/Electronic materials.

(B) Experiments on Material Testing (at least 5 of the following):

1. Strength test of a given mild steel specimen on UTM with full details and stressversus strain plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testingmachines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflectionwith dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector,ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

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THERMODYNAMICS LAB

Minimum 10 experiments out of following;

1. Study of Fire Tube boiler
2. Study of Water Tube boiler
3. Study and working of Two stroke petrol Engine
4. Study and working of Four stroke petrol Engine
5. Determination of Indicated H.P. of I.C. Engine by Morse Test
6. Prepare the heat balance sheet for Diesel Engine test rig
7. Prepare the heat balance sheet for Petrol Engine test rig
8. Study and working of two stroke Diesel Engine
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine
11. Study of Pressure compounded steam turbine
12. Study of Impulse & Reaction turbine
13. Study of steam Engine model.
14. Study of Gas Turbine Model
15. Any other suitable experiment(s) on thermodynamics

ME-III SEM Session: 2018-19

COMPUTER AIDED MACHINE DRAWING-I LAB

Introduction (1 drawing sheets)

Introduction, classification of machine drawings, principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioningtypes, lines and rules of dimensioning.

Orthographic Projections (3 drawing sheets)

Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing line problems, principleof visualization of objects, sectional views, full and half sectional views, auxiliary views.

Fasteners (2 drawing sheets)

Temporary and permanent fasteners, thread nomenclature and forms, thread series,designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints.

Riveted joints (1 drawing sheet)

Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boilerjoints etc.

Assembly drawing (2 drawing sheets)

Introduction to assembly drawing, drawing assembly drawing of simple machine elementslike rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

Free hand sketching (1 drawing sheet**)**

Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.

Computer aided drafting (1 drawing**)**

Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw and modify commands, making 2D drawings of simple machine parts.

Books and References:

1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI
2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age
5. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill
6. Engineering Drawing, Pathak, Wiley
7. Textbook of Machine Drawing, K C John, PHI
8. AutoCAD 2014 for Engineers & Designers, Bhatt, WILEY
9. Engineering Graphics with AutoCAD, Bethune, PHI

ME-III SEM **Session: 2018-19**

Mathematics-III

CO1-The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

UNIT–I: Function of Complex variable: Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int ff(\cos\theta\theta, \sin\theta\theta)dddd\ aaaaaa \int ff(xx)dddd$.

UNIT–II: Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non–linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of significations: Chi-square test, t-test.

UNIT–III: Numerical Techniques–I: Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.

UNIT–IV: Numerical Techniques–II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidel method. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge- Kutta methods.

UNIT–V: [This unit contains two parts. Students have to read only one part of this unit as question paper will contain questions from both the parts with choice.] Numerical Techniques-III: Boundary Value Problem, Finite Difference Method, Eigen Value Problems, Condition Number, Polynomial Method, Power Method, Numerical solution of partial differential equations, Elliptic, parabolic and Hyperbolic equations.

OR

Integral Transforms: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Test Books: 1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.

2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi.

3. JN Kapur, Mathematical Statistics, S. Chand & company Ltd.

4. BS Grewal, Higher Engineering Mathematics, Khanna Publishers.

Reference Books: 1. RK Jain & SRK Iyenger, Advance Engineering Mathematics, Narosa Publication House.

2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.

3. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Limited, New Delhi

4. E. Balagurusamy, Numerical Methods, Tata McGraw-Hill Publishing Company Limited, New Delhi

5. T. Veerajan& T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi.

Syllabus

ENVIRONMENT & ECOLOGY

ME-III SEM Session: 2018-19

UNIT: Oeflnit loo, Soope & Importance, Need For Publk Awarene:ss• Environment definition, Eco system - Balanced ecosystem, Human activities - Food, Shelter, Eco.nomic and social Security. Effects or hum.an activities on

envlronment·Agriculture, Housing, Industry, Mining nd Transportation activities, Bask$ of Environmental

Impact As.sessment. Sustainable Development.

UNIT•II: Natural Resources• Water Resources· Availablhty ond Quality aspects. Water borne diseases, Water Induced diseases, Fluoride problem indrinking water. Mineral Resources, Fore$1 Wealth, Material cyycles-- Carbon, Nitroogen and Sulphur Cydes.Energy - Oifferent types of energy, Elec.tro•ma&netic radiation. Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuet based, Nudear, Solar, Biomass and Bio.gas. H'ydrogen as an alternative future sou rce of Energy.

UNIT-Ill: Environmental Pollutlon and their effects. Water pollution, Land pollution. Noke pollution, Public Health aspec.ts, Air Pollution, SOiid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Efretts, Urbaniution, Automobile pollution.

Acid Rain Ozone Layer depletion, Animal Husbandry,

UNITIV: Environmental Pollutlon and their effects. Water pollution, Land pollution. Noke pollution, Public Health aspec.ts, Air Pollution, SOiid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Efretts, Urbaniution, Automobile pollution. Acid Rain Ozone Layer depletion, Animal Husbandry.

Text Books

1.Environmental Studies -Benny Joseph- Tata McgrawHiU-200S

2.Environme,H-al Studies- Or. D.l. Manjunath, Pearson Education-2006.

3.Envlronmental studies - R, Rajagop-illan -Oxford Pubtioti,on • 200S.

4.Text book of Environmental S<::ience & Techno\ogy- M. Anji Reddy- US Publication .

Reference Books

l.P,iociples ot Environmental SC It-nee and Engineer'l'lg -P. Venugoplan Rao, Pteritlce Hall of India.

2.E nvlron 1\,ental Sc ience and Engi neering **Mecoa kshi,** Prentice Hall In dia

ME-IV SEM **Session: 2018-19**

ELECTRICAL MACHINES & CONTROLS

UNIT I

Single phase Transformer: Efficiency Voltage regulation, O.C.& S.C. Tests. **Three Phase Transformer:** Three phase transformer connections, 3-phase to 2-phase or 6-phase connections and their applications. **Auto Transformer:** Volt- Amp relations, efficiency,advantages & disadvantages, applications. **D.C. Motors:** Concept of starting, speed control, losses and efficiency.

UNIT II

Three phase Induction Motor: Construction, equivalent circuit, torque equation and torque- slip characteristics, speed control. **Alternator:** Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. **Synchronous Motor:** Starting, effect of excitation on line current (V-curves), synchronous condenser. **Servo Motor:** Two phase A.C. servo motor & its application.

UNIT III

Modeling of Mechanical System: linear mechanical elements, force-voltage and force current analogy, electrical analog of simple mechanical systems; concept of transfer function & its determination for simple systems. **Control System:** Open loop & closed loop controls, servo mechanisms; concept of various types of system. **Signals:** Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics**.**

UNIT IV

Time Response Analysis: Time response of a standard second order system and response specifications, steady state errors and error constants. **Stability:** Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment of stability.

UNIT V

Root Locus Techniques: Concept of root locus, construction of root loci. **Frequency Response Analysis:** Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots. **Process control:** Introduction to P, PI and PID controllers their characteristics, representation and applications.

Text and Reference Books:

1. IJ Nagrath & D. P. Kothari, “Electrical machines” Tata McGraw Hill.
2. BR Gupta & Vandana Singhal, “Fundamentals of Electrical Machines”, New AgeInternational.
3. K. Ogata, “Modern Control Engineering” Prentice Hall of India.
4. BC Kuo, “Automatic Control systems.” Wiley India Ltd.
5. Irvin L. Kosow, “Electric Machinery and Transformers” Prentice Hall of India.
6. D. Roy Choudhary, “Modern Control Engineering” Prentice Hall of India.
7. M. Gopal, Control Systems: Principles and Design” Tata McGraw Hill.

ME-IV SEM **Session: 2018-19**

MEASUREMENT AND METROLOGY

CO1 - Understand the methods of measurement and selection of measuring instruments ,standards of measurement
CO2 - Identify and apply various measuring instruments
CO3 - Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design
CO4 - Recommend the Quality Control Techniques and Statistical Tools appropriately
CO5 - Analyze the Data collected
CO6 - Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality

UNIT I

Mechanical Measurements: Introduction to measurement and measuring instruments. General concept–Generalized measurement system and its elements-Unit sand standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response- repeatability-systematic, Source of error, statistical analysis of error and random errors- correction, calibration. Dimensional and geometric tolerance

Sensors and Transducers: Types of sensors, types of transducers and their characteristics.

UNIT II

Time Related Measurements: Stroboscope, frequency measurement by direct comparison.Measurement of displacement

Measurement of Pressure: Gravitational, directing acting, elastic and indirect type pressuretransducers. Measurement of very low pressures (high vacuum).

Strain Measurement: Types of strain gauges and their working, strain gauge circuits,temperature compensation. Strain rosettes, calibration.

UNIT III

Flow Measurement: Hot Wire Anemometry, Laser Doppler Velocimetry, Rotameter **Temperature Measurement**: Thermometers, bimetallic thermocouples, thermistors andpyrometers.

Measurements of Force, Torque: Different types of load cells, elastic transducers,pneumatic & hydraulic systems. Seismic instruments

Measurements of Acceleration, and Vibration: Accelerometers vibration pickups anddecibel meters, vibrometers.

UNIT IV

Coordinate measuring machine (CMM): Need, constructional features and types, **Metrology and Inspection:** Standards of linear measurement, line and end standards.Interchange ability and standardization. Linear and angular measurements devices andsystems **Comparators:** Sigma, Johansson's Microkrator. Limit gauges classification,Taylor's Principle of Gauge Design.

UNIT-V

Limits, Fits &Tolerance and Surface roughness: Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness. Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile projector, autocollimator.

Interferometry: principle and use of interferometry, optical flat. Measurement of screwthreads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement.

Books and References:

1. Experimental Methods for Engineers by Holman, MCGRAW HILL INDIA
2. Mechanical Measurements by Beckwith, Pearson
3. Principles of Measurement Systems by Bentley, Pearson
4. Metrology of Measurements by Bewoor and Kulkarni, MCGRAW HILL INDIA
5. Measurement Systems, Application Design by Doeblein, MCGRAW HILL INDIA
6. Hume KJ, "Engineering Metrology", MacDonald and Co
7. Jain, RK, "Engineering Metrology" Khanna Publishers
8. Jain, R.K., "Mechanical Measurement" Khanna Publishers 9.Gupta SC, Engineering Metrology, Dhanpat Rai Publications

ME-IV SEM **Session: 2018-19**

MANUFACTURING SCIENCE & TECHNOLOGY-I

CO1-Upon completion of This course, students will be able to understand the different

conventionaland unconventional manufacturing methods employed for making different products

UNIT I

Introduction: Importance of manufacturing. Economic & technological considerations in

manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items. Metal Forming Processes: Elastic & plastic deformation, yield criteria (Mises' and Tresca's). Hot working versus cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking frictionand mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.

UNIT II

Metal Forming Processes (continued): Analysis of Wire/strip drawing and maximum- reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and powerin rolling. Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes.

UNIT III

Sheet Metal working: Presses and their classification, Die & punch assembly and press workmethods and processes. Cutting/Punching mechanism, Blanking vs. Piercing. Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load (capacity) needed. Analysis of forming process like cup/deep drawing. Bending & spring-back.

UNIT IV

Casting (Foundry): Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runnes, Core. Solidification of casting, Sand casting, defects & remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO_2 casting and Stir casting etc.

UNIT V

Unconventional Metal forming processes: Unconventional metal forming or High EnergyRate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming. Powder Metallurgy: Introduction to Powder metallurgy manufacturingprocess. Application and, advantages. Jigs & Fixtures: Locating & Clamping devices &principles. Jigs and Fixtures and its applications. Manufacturing of Plastic components:Review of plastics, and its past, present & future uses. Injection moulding. Extrusion ofplastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives. Books and

References :

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by PC Pandey
3. Manufacturing Engineering & Technology by Kalpakjian, Pearson
4. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA
5. Manufacturing Processes by Lindberg, Pearson.
6. Manufacturing Processes foe Engineering materials by Kalpakjian, Pearson
7. Materials and Manufacturing by Paul Degarmo.
8. Manufacturing Processes by Kaushish, PHI
9. Principles of Foundry Technology, Jain, MCGRAW HILL INDIA
10. Production Technology by RK Jain

ME-IV SEM Session: 2018-19

APPLIED THERMODYNAMICS

C01-After completing this course, the students will get a good understanding of various practicalpower cycles and heat pump cycles.

CO2-They will be able to analyze energy conversion in various thermal devices such as combustors,air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.

CO3-They will be able to understand phenomena occurring in high speed compressible flows.

UNIT I

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto,Diesel and dual cycles.

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

UNIT II

Vapour Power cycles: Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

UNIT III

Boilers: Classifications and working of boilers, boiler mountings and accessories, Draughtand its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

UNIT IV

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Shock waves stationary normal shock waves, Effect of frictionon nozzle, Super saturated flow.

Steam Turbines : Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

UNIT V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbinecycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

Books and References:

1. Basic and Applied Thermodynamics by P.K. Nag, MCGRAW HILL INDIA
2. Applied thermodynamics by Onkar Singh, New Age International
3. Applied Thermodynamics for Engineering Technologists by Eastop, PearsonEducation
4. Applied Thermodynamics by Venkanna And Swati, PHI
5. Theory of Stream Turbine by WJ Kearton
6. Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man
7. Gas Turbine, by V. Ganeshan, Tata McGraw Hill Publishers.
8. Steam & Gas Turbine by R. Yadav, CPH Allahabad
9. Thermodynamics and Energy Systems Analysis, Borel and Favrat, CRC Press
10. Thermodynamics by Prasanna Kumar, Pearson
11. Thermal Engineering by Kulshrestha, Vikas Publishing.
12. Thermal Engg. By PL Ballaney, Khanna Publisher
13. Thermal Engg. By RK Rajput, Laxmi Publication

ME-IV SEM **Session: 2018-19**

ELECTRICAL MACHINES & CONTROLS LAB

Note: To perform at least 7 experiments of Electrical Machines and 3 experiments ofControl Systems

A. Electrical Machines

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by directloading.
2. To obtain efficiency of a dc shunt machine by no load test.
3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) fieldcontrol.
4. To determine polarity and voltage ratio of single phase and three phase transformers.
5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on asingle phase transformer at full load and 0.8 p.f. loading.
6. To obtain 3-phase to 2-phase conversion using Scott connection.
7. To perform load test on a 3-phase induction motor and determine (a) speed- torque characteristics (b) power factor v/s line current characteristics.
8. To study speed control of a 3-phase induction motor using (a) Voltage Control (b) Constant (Voltage/ frequency) control.
9. To perform open circuit and short circuit test on a 3-phase synchronous machine and determine voltage regulation at full load and unity, 0.8 lagging and 0.8 leading powerfactor using synchronous impedance method.
10. To determine V-curve of a 3-phase synchronous motor at no load, half load and full load.

B. Control Systems:

1. To determine transient response of a second order system for step input for various values of constant ‘K’ using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare theirperformance.

3. To determine speed – torque characteristics of an a.c. 2-phase servo motor.
4. To study and calibrate temperature using Resistance Temperature Detector(RTD)
5. To study dc servo position control system within P and PI configurations.
6. To study synchro transmitter and receiver system and determine output V/s inputcharacteristics.
7. To study open loop and closed loop control of a dc separately excited motor.

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MEASUREMENT & METROLOGY LAB

Minimum 8 experiments out of following (or such experiment) are to be performed:

1. Study the working of simple measuring instruments- Vernier calipers, micrometer,tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sine bar & slip gauges. Study of limit gauges.
4. Study & angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.
9. Study and understanding of limits, fits & tolerances.
10. Experiment on measurement of pressure.
11. Study of temperature measuring equipments.
12. Measurement using Strain gauge.
13. Measurement of speed using stroboscope.
14. Experiment on measurement of flow.
15. Measurement of vibration/power.
16. Experiment on dynamometers.

17 To study the displacement using LVDT.

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MANUFACTURING TECHNOLOGY-I LAB

Minimum 8 experiments out of following (or such experiment) are to be performed:

1. Design of pattern for a desired casting (containing hole).
2. Pattern making with proper allowance.
3. Making a mould (with core) and casting.
4. Sand testing methods (at least one, such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging - hand forging processes
7. Forging - power hammer study & operation
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/piercing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.
12. Bending & spring back.
13. Powder metallurgy experiment.
14. Jigs & Fixture experiment.
15. Any other suitable experiment on manufacturing science / process / technique.

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COMPUTER AIDED MACHINE DRAWING-II LAB

CO1-Upon completion of this course, the students can use computer and CAD software formodellingmechanical components

Note: All drawing conform to BIS Codes.

Introduction: Conventional representation of machine components and materials, Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements and welded joints. Classification of Drawings: Machine drawings, Production drawing, part drawing and assembly drawing. Introduction to detail drawing and bill of materials (BOM).

Limits, Fits and Tolerances: General aspects, Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, Commonly used holes and shafts. List of Standard Abbreviation used.

Part Modeling: Introduction to part modeling of simple machine components using any 3D software (like CATIA, PRO E, UGNX, Autodesk Inventor or SOLIDWORKS) covering all commands/ features to develop a part model ***(Minimum 24 machine components need to be developed).***

Part Modeling & Assemblies of: Plummer Block Bearing, Machine Vice, Screw Jack,Engine Stuffing box, Lathe Tailstock, Feed Check Valve and Rams Bottom Safety Valve.

Boks and References:

1. Textbook of Machine Drawing, K C John, PHI
2. Machine Drawing by K.R. Gopalakrishna, Subhas Stores.
3. A Textbook of Machine Drawing by PS Gill from S.K. Kataria & Sons
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age publications
5. Engineering Graphics with AutoCAD, Bethune, PHI
6. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill
7. Fundamentals of Machine Drawing, Dr Sadhu Singh & P L Shah, Prantice Hall India
8. Autodesk Inventor by Examples, Sam Tikoo, Wiley

ME-IV SEM **Session: 2018-19**

NANO SCIENCE

UNIT I Introduction: Definition of Nano-Science and Nano Technology, Applications of NanoTechnology. Quantum Theory for Nano Science: Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Potential box (Traped particle in 3D: Nanodot). Physics of Solid State Structures: Size dependence of properties, crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces. Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT II Quantum Nanostructure: Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantum dot laser superconductivity. Properties of Individual Nano Particles: Metal nano clusters; Magic numbers; Theoretical modeling of nanoparticles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulk to nanostructure, semiconducting nanoparticles, Optical Properties, Photofragmentation, Coulombic Explosion. Rare Gas & Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.

UNIT III Growth Techniques of Nanomaterials: Litho and Nonlithograpahic techniques, RF Plasma, Chemical methods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical Vapour Deposition, Pulsed Laser Deposition.

UNIT IV Methods of Measuring Properties: Structure: X-ray Diffraction Technique, Particle size determination, surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy(TEM). Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

UNIT V Carbon Nano Materials: Bucky Ball and Carbon Nano- Tubes: Nano structures of carbon (fullerene), Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. Nano Diamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:

1. CP Poole Jr, FJ Owens, “Introduction to Nanotechnology”.

2. C Kittel, “Introduction to S.S. Physics”-(7th Edn.) Wiley 1996.

3. HS Nalwa, “Handbook of Nanostructured Materials & Nanotechnology” vol. 5. Academic Press 2000

ME-IV SEM **Session: 2018-19**

Universal Human Values and Professional Ethics

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Catalogue DescriptionEvery human being has two sets of questions to answer for his life: a) what to do? and, b) how to do?. The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence,the basic aspiration of a human being, that is to live with happiness andprosperity, gets defeated, in spite of abundant technologica progress.

This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, the comprehensive human goal in the society, the mutual fulfillment in the nature and the coexistence in existence. As a natural outcome of such inputs, they are able to evaluate an ethical life and profession ahead.

UNIT-1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, ContinuousHappiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2 Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3 Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in societyUndivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)-

from family to world family!.

UNIT-4 Understanding Harmony in the Nature and Existence – Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5 Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics
2. .References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation: Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

ME-V SEM **Session: 2018-19**

MACHINE DESIGN-I

UNIT I

Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

Design for Static Load

Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

UNIT II

Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor,Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

Riveted Joints

Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

UNIT III

Shaft

Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity.

UNIT I

Mechanical Springs

Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

UNIT V

Keys and Couplings

Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid andflexible couplings.

Power Screws

Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws,Design of screw jack

Note: Design data book is allowed in the examinationBooks and References:

1. Design of Machine Elements,V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Elements-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
8. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

ME-V SEM **Session: 2018-19**

HEAT & MASS TRANSFER

UNIT-1

Introduction to Heat Transfer:

Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effectof temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

Conduction :

General differential heat conduction equation in the rectangular, cylindrical and spherical coordinatesystems.Initial and boundary conditions.

Steady State one-dimensional Heat conduction :

Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Concept of thermal resistance.Analogy between heat and electricity flow; Thermal contact resistance and over all heat transfer coefficient; Critical radius of insulation.

UNIT-2 Fins:

Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement oftemperature in thermometer wells.

Transient Conduction:

Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction inone dimension only, Heisler charts.

UNIT-3

Forced Convection:

Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Thermal entrance region, Empirical heat transfer relations; Relation between fluid friction and heat transfer;Liquid metal heat transfer.

Natural Convection :

Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined free and forced convection.

UNIT-4

Thermal Radiation :

Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect

UNIT-5

Heat Exchanger :

Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperaturedifference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

Condensation and Boiling:

Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convection boiling.

Introduction to Mass Transfer:

Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusionthough a stagnant gas film.

Books:

1. Fundamentals of Heat and Mass Transfer, by Incroperra& DeWitt, John Wiley and Sons
2. Heat and Mass Transfer by Cengel, McGraw-Hill
3. Heat Transfer by J.P. Holman, McGraw-Hill
4. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education
5. Heat Transfer by Ghoshdastidar, Oxford University Press
6. A text book on Heat Transfer, by Sukhatme, University Press.
7. Heat Transfer by Venkateshan, Ane Books Pvt Ltd
8. Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill
9. Heat and Mass Transfer by R Yadav, Central Publishing House

MANUFACTURING SCIENCE& TECHNOLOGY-II

Unit I

Metal Cutting-

Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Heat generation and cutting tool temperature, Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Dynamometer, Brief introduction to machine tool vibration and surface finish. Economics of metal cutting.

Unit-II *Machine Tools*

(i) Lathe: Principle, construction, types, operations, Turret/capstan, semi/Automatic, Tool layout

(ii) Shaper, slotter, planer: Construction, operations & drives.

(iii) Milling: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chipthickness & power required.

(iv) Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills.

Unit-III

Grinding & Super finishing

(i) Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding.Centerless grinding

(ii) Super finishing: Honing, lapping and polishing.

Limits, Fits & Tolerance and Surface roughness:

Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness.

Unit-IV

B. Metal Joining (Welding)

Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot,
seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, frictionwelding. Soldering & Brazing. Adhesive bonding. Thermodynamic and Metallurgical aspects in welding and weld, Weldability, Shrinkage/residual stress in welds. Distortions & Defects in welds andremedies. Weld decay in HAZ

Unit-V

C. Introduction to Unconventional Machining and Welding

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma- arc welding, Diffusion welding, Explosive welding/cladding. Introduction to Hybrid machining processes

6

Books and References:

1. Manufacturing Science – A. Ghosh and A.K. Mallik,Affiliated East-West Press
2. Fundamentals of Metal Machining and Machine Tools – Geoffrey Boothroyd, CRC Press
3. Production Technology - R.K. Jain Khanna Publishers.
4. Introduction to Manufacturing Processes – John A. Schey ,McGraw-Hill
5. Production Engineering Science - P.C. Pandey,Standard Publishers Distributors,
6. Modern Machining Processes - P.C. Pandey& H.S. Shan, McGraw-Hill
7. Degarmo's Materials and Processes in Manufacturing - Ernest P. De Garmo, J. T. Black,Ronald A. Kohser, Wiley
8. Fundamentals of Metal Cutting & Machine Tools – B.L. Juneja& G.S. ShekhonWiley
9. Process &Materials of Manufacturing – R.A. Lindburg, Pearson Eductaion
10. Advanced Machining Process - VK Jain ,Allied Publishers
11. Manufacturing Engineering & Technology, -Kalpakjian, Pearson
12. Manufacturing Technology Part I and Part II,-Rao,PN, McGraw-Hill

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I C ENGINES & COMPRESSORS

Unit-1

Introduction to I.C Engines: Engine classification and basic terminology, Two and four stroke engines,SI and CI engines, Valve timing diagram.
Thermodynamic analysis of Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle,Ericsson cycles, Comparison of Otto, Diesel and Dual cycles
Fuel air cycle, factors affecting the fuel air cycle, Actual cycle.

Unit–II

SI Engines: Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it'scontrol, combustion chamber design for SI engines.
Carburetion, Mixture requirements, Carburetors and fuel injection system in SI Engine
Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug,Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect

Unit–III

CI Engine: Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamberdesign of CI engines.
Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors,Injection timings
Exhaust emissions from SI engine and CI engine and it's contro

Unit-IV

Engine Cooling and Lubrication: Different cooling systems, Radiators and cooling fans, Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation.
Fuels: Fuels for SI and CI engine , Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.
Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines

Unit V

Compressors: Classification, Reciprocating compressors, Single and Multi stage compressors,Intercooling, Volumetric efficiency.
Rotary compressors, Classification, Centrifugal compressor , Axial compressors, Surging and stalling,Roots blower, Vaned compressor.

BOOKS:

1. Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing CO.
2. Fundamentals of Internal Combustion Engines by H.N. Gupta, Prentice Hall of India
3. A Course in International Combustion Engines, by Mathur& Sharma, DhanpatRai& Sons.
4. I.C Engine Analysis & Practice by E.F Obert.
5. I.C Engine, by Ganeshan, Tata McGraw Hill Publishers.
6. I.C Engine, by R. Yadav, Central Publishing House, Allahabad
7. Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications, Czechoslovakia
8. Turbines, Compressors and Fans, by S.M.Yahya, Tata McGraw Hill Pub.
9. Engineering Fundamentals of Internal Combustion Engines by W.W. Pulkrabek,,Pearson Eductaion

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Design and Simulation - Lab I

CO1-Creation of part drawings and 3D models using CAD techniques.
CO2-Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.

Minimum eight experiments out of the following are to be performed.
Students are advised to use design data book for the design. Drawing shall be made wherevernecessary on small drawing sheets

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

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HEAT & MASS TRANSFER – LAB

Minimum eight experiment of the following

1. Conduction – Experiment on Composite plane wall
2. Conduction – Experiment on Composite cylinder wall
3 Conduction - Experiment on critical insulation thickness
4. Conduction – Experiment on Thermal Contact Resistance
5. Convection - Pool Boiling experiment
6. Convection - Experiment on heat transfer from tube-(natural convection).
7. Convection - Heat Pipe experiment.
8. Convection - Heat transfer through fin-(natural convection) .
9. Convection - Heat transfer through tube/fin-(forced convection).
10 Convection - Determination of thermal conductivity of fluid
11 Experiment on Stefan's Law, on radiation determination of emissivity, etc.
12 Experiment on solar collector, etc.
13. Heat exchanger - Parallel flow experimentHeat exchanger - Counter flow experiment

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MANUFACTURING TECHNOLOGY-II – LAB

Mini**mum eight experiments out of the following along-with study of the machines / processes**

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment
13. Resistance welding experiment.
14. Soldering & Brazing experiment

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FLUID MACHINERY

UNIT-I

Introduction: Impulse of Jet and Impulse Turbines:

Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler's fundamental equation. Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat &curve), Classification of turbines, Impulse turbines, Constructional details, Velocitytriangles, Power and efficiency calculations, Governing of Pelton wheel

UNIT-II

Reaction Turbines:

Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

UNIT-III

CentrifugalPumps:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies ofcentrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

UNIT-IV

Positive Displacement and other Pumps:

Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels,Comparison of centrifugal and reciprocating pumps, Performance characteristics.

UNIT-V

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift,hydraulic Ram,hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.

Spoken Tutorial (MOOCs):

Spoken Tutorial MOOC, 'Course on OpenFOAM', IIT Bombay(http://spoken-tutorial.org/)**BOOKS:**

1. Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli,Oxford University Press
4. Fluid Mechanics and Fluid Power Engineering by D S Kumar, S K Kataria& Sons
5. Fluid Mechanics and Turbo machines by Das, PHI
6. Fluid Power with Applications, by Esposito, Pearson
7. Fluid Mechanics and hydraulic machines by Modi& Seth, Standard Book House
8. Fundamentals of Turbomachinery by Venkanna B.K., PHI
9. Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
10. Fluid Mechanics and Hydraulic Machines by SukumarPati, Tata McGraw Hill

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THEORY OF MACHINES

Unit I

Introduction, mechanisms and machines, kinematics and kinetics, types of links, kinematic pairs and their classification, types of constraint, degrees of freedom of planar mechanism, Grubler's equation, mechanisms, inversion of four bar chain, slider crank chain and double slider crank chain.

Velocity analysis:

Introduction, velocity of point in mechanism, relative velocity method, velocities in four bar mechanism, instantaneous center .

Acceleration analysis:

Introduction, acceleration of a point on a link, acceleration diagram, Corioli's component of acceleration, crank and slotted lever mechanism,.

Unit II

Cams

Introduction, classification of cams and followers, cam profiles for knife edge, roller and flat facedfollowers for uniform velocity, uniform acceleration,

Gears and gear trains

Introduction, classification of gears, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact, contact ratio, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, sun and planet gear train.

Unit III

Force analysis:

Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid link in plane motion, dynamic force analysis of planar mechanisms, piston force and crank effort. Turning
moment on crankshaft due to force on piston, Turning moment diagrams for single cylinder double acting steam engine, four stroke IC engine and multi-cylinder engines, Fluctuation of speed, Flywheel.

Unit IV

Balancing:**Introduction,static balance, dynamic balance, balancing of rotating masses,two planebalancing,**
graphical and analytical methods, balancing of reciprocating masses,

Governors:

Introduction, types of governors, characteristics of centrifugal governors, gravitycontrolledand spring controlled centrifugal governors, hunting of centrifugal governors, inertia
governors. Effort and Power of governor

Unit V

Brakes and dynamometers:

Introduction, Law of friction and types of lubrication, types of brakes, effect of braking on rear and front wheels of a four wheeler, dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer

Text/Reference Books:

1. Kinematics and dynamics of machinery: Wilson and Sadler, Third edition, Pearson.
2. Theory of Mechanisms and Machines: AmitabhaGhosh and Ashok kumarMallik, ThirdEdition
3. Affiliated East-West Press.
4. Theory of Machines and Mechanisms: Joseph Edward Shigley and John JosephUicker, Jr.
5. Oxford University Press
6. Kinematics and dynamics of machinery: R L Norton, McGraw Hill
7. Theory of Machines: S.S. Rattan, McGraw Hill
8. Theory of Machines: Thomas Bevan, CBS Publishers.

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MACHINE DESIGN-II

UNIT I

Principle of transmission and conjugate action**Spur Gears** Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength& wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

UNIT II Bevelgears

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strengthof bevel gears,Effective load of gear tooth, Design of a bevel gear system.

Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation inworm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

4

UNIT III

Sliding Contact Bearing

Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing,

UNIT IV

Rolling Contact Bearing

Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing

UNIT V

IC ENGINE parts,

Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head; Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design ofcrankshaft

Note: Design data book is allowed in the examination

Books and References:

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Eesign-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
9. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

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REFRIGERATION & AIR CONDITIONING

Unit-1

Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit ofrefrigeration, Refrigeration effect & C.O.P.

Air Refrigeration cycle:

Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

8

Unit-2

Vapour Compression System:

Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

8

Unit-3

Vapour Absorption system;

Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Three fluid system.

5

Refrigerants:

Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

3

Unit-4

Air Conditioning:

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

9

Unit-5

Refrigeration Equipment & Application:

Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers, evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

7

Books:

1. Refrigeration and Air conditioning by C.P Arora, McGraw-Hill
2. Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd.Pub.
3. Refrigeration and Air conditioning by R. C. Arora, PHI
4. Principles of Refrigeration by Roy J. Dossat. Pearson Education
5. Refrigeration and Air conditioning by stoecker& Jones. McGraw-Hill
7. Refrigeration and Air conditioning by Arora&Domkundwar. DhanpatRai
7. Thermal Environment Engg. byKuhen, Ramsey &Thelked.

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FLUID MACHINERY Lab

Minimum ten experiments out of the following along with study of the machines and processes

1. Impact of Jet experiment.
2. Experiment on Pelton wheel.
3. Experiment on Francis turbine.
4. Experiment on Kaplan turbine.
5. Experiment on Reciprocating pump.
6. Experiment on centrifugal pump.
7. Experiment on Hydraulic Jack/Press
8. Experiment on Hydraulic Brake
9. Experiment on Hydraulic Ram
10. Study through visit of any water pumping station/plant
11. Any other suitable experiment/test rig such as comparison & performance of different typesof pumps and turbines.
12. Experiment on Compressor
13. Experiment for measurement of drag and lift on aerofoil in wind tunnel

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THEORY OF MACHINES LAB

Minimum eight experiments out of the following:

1. Study of simple linkage models/mechanisms
2. Study of inversions of four bar linkage
3. Study of inversions of single/double slider crank mechanisms
4. Experiment on Gears tooth profile, interference etc.
5. Experiment on Gear trains
6. Experiment on longitudinal vibration
7. Experiment on transverse vibration
8. Experiments on dead weight type governor
9. Experiment on spring controlled governor
10. Experiment on critical speed of shaft
11. Experiment on gyroscope
12. Experiment on static/dynamic balancing
13. Experiment on Brake
14. Experiment on clutch

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Design And Simulation - Lab II **L T P**

0 0 2

A. Computer and Language :students are required to learn the basics of computer language such as Cand C++ so that they should be able to write the computer programme (*3practical turns*)

B. Writing Computer programme for conventional design: Students are required to write computerprogram and validate it for the design of machine components done in theory subject (*5practical turns*)

C. Mini Project: Each **s**tudent will be given a real life problem for the complete design of asubsystem/system using either manual calculation with the help of design handbook or through computer programme, if needed. This will be done as home assignment to be submitted at the end of the semester.

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REFRIGERATION & AIR CONDITIONING Lab

Minimum eight experiments out of the following:

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. Study of different types of expansion devices used in refrigeration system.
3. Study of different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. Experiment on air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant and its detailed study.
10. Visit of cold-storage and its detailed study.
11. Experiment on Ice-plant.
12. Experiment on two stage Reciprocating compressor for determination of volumetric efficiency ,PV diagram and effect of intercooling.
13. Study of Hermetically sealed compressor.
14. Experiment on Desert coolers.

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MECHATRONICS AND MICROPROCESSOR

Unit 1

Introduction, synergy of systems, definition of mechatronics, applications of mechatronics in design and modeling, actuators and sensors, intelligent controls, robotics, manufacturing etc., objectives,advantages and disadvantages of mechatronics, examples of mechatronics systems in industry.

Mechanical components in mechatronics, force, friction and lubrication, materials, mechanical behavior of materials, mechanisms used in mechatronics, lever and four bar mechanisms, bearing, belt, chain, cam, slider crank, clutches etc.

8

Unit II

Electronics elements in mechatronics, conductors, insulators and semiconductors, passive electrical components, resistors, capacitor and inductor, transformer, active elements, semiconductor devices, transistors and integrated circuits, digital electronics components like logic gates, flip-flops, shiftregister, multiplexer and counter.

Computing elements in mechatronics, analog computer, timer, analog to digital converter, digital to analog converter, digital computer, microprocessor and its architecture, micro-controllers, programming logic controllers, their basic structures, mnemonics.

8

Unit III

System modeling and analysis, control system concepts, transfer function of physical systems, block diagrams representation of systems, transfer function of a system, standard input signals, time response of a first and second order systems to a step input, frequency response analysis, automatic control systems, digital control systems.

Motion control devices, actuator types & application areas, hydraulic and pneumatic actuators, electrical actuators, DC servomotor, AC servomotor and stepper servomotor, micro-actuators, drive selection and applications.

8

Unit IV

Sensors and transducers, their static and dynamic performance characteristics, internal sensors, external sensors and micro-sensors, sensors for displacement, position and proximity; velocity, motion, force, fluid pressure, liquid flow, liquid level, temperature, light sensors, selection of Sensors.

Stages in designing mechatronics systems, traditional and mechatronic design, possible design solutions, case studies of mechatronics systems, pick and place robot, automatic car park systems, engine management systems etc.

8

Unit V

Mechatronics in industry, autotronics, bionics and avionics and their various applications, mechatronics in manufacturing, features of mechatronics in manufacturing, flexible manufacturing systems, manufacturing automatic protocol, computer integrated manufacturing, just in time production systems, CNC machines, adaptive control machine system, CNC machine operations, challenges in mechatronics production units.

8

BOOKS & REFERENCES:

1. A Kuttan, "Introduction to Mechatronics, Oxford University Press, 2010.
2. Alciatore&Histand, "Introduction to Mechatronics & Measurement Systems, 4e", McGraw-Hill Education, 2014.
3. M Jouaneh, "Fundamentals of Mechatronics", Cengage Learning, 2013.
4. W. Bolton, "Mechatronics", Pearson Education, Second Edition, 1999.
5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall,1993.
6. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
7. NitaigourPremchandMahadik, "Mechatronics", McGraw-Hill Education, 2015.
8. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering, An Introduction toMechatronics", Prentice – Hall of India Pvt., Ltd., 2000.
9. Ramachandran K. P., Vijayaraghavan G. K., Balasundaram M.S. "Mechatronics: IntegratedMechanical Electronic Systems", Wiley

COMPUTER AIDED DESIGN (CAD)

UNIT-I

Introduction: Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications Computer Graphics-I CAD/CAM systems,

Computer Graphics-I Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices- Cathode Ray Tube, Random & Raster scan display, Color CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

8

UNIT-II

Computer Graphics-II Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation .

8

UNIT-III

Curves: Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves

8

UNIT-IV

3D Graphics: Polygon surfaces-Polygon mesh representations, Quadric and Superquadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Basic application commands for 2d drafting software like AutoCAD/Draftsight (any one)&3d solid modeling software Solidworks/Autodesk Inventor/PTC Creo /Catia (Any one)etc.

8

UNIT-V

Finite Element Analysis: Basic concept of the finite element method, comparison of FEM with direct analytical solutions; Steps in finite element analysis of physical systems, Finite Element analysis of 1-D problems like spring, bar, truss and beam elements formulation by direct approach; development of elemental stiffness equations and their assembly, solution and its post processing.

Books and References:

1. Computer Graphics, by Hearn & Baker, Prentice Hall of India
2. CAD/CAM, by Groover and Zimmers, Prentice Hall India Ltd.
3. CAD/CAM :Theory and Practice, by Zeid, McGraw Hill
4. CAD/CAM: Computer Aided Design and Manufacturing, by Groover, Pearson India
5. Mathematical Elements for Computer Graphics, buy Rogers and Adams, McGraw Hill
6. Finite Element Method By S S Rao
7. FE Analysis Theory and Programming, by Krishnamoorthy, Tata McGraw Hill

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AUTOMOBILE ENGINEERING

UNIT-I

Introduction:

Basic concepts of Automobile Engineering and general configuration of an automobile, Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination.

6

UNIT-II

Transmission System:

Requirements. Clutches. Toque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

8

UNIT-III

Braking System:

General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes,Hydraulic brakes. Vacuum and air brakes. Thermal aspects.

5

Chasis and Suspension System:

Loads on the frame, Strength and stiffness, Independent front & rear suspension, Perpendicular arm type, Parallel arm type, Dead axle suspension system, Live axis suspension system,Air suspension & shock absorbers.

5

UNIT-IV

Electrical System :

Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Batteryetc.

5

Fuel Supply System:

Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetoretc. MPFI.

4

UNIT-V

Emission standards and pollution control :

Indian standards for automotive vehicles-Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fueladditives and modern trends in automotive engine efficiency and emission control.

Maintenance system: Preventive maintenance, break down maintenance and over hauling.

2

Books and References:

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.
3. Automobile Engineering - Narang.
4. Automobile Engineering –TTTI, Pearson India
5. Automotive Mechanics- Crouse
6. Automobile Engineering - Newton and Steeds.
7. Automobile Engineering –Ramakrishna, PHI, India

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:CAD/CAM LAB

Total TEN Experiments are to carried out. FIVE Experiments each from CAD and CAM.

A. CAD Experiments

1. Line Drawing or Circle Drawing experiment: Writing and validation of computerprogram.
2. Geometric Transformation algorithm experiment for translation/rotation/scaling: Writingand validation of computer program.
3. Design of machine component or other system experiment: Writing and validation ofcomputer program.
4. Understanding and use of any 3-D Modeling Software commands.
5. Pro/E/Idea etc. Experiment: Solid modeling of a machine component
6. Writing a small program for FEM for 2 spring system and validation of program or usinga FEM Package
7. Root findings or curve fitting experiment: Writing and validation of computer program.
8. Numerical differentiation or numerical integration experiment: Writing and validation ofcomputer program.

B. CAM Experiments

1. To study the characteristic features of CNC machine
2. Part Programming (in word address format) experiment for turning operation (includingoperations such as grooving and threading) and running on CNC machine
3. Part Programming (in word address format or ATP) experiment for drilling operation(point to point) and running on CNC machine
4. Part Programming (in word address format or ATP) experiment for milling operation(contouring) and running on CNC machine
5. Experiment on Robot and programs
6. Experiment on Transfer line/Material handling
7. Experiment on difference between ordinary and NC machine, study or retrofitting
8. Experiment on study of system devices such as motors and feed back devices
9. Experiment on Mecatronics and controls

I.C. ENGINES AND AUTOMOBILE LAB

Experiments: Say minimum 10 experiments out of following in depth and details.

1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brakethermal efficiency, specific fuel consumption at different loads, Energy Balance.
2. Determination of Indicated H.P. of I.C. Engine by Morse Test.
3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brakethermal efficiency, specific fuel consumption at different loads, Energy Balance.
4. Study & experiment on Valve mechanism.
5. Study & experiment on Gear Box.
6. Study & experiment on Differential Gear Mechanism of Rear Axle.
7. Study & experiment on Steering Mechanism.
8. Study & experiment on Automobile Braking System.
9. Study & experiment on Chassis and Suspension System.
10. Study & experiment on Ignition system of I.C. Engine.
11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel InjectionPump and MPFI.
12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
13. Study & experiment on Air Conditioning System of an Automobile.
14. Comparative study of technical specifications of common small cars (such as MarutiSwift, Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc.
15. Comparative study & technical features of common scooters & motorcycles available inIndia.
16. Visit of an Automobile factory.
17. Visit to a Modern Automobile Workshop.
18. Experiment on Engine Tuning.
19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

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COMPUTER AIDED MANUFACTURING (CAM)

UNIT-I

Introduction to Automation: Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.

8

UNIT-II

Fundamental of Numerical Control, elements of NC machine tools, classification of NC machinetools, Advantages, suitability and limitations of NC machine tools, Application of NC system.

Definition and designation of control axes, Constructional details of Numerical Control MachineTools, MCU structure and functions, Methods of improving accuracy and productivity using NC.

8

UNIT -III

Computer Numerical Control (CNC) : Features of CNC, Elements of CNC machines, the machine control unit for CNC , Direct Numerical Control(DNC) and Adaptive Controls.

System Devices: Drives, Feedback devices, Counting devices, DAC and ADCs, Interpolator systems, Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

8

UNIT -IV

NC Part Programming- (a) Manual (word address format) programming Examples Drilling,Turning and Milling; canned cycles, Subroutine, and Macro.

(b) Computer Assisted Part programming (APT) Geometry, Motion and Additional statements,Macro- statement.

8

UNIT-V

Computer Integrated manufacturing system , Group Technology, Flexible Manufacturing System, Computer aided process planning-Retrieval and Generative System. Types and generations of Robots, Structure and operation of Robot, Robot applications.

8

Books and References :

1. Automation, Production System and Computer Integrated Manufacturing, by Mikell P. Grover, PrenticeHall of India Pvt Ltd.
2. CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill
3. Computer Aided Manufacturing, by Cheng, Pearson India
4. CAD/CAM: Principles and Oerations, by P. N. Rao, McGraw Hill
5. CAD/CAM: Computer Aided Design and Manufacturing, by M. Groover, Pearson India.
6. CAD/CAM: Concepts and Applications by Alavala, PHI India
7. Computer Aided Manufacturing, by Srinivas, Oxford University Press.

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OPERATIONS RESEARCH

UNIT-I

Introduction: Basic of Operation Research, Origin & development of OperationResearch,Applications.

Linear Programming: Introduction & Scope, Problem formulation, Graphical Method, Simplexmethods, primal and dual problem sensitivity analysis

UNIT-II

Transportation Problem: Methods of obtaining initial and optimum solution, degeneracy intransportation problems, unbalanced Transportation Problem.

Assignment Problem: Methods of obtaining optimum solution, Maximization problem,travelling salesman problem.

UNIT-III

Game Theory: two person Zero sum game, Solution with/without saddle point, dominance rule, Different methods like Algebraic, Graphical and game problem as a special case of Linear Programming.

Sequencing: Basic assumptions, n Jobs through 2-3 machines, 2 Jobs on m machines.

UNIT-IV

Stochastic inventory models: Single & multi period models with continuous & discretedemands, Service level & reorder policy.

Simulation: Use, advantages & limitations, Monte-carlo simulation, Application to queuing,inventory & other problems.

UNIT-V

Queuing models: Characteristics of Queuing Model, M/M/1 and M/M/S system, costconsideration

Project management: Basic Concept of network Scheduling, Rules for drawing network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing ofoperations; resource allocation.

Books and References:

1. Operations Research: Principles and Practice, by- Ravindran, Phillips, Solberg, John Wiley & Sons.
2. Principal of Operation Research, by- Harvey M. Wagner, Prentice Hall.
3. Introduction to Operation Research, by- Gillett, McGraw Hill.
4. Operations Research - An Introduction, by- Hamdy A. Taha, Pearson India.
5. Operation Research, by- Wayne L. Winston, Thomsan Learning.
6. Problems in Operations Research by- Prem Kumar Gupta & D.S. Hira, S. Chand.
7. Operation Research Application and Algorithms, by- Wayne L Winston, Duxbury Press.
8. Operations Research, by Jha, McGraw Hill.
9. Operation Research, by Yadav & Malik Oxford University Press
10. Operations Research, by Panneerselvam, PHI, India

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MECHANICAL SYSTEM DESIGN

UNIT-I

Engineering process and System ApproachBasic concepts of systems, Attributes characterizing a system, types of system, Application of system concepts, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing.

Problem Formulation :Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system

UNIT-II

System Theories: Introduction, System Analysis, Black box approach, state theory approach,component integration approach, Decision process approach, A case study-automobileinstrumentation panel system.

System modelingIntroduction, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system.

UNIT-III

Graph Modeling and Analysis Graph Modeling and analysis process, path problem, Network flow problem, A case study:

Material handling system.

Optimization ConceptsOptimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminium extrusion system.

UNIT-IV

System EvaluationFeasibility assessment, planning horizon, time value of money, Financial analysis, A case study:Manufacture of maize starch system.

Calculus Method for OptimizationModel with single decision variable, model with two decision variables, model with equality

constraints, model with inequality constraints, A case study: Optimization of an insulation system.

UNIT-V

Decision AnalysisElements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery.

System Simulation Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant.

Books and References:

1. Design and Planning of Engineering systems-DD Reredith, KV Wong, RW Woodhead,

and RR Worthman, Prentice Hall Inc., Eaglewood Cliffs, New Jerse

2. Engineering Design, by Dieter, McGraw Hill

3. Design Engineering-JR Dixon, TMH, New Delhi

4. An Introduction to Engineering Design Method-V Gupta and PN Murthy, TMH, New Delhi

5. Engineering Design-Robert Matousck, Blackie and son ltd. Glasgow

6. Optimization Techniques-SS Rao

7. System Analysis and Project Management-Devid I Cleland, William R King, McGraw Hill.

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ADVANCED WELDING TECHNOLOGY

UNIT-I

Introduction: Welding as compared with other fabrication processes,Importance and application of welding, classification of welding processes, Health & safety measures in welding.

Welding Power Sources: Physics of welding Arc**,** Basic characteristics of power sources forvarious arc welding processes, Transformer, rectifier and generators.

Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow.

Metal Transfer: Mechanism and types of metal transfer in various arc welding processes.

UNIT-II

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrogas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding,Underwater welding & Microwave welding.

UNIT-III

Heat Flow Welding: Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention

UNIT-IV

Repair & Maintenance Welding: Hardfacing, Cladding, Surfacing, Metallizing processes andReclamation welding.

Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, CastIron and aluminium. Micro & Macro structures in welding.

UNIT-V

Weld Design : Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds, Introduction to Welding Procedure Specification & Procedure Qualification Record.

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principals and Practices, by- Edwars R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishsers.
4. Welding Handbooks (Vol. I & II).

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PLANT LAYOUT AND MATERIAL HANDELING

UNIT -I

Introduction Criteria, Strategies/Tactics, Sustainability and Eco-Efficiency in Facility Design, Basic Planning,Alternative Machine Arrangements, Flow Lines, Location Models, Act/Building Details, Aisles and Security, Storage, Shipping and Receiving, Offices, Specialized Areas

UNIT -II

Workstations, Unit Loads & Containers, Conveyors, Vehicles, Lifting Devices, WorkstationMaterial Handling, Ethics in Facility Design

Facilities design procedure and planning strategies, Production, activity and materials flowanalysis, Space requirements and personnel services design considerations.

UNIT -III

Layout construction techniques: systematic layout planning; activity relationship analysis, pairwise exchange, graph-based construction algorithmic.

Material Handling: Material handling principles; material handling equipment and materialhandling systems.

UNIT -IV

Computerized Layout and Analytical Methods: ALDEP, CORELAP, CRAFT, BLOCPLAN,etc. **Warehouse operations**: function, storage operations.

Manufacturing operation: JIT, TQM, AM, CIM, SCM, Facility systems,

Quantitative models: Layout model, waiting line, AS/RS, simulation model, etc.

UNIT -V

Assessment and evaluation of layout alternatives Projects, Use Spiral software to practice plant layout design, Apply mathematical and engineering techniques such as systematic layout planning approach, quantitative model, cost estimate to solve practical facility layout problem.

8

Books and References:

1. Plant Layout and Material Handling, by- James M. Apple, John Wiley & Sons.
2. Plant Layout and Material Handling, by- Fred E. Meyers, Prentice Hall.
3. Facility Layout and Location: An Analytical Approach, by Richard L, Francis, Pearson India.
4. Plant Layout and Material Handling, by- B. K. Aggarwal, Jain Brothers.
5. Plant Layout and Material Handling, by- S. C. Sharma, Jain Brothers.
6. Materials Handling Handbook, by- Raymond A. Kulwiec, John Wiley & Sons.
7. Plant Design and Economics, by- Peters, McGraw Hill Education.
8. Purchasing and Material Management, by- Gopalakrishnan, McGraw Hill Education.

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OPEN ELECTIVES- II

NON-CONVENTIONAL ENERGY RESOURCES

UNIT-I: Introduction :Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant,limitations.

UNIT-II :Solar Thermal Energy: Solar radiation, flat plate collectors and their materials,applications and performance, focussing of collectors and their materials, applications andperformance; solar thermal power plants, thermal energy storage for solar heating and cooling,limitations.

UNIT-III :Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV :Thermo-electrical and thermionic Conversions:Principle of working, performance and limitations.Wind Energy: Wind power and its sources, site selection, criterion, momentum theory,classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems.

UNIT-V :Bio-mass:Availability of bio-mass and its conversion theory.Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle,performance and limitations.Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text/References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.

2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.

3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.

4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.

5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

7. Godfrey Boyle,“ Renewable Energy Power For A Sustainable Future”, Oxford University Press.

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QUALITY CONTROL

UNIT-I

Introduction : Concept and evaluation of quality control. Measurement & Metrology, precisionvs accuracy. Process capability, standrdisation & Interchangeability.

Inspection and Gauges : Inspection methods. Types of Gauges. Limits Fits and Tolerances.Non-Destructive Testings & Evaluation.

UNIT-II

Control Charts for SQC : Statistical Quality Control (SQC). Control charts for variables suchas X, R charts and control charts for attributes such as p-chart, c-chart. Construction & use of the control charts. Process capability.

UNIT-III

Acceptance Sampling for SQC : Principle of acceptance sampling. Producer's and consumer'srisk. Sampling plans –single, double & sequential. Sampling by attributes and variables.

UNIT-IV

Reliability : Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design.Series & Parallel System.

Defect Diagnosis and prevention : Basic causes of failure, curve/control of failure.

MTBF. Maintainability, Condition monitoring and dignostic techniques.

Value Engineering : Elements of value analysis, Techniques.

Unit-V :

TQM : Basic Concept, Quality control , Quality Assurance and Quality Management and Total Quality Management. Implementation of TQM . ISO 9000 and its series, Zero defect. . Taguchi method, Six Sigma concepts.

Other Factors in Quality : Human Factors such as attitude and errors. Material-Quality, Qualitycircles, Quality in sales & service.

Books and Reference:

1. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
2. Maintenance for Reliability by Rao.