List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Mechanical Engineering*

Programme Name : *B.Tech.*

Academic Year: 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	ME3TES07	Mechanics of Solid-I
02.	ME3TES08	Material Science & Metallurgy
03.	ME3TPC01	Kinematics of Machine
04.	ME3TPC02	Applied Thermodynamics
05.	ME4TPC03	Fluid Mechanics
06.	ME4TPC04	Manufacturing Science-I
07.	ME4TPC06	Machine Drawing
08.	ME4T PE11	Business Communication and Presentation Skill
09.	ME5TPC07	Machine Design-I
10.	ME5TPC08	Mechanics of Solid-II
11.	ME5TPC09	Fluid Machinery
12.	ME5TPC10	Internal Combustion Engine Lab
13	ME6TPC11	Dynamics of Machine
14.	ME6TPC12	Machine Design-II
15.	ME6TPC13	Heat & Mass Transfer
16.	ME6TPC14	Manufacturing Science-II
17.	ME6LPS01	Seminar
18.	ME7TPC15	Power Plant Engineering
19.	ME-471	Refrigeration & Air Conditioning
20.	ME-472	Turbo Machinery
21.	ME-473	Vibration
22.	ME-474	CAD-CAM
23.	ME-477	Minor Project
24.	ME-478	Seminar on Summer Training
25.	ME-481	PPC
26.	ME-482	Operations Research
27.	ME-483	Auto Mobile Engineering

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28.	ME-486	Major Project
29.	ME-5102	Theory of Elasticity
30.	ME-5103	Theory of Plasticity
31.	ME-5104	Systems Dynamics
32.	ME-5105	Computer Aided Design
33.	ME-5106	Mechatronics
34.	ME-5107	Advanced Mechanism Design
35.	ME-5108	Experimental Mechanics and Non-Destructive Testing
36.	ME-5109	Engineering Design
37.	ME-5110	Design of Pressure Vessels and Piping
38.	ME-5111	Quality Engineering
39.	ME-5112	Advance Mechanics of Solid
40.	ME-5113	Theory of Vibration
41.	MEPHDT01	Mechatronic System Design
42.	MEPHDT02	Reliability and Maintenance Engineering
43.	MEPHDT03	Composite Materials
44.	MEPHDT04	Material Characterization Techniques
45.	MEPHDT05	Advanced Machining Processes
46.	MEPHDT06	Micro and Precision Manufacturing
47.	MEPHDT07	Industrial Automation

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INSTITUTE OF TECHNOLOGY
GURU GHASIDAS
VISHWAVIDHALAYA

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DEPARTMENT OF MECHNICAL ENGINEERING

STUDY & EVALUATION SCHEME

W.E.F. SESSION 2016-2017

Year: B.Tech. II year

III SEM

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME3THS03	Elective from Humanity Science	3	0	0	40	60	100	3
2.	ME3TBS05	Statistical Methods	3	1	0	40	60	100	4
3.	ME3TES07	Mechanics of Solid-I	3	1	0	40	60	100	4
4.	ME3TES08	Material Science & Metallurgy	3	0	0	40	60	100	3
5.	ME3TPC01	Kinematics of Machine	3	0	0	40	60	100	3
6	ME3TPC02	Applied Thermodynamics	3	0	0	40	60	100	3
		Total	**18**	**02**	**0**	**240**	**360**	**600**	**20**
		PRACTICALS							
1.	ME3LPC01	Kinematics of Machine Lab	-	-	03	45	30	75	2
2.	ME3LES07	Mechanics of Solid-I Lab	-	-	03	45	30	75	2
		Total			**06**	**90**	**60**	**150**	**04**

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DEPARTMENT OF MECHNICAL ENGINEERING

STUDY & EVALUATION SCHEME

W.E.F. SESSION 2016-2017

Year: B.Tech. II year

SEMESTER-IV

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME4TPE01	Professional Elective	3	0	0	40	60	100	3
2	ME4TPC03	Fluid Mechanics	3	0	0	40	60	100	3
3	ME4TPC04	Manufacturing Science-I	3	0	0	40	60	100	3
4	ME4TPC05	Electrical Machine	3	1	0	40	60	100	4
5	ME4TPC06	Machine Drawing	3	0	0	40	60	100	3
6	ME4TBS06	Numerical Analysis & Computer Programming	3	1	0	40	60	100	4
		Total	**18**	**02**		**240**	**360**	**600**	**20**
PRACTICALS									
7.	ME4LPC03	Fluid Mechanics	-	-	03	45	30	75	2
8.	ME4LPC05	Electrical Machine	-	-	03	45	30	75	2
		Total			**06**	**90**	**60**	**150**	**04**

Professional Elective –PE01
ME4T PE01
ME4T PE11 Business Communication and Presentation Skill
ME4T PE12 Renewable energy system and management
ME4T PE13 Energy and environment management

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DEPARTMENT OF MECHANICAL ENGINEERING
STUDY & EVALUATION SCHEME
W.E.F. SESSION 2017-2018

Year: B.Tech. III year SEMESTER-V

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME5TPC07	Machine Design-I	3	1	0	40	60	100	4
2.	ME5TPC08	Mechanics of Solid-II	3	1	0	40	60	100	4
3.	ME5TPC09	Fluid Machinery	3	0	0	40	60	100	3
4.	ME5TPC10	Internal Combustion Engine	3	0	0	40	60	100	3
5.	ME5TPE02	Professional Elective-PE2	3	0	0	40	60	100	3
6	ME5TOE01	Open Elective-OE1	3	0	0	40	60	100	3
Total			18	02	0	240	360	600	20
PRACTICALS									
1.	ME5LPC09	Fluid Machinery lab	-	-	3	30	20	50	2
2.	ME5LPC10	Internal Combustion Engine Lab	-	-	3	30	20	50	2
Total					6	60	40	100	04

Professional Elective-PE2	Open Elective-OE1
~~ME5TPE01~~	~~ME5TOE01~~
ME5TPE21 Industrial Engineering	**ME5TOE11** Innovation and Technology Management
ME5TPE22 Technology and Management	**ME5TOE12** Innovative & Entrepreneurial Skills
ME5TPE23 Simulation Modeling and Analysis	**ME5TOE13** Financial Management
ME5TPE24 Material Management	**ME5TOE14** Management Information System

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Department of Mechanical Engineering

INSTITUTE OF TECHNOLOGY, (SCHOOL OF ENGINEERING & TECHNOLOGY)
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DEPARTMENT OF MECHANICAL ENGINEERING
STUDY & EVALUATION SCHEME
W.E.F. SESSION 2017-2018

Year: B.Tech. III year
SEMESTER-VI

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME6TPC11	Dynamics of Machine	3	1	0	40	60	100	4
2.	ME6TPC12	Machine Design-II	3	1	0	40	60	100	4
3.	ME6TPC13	Heat & Mass Transfer	3	1	0	40	60	100	4
4.	ME6TPC14	Manufacturing Science-II	3	0	0	40	60	100	3
5.	ME6TPE03	Professional Elective-PE3	3	0	0	40	60	100	3
6.	ME6TOE02	Open Elective-OE02	3	0	0	40	60	100	3
		Total	18	3		240	360	600	21
		PRACTICALS							
7.	ME6LPC11	Dynamics of Machine Lab	-	-	3	45	30	75	2
8.	ME6LPC13	Heat & Mass Transfer Lab	-	-	3	45	30	75	2
9.	ME6LPS01	Seminar			3	50	-	50	2
		Total			9	140	60	200	6

Total Credits: 27
Total Contact Hour: 30
Total Marks: 800
*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment/Quizzes/Group Discussion etc.)

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DEPARTMENT OF MECHNICAL ENGINEERING STUDY & EVALUATION SCHEME
W.E.F. SESSION 2015-2016

Year: B.Tech. IV year
SEMESTER- VII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME-471	Refrigeration & Air Conditioning	3	1	-	40	60	100	4
2.	ME-472	Turbo Machinery	3	1	-	40	60	100	4
3.	ME – 473	Theory of Vibration	3	1	-	40	60	100	4
4.	ME-474	Computer Aided Design & Manufacturing (CAD/CAM)	4	-	-	40	60	100	4
5.	ME-475	Elective-I*	3	1	-	40	60	100	4
		Total	16	04		200	300	500	20
PRACTICALS									
6.	ME-476	Refrigeration & Air Conditioning Lab	-	-	3	30	20	50	2
7.	ME-477	Project	-	-	4	50	-	50	2
8.	ME-478	Seminar on Summer Training (About 30 Days)**	-	-	3	50	-	50	2
		Total			10	130	20	150	6

** 30 days summer training after the end semester examination of VI semester and students are required to submitdetailed training report & presentation during the seventh semester.

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Elective - I	
ME – 475 B	Finite Element Method
ME – 475 C	Mechatronics
ME – 475 D	Organization & Management
ME-475 E	Production Planning & Control

Total Credits: 26
Total Contact
Hour: 33Total
Marks: 650
*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment/Quizzes/GroupDiscussion etc.) L-LECTURE, T-TUTORIAL, P-PRACTICAL,CT-CLASS TEST, E.S.E –END SEMESTER EXAMINATION.

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DEPARTMENT OF MECHNICAL ENGINEERING STUDY & EVALUATION SCHEME
W.E.F. SESSION 2015-2016
Year: B.Tech. IV year
SEMESTER- VIII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME-481	Power Plant Engineering	3	1	-	40	60	100	4
2.	ME-482	Operation Research	3	1	-	40	60	100	4
3.	ME-483	Auto Mobile Engineering	4	-	-	40	60	100	4
4.	ME-484	Elective-II*	3	1	-	40	60	100	4
		Total	13	03		160	240	400	16
PRACTICALS									
6.	ME-486	Project	-	-	12	120	80	200	8
7.	ME-487	Comprehensive Viva	-	-	-	-	50	50	2
		Total				120	130	250	6

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Elective – II*	
ME – 485 A	Total Quality Management
ME – 485 B	Enterprise Resource Planning
ME – 485 C	Machine Tool Design
ME – 485 D	Robotics

Total Credits: 26 Total Contact Hour: 28 Total Marks: 650
INTERNAL ASSESSMENT- (MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment /Quizzes/GroupDiscussion etc.)
L-LECTURE, T-TUTORIAL, P-PRACTICAL, CT-CLASS TEST, E.S.E – END SEMESTER EXAMINATION

MTech. (Machine Design) 1st year

Semester: - I

S No.	Course No.	SUBJECT	CONTACT HOURS/ WEEK	EVALUATION SCHEME			Credits
(THEORY)				INTERNAL ASSE	ESE	SUB TOTAL	
1.	ME- 5101	Advance Engineering Mathematics	3	40	60	100	3
2.	ME-	Elective-I	3	40	60	100	3
3.	ME-	Elective-II	3	40	60	100	3
4.	ME-	Elective-III	3	40	60	100	3
5.	ME-	Elective-IV	3	40	60	100	3
Total			**15**	**200**	**300**	**500**	**15**
(PRACATICALS)							
6.		Machine Design Practical	3	30	20	50	2
		Total	18	**230**	**320**	**550**	**17**

of Electives approved for the semester for the Machine Design Specialization

1. ME-5102 Theory of Elasticity
2. ME-5103 Theory of Plasticity
3. ME-5104 Systems Dynamics
4. ME-5105 Computer Aided Design
5. ME-5106 Mechatronics
6. ME-5107 Advanced Mechanism Design
7. ME-5108 Experimental Mechanics and Non Destructive Testing
8. ME-5109 Engineering Design
9. ME-5110 Design of Pressure Vessels and Piping
10. ME-5111 Quality Engineering
11. ME-5112 Advance Mechanics of Solid
12. ME-5113 Theory of Vibration

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M.Tech.(Machine Design) 1st year

Semester: - II

S No.	Course No.	SUBJECT	CONTACT HOURS/ WEEK	EVALUATION SCHEME			Credits
(THEORY)				INTERNAL ASSESSMENT*	ESE	SUB TOTAL	
1.	ME-	Elective-I	3	40	60	100	3
2.	ME-5202	Elective-II(Robotics)	3	40	60	100	3
3.	ME-5203	Elective-III(Finite Element Method)	3	40	60	100	3

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4.	ME- 5204	Elective-IV(Creep, Fatigue & Fracture*)	3	40	60	100	3
5.	ME- 5206	Elective-V (Mechanics of Composite Materials)	3	40	60	100	3
		Total	**15**	**200**	**300**	**500**	**15**

List of Electives approved for the semester for the Machine Design (M.Tech.-II year) Specialization

1. ME 5201 Theory of Vibration
2. ME 5202 Robotics
3. ME 5203 Finite Element Method
4. ME 5204 Creep Fatigue & Fracture
5. ME 5205 Theory of Plates
6. ME 5206 Mechanics of Composite Materials
7. ME 5207 Tribology
8. ME 5208 Non-Linear Vibration
9. ME 5209 Theory of shells
10. ME 5210 Fracture Mechanics

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Note: *This end Semester Examination will be of 4 hours duration & P.S.G. Design data book will be Permitted for use.**In the End Semester Examination, class notes will be permitted but not the books

M.Tech. (Machine Design) 2nd year

Semester: - III

S.No	Course No.	SUBJECT	Internal Assessment	Credits
1.	ME- 6101	Seminar on Dissertation	100	5
2.	ME- 6102	Dissertation- Interim Evaluation	100	5
		Total	**200**	**10**

M.Tech.(Machine Design) 2nd year

Semester: - IV

S.No.	Course No.	SUBJECT	Internal Assessment	ESE (External)	Credits
1.	ME- 6201	Dissertation- Open Defence	100	----	5
2.	ME- 6202	Dissertation- Evaluation*	100	100	10
		Total	**200**	**100**	**15**

Semester M.Tech. Thesis/ dissertation will be evaluated by the internal supervisor as well as by the external examiner appointed for the purpose. The internal and the external examiners both will evaluate the thesis out of 100 marks and the grade will be delivered by taking the average of the marks given by the internal and the external examiner.

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DEPARTMENT OF MECHANICAL ENGINEERING
INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

EVALUATION SCHEME OF Pre-Ph. D COURSE WORK

EFFECTIVE FROM SESSION 2016-17

SN.	Name of the Subject	Subject Code	Periods / Week L – T – P	ESE Duration	ESE MARKS		Credits
					Max.	Min. 50%	
1	Research Methodology in Engineering	ETPHDT00	3 – 1 – 0	3 Hrs.	100	50	4
2	Elective - I	**	3 – 1 – 0	3 Hrs.	100	50	4
3	Elective - II	**	3 – 1 – 0	3 Hrs	100	50	4
4	Seminar	ETPHDS00	-	-	100	50	2
Total			**9 – 3 – 0**	**-**	**400**	**200***	**14**

Duration of the semester will be 6 months.
*Candidate has to score minimum 60% of the aggregate marks to qualify in ESE.
Two core subjects as Electives (4 credits each) to be decided by the DRC.

LIST OF ELECTIVES		**	LIST OF ELECTIVES		**
SN	Name of the Subject	Subject Code	SN	Name of the subject	Subject Code
1	Mechatronic System Design	MEPHDT01	5	Advanced Machining Processes	MEPHDT05
2	Reliability and Maintenance Engineering	MEPHDT02	6	Micro and Precision Manufacturing	MEPHDT06
3	Composite Materials	MEPHDT03	7	Industrial Automation	MEPHDT07
4	Material Characterization Techniques	MEPHDT04			

L : Lecture, T: Theory, P: Practical, Max.: Maximum Marks in ESE; Min.: Minimum Pass Marks in each subject as 50%

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ME3TPC01 -KINEMATICS OF MACHINES

UNIT-1Mechanism and Machines

Links, kinematics pair, classification of kinematics pair, kinematics chain, degree of freedom & constrained motion, mechanism, inversion problem of slider crank mechanism & its inversion, four bar chain etc, equivalent linkage, mechanism with lower pairs, pantograph.

UNIT-2Velocity and Acceleration in Mechanism

Plane motion, absolute and relative motion, velocity and acceleration of a point velocity and acceleration of a mechanism by relative velocity diagram, klein's construction, and coriolis components.

UNIT-3Gear and Gear Train

Classification of gears, spur, helical, bevel, worm gears, spur gear, conjugate action, law of gearing, involutes and cycloidal tooth's profiles, interference and under cutting, contact ratio, gear train, simple, compound and epicyclical gear trains.

UNIT-4 Cams and Followers

Classification of cam and followers, types of follower motion uniform simple, harmonic parabolic, cycloid, Cams profile by graphical method.

UNIT – V

Clutch: single plate and multi plate clutch, cone clutch

Brakes: Analysis & simple brakes assuming uniform pressure and uniform wear, band brake, block brake, internal shoe brake.

Text books:

1. Mechanism of machines By Ghosh and Mallick East West Press
2. Theory of machine By S. Ratan TMGH
3. Theory of Machine ByThomosBeven, C.B.S. Publications

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ME3TES07-MECHANICS OF SOLIDS-I

UNIT-I

State of stress and strain at a point; Engineering stress and strain, Two dimensional and one dimensional state of stress as a particular case of three dimensional stress system, Members under axial compression and tension, temperature stresses in composite members, Principal stresses and Principal planes for Two dimensional stress system, Mohr's stress circle, Hooke's law and stress strain relation, Ductile and Brittle materials, Relationship between elastic constants.

UNIT-II

Bending of beams; shear force and bending moment diagram in beams, bending and shear stresses, composite beams, initially curved beams, leaf spring.

UNIT-III

Deflection of beams; double integration, area moment method, Macaulay's methods, Conjugate beam, method of superposition.

UNIT-IV

Torsion of circular shaft; solid and hollow circular shafts, torsion of thin hollow sections, Torsion beyond elastic limit, closed coil helical spring

UNIT-V

Stability of structure; buckling of columns and beams, eccentrically loaded columns/beams and columns with initial curvature, empirical relations of column design.Theories of failure, thin pressure vessels.

Text Books:

1. Mechanics of material by F.P. Beer & E.R. Johnson Jr. Tata McGraw Hill.
2. Engineering Mechanics of solids by Egor P. Popov., PHI
3. Introduction of solid mechanics by I.H.Shames.

Reference books:

1. An Introduction of mechanics of solid by Crandall, Dahl &Lardnee Tata McGraw Hill.
2. Advance Strength of Materials by L.S. Srinath
3. Strength of Materials by Timoshenko

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ME3TES08-MATERIAL SCIENCE AND METALLURGY

UNIT-I

Introduction: Classification of engineering Materials, metals, non metals, plastics, ceramics and composites. Crystalline structure of solids: concepts of unit cell and space lattice, miller indices, crystal structure determinationby X-ray diffraction. Crystal structure of ferrous and non-ferrous metals, crystal imperfections.

Plastic Deformation: Mechanisms of plastic deformation, role of dislocation, slip and twinning, slipmechanism,strain hardening.

UNIT II

Phase Diagrams, Phases, phase rules, concept of equilibrium, Phase diagram, lever rule, eutectic, eutectoid, peristaltic and peritectoid systems, iron–carbon diagram, and simplified IC diagram.Heat TreatmentIsothermal Transformationof austenite(TTT diagram), Transformations of austenite upon continuous cooling, annealing, normalizing, hardening, tempering,hardenability of steel, Surface hardening, tempering, case hardening, Jominy test forhardenability,recovery, recrystallization and grain growth, Age hardening.

UNIT III

Corrosion: Principles of corrosion forms of corrosion, factors affecting the rate of corrosion. Corrosive agents and protection against corrosion.

Creep: Introduction to creep mechanism,creep curves,creep resistant materials, introduction to fatigue, cold working of metals and hot working.

UNIT IV

Engineering Materials

Ferrous: Cast irons, carbon and alloy steels and their coding

Non-ferrous: Aluminum, copper, nickel, chromium, zinc, lead, tin, tungsten, etc. and their alloys.

Classification, structure, general properties and applications of polymers, ceramics and composites.

UNIT V

Powder Metallurgy: Characteristics of metal powder, Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density, flow rate, friction conditions. Properties of green compacts and sintered compacts.

Machining, milling, atomization, electro-deposition, reduction from oxide, carbonyl process, production of alloy powders, New development.

Powder rolling, powder forging, powder extrusion and explosive forming technique.

Text Books

1 Raghavan. Material Science and Engineering.

2. Swamp. Elements of Metallurgy

3. Vanvlack, Elements of Material Science and Engineering.

4. Aagarwal, B.K Introduction to engineering Materials

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ME3TPC02-APPLIED THERMODYNAMICS

UNIT – IFirst Law of Thermodynamics

First Law of thermodynamics, Closed system, work done, change in Internal energy, heat transferred during various thermodynamic processes, P-V diagrams. Open system, Thermodynamic analysis of control volume, Conservation of energy principle, The steady flow process applied to (i) Nozzles and Diffuser (ii) Turbines and Compressor, (iii) Throttle valve. Unsteady flow process (Simple system like Charging & Discharging of tanks)

UNIT-II Second Law of Thermodynamics

Second law of Thermodynamics Introduction (Law of degradation of Energy) Thermal Energy reservoir, Kelvin-Plank &Clausius Statement, Heat engine, Refrigerator and Heat pump, Reversible and Irreversibleprocesses, Carnot cycle, Thermodynamic temperature scale. Entropy: The Clausius Inequality, Entropy, Principle of increaseof entropy, Change in entropy for Closed and steady flow open systems.Second law analysis of engineering system,Availability, reversible work and Irreversibility.

UNIT–IIIVapour power cycles

Property of steam , P-V chart , T-S chart , H-S chart and application of these chart Carnot and Rankine cycles; Reheating and regenerative feed heating Rankine cycles;Binary vapour cycle; Thermal efficiency and work ratios; Factors affecting efficiency and work output. Condenser, classification, vacuum efficiency, cooling towers, types and application.

UNIT-IV Air Compressors

Classification of air compressors, Advantages, Disadvantages of reciprocating compressors, Working of reciprocating compressor, Equation of work (with & without clearance) volumetric efficiency, Multistage compressors, Efficiency of compressor, Effect of atmospheric condition on output of Compressors, Thermodynamic analysis of reciprocating compressor, Intercooler & External cooler.

UNIT-V

Thermodynamic (PVT) relations of Working Fluids Equation of state for ideal gas; Behaviour of real gases and compressibility factor; Generalized, empirical and theoretical equations of state for real gases; Law of corresponding states and use of generalized compressibility chart; Helmoltz and Gibbs functions; Maxwell's relations; Enthalpy, entropy, internal energy, and specific heat relations; Clausius-Clapeyron's equation; Applications to ideal and real gases **Joule-thomson coefficient.**

Text Books:

.•Nag, P.K.," Engineering Thermodynamics", Tata McGraw Hill, New Delhi
•Thermal Engg. By C.P.Arora Tata McGraw –Hill, New Delhi
•Engg.Thermodynamic& Approach, Cengel& Boles, TMH
•Engg. Thermodynamic, John Hawkins
• Reyner Joel; Engineering Thermodynamics, 5th Ed; Addison Wesley, 1999

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ME4TPC03-FLUID MECHANICS

UNIT–I Properties of Fluid: Fluid ideal and real fluid, properties of fluid, mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modules, Newtonian and non-Newtonian fluids.
Fluid Statics: Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force **on submerged surface and curved surface, law of buoyancy and flotation.**

UNIT – II Fluid Kinematics
Description of fluid motion, Langragian and Eulerian approach, types of fluid flow, types of flow lines-path line, streak line, stream line, stream tube acceleration of a fluid particle, rotational flow, rotation and vorticity, circulation, velocity function, stream and potential function, flow net, its characteristics and utilities. Control volume and surface concept.

UNIT – III Fluid Dynamics
Conservation of Mass: Continuity equation, conservation of momentum, momentum **theorem. Euler's equation. Bernoulli's equation and its practical application. Venturimeter.** Orifice meter, Nozzle, Pitot tube, Rotameter, notches and weirs.

UNIT – IV Turbulance
Basics ofTurbulance, Reynolds stresses, Prandtt's mixing length hypothesis, friction velocity, laws of walls. Dimensional Analysis and Similitude: methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, dimensional number and their significance, concept and types of physical similarity, dynamic similarity, applications of **dynamic similarity.**

UNIT – V- Viscous Flow
Flow through circular pipes, flow between two parallel plates, loss of head due to friction in viscous flow. Kinetic energy corrections & momentum correction factors.
Flow Through pipe: major & minor loss in pipe, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe, power transmission through pipe, water hammer in **pipes.**

Text Books:

1. Modi& Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechnics and machinery; TMH
3. JNIK DAKE; Essential of EnggHyd; Afrikan Network &ScInstt. (ANSTI)
4. Franiss JRD; A Text Book of fluid Mech. for Engg. Student
5. R Mohanty; Fluid Mechanics; PHI
6. Gupta; Fluid Mechanics; Pearson.

Reference Books:

1. Streeter &Wyils. Fluid Mechanics
2.Cengal; Fluid Mechanics; TMH
3.V.L.Shames, Fluid Mechanics

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ME4TPC04-MANUFACTURING SCIENCE - I

UNIT- I

Welding: Classification of welding process, basic principal & scope of application,Principle of Gas and electric arc welding, soldering, brazing, power sources and consumables.TIG& MIG processes and their parameter selection, electrodes, types & coatings, welding defects and remedies.

Resistance welding: principle, equipments& types.

UNIT- II

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances and design considerations, types of moulding sand and their properties, testing, cores boxes, core making, moulding machine.

Melting furnaces and practices: Melting cast iron, steel and non ferrous material, cupola, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

UNIT- III

Casting: Centrifugal and investment casting, shell, plastic and mould methods, melting of cast iron, element of gating system, types and design of riser, solidification of casting, casting defects, clearing of casting, principle of die casting, gravity and pressure die casting, Die casting consideration.

Plastic processing, injection, compression & blow moulding

UNIT- IV

Forming: mechanism of forming process, elastic and plastic deformation.

Rolling: classification, theories of Hot & Cold rolling, rolling mills & its types, calculation of rolling parameter & rolling defect.

forging operations and their classification forging design and defects.

Extrusion: types, extrusion equipments& analysis of processes, drawing of rods, wire tube-analyses of wire drawing, tube drawing, defects in extrusion & drawing.

UNIT- V

Sheet-metal working: Role of sheet Metal Components, cutting mechanism, description of cutting processes blanking, piercing, description of forming processes like bending cup drawing, coining embossing, basic elements of press, classification, punch and die clearances, elements of die and punches ,clearance ,compound ,combination ,progressive and inverted dies and their operations

Text Books:

1. Manufacturing Technology vol.1 , P.N. Rao, T.M.G.H. Publications
2. Manufacturing Science ,Ghose and Mallick, , East West press
3. Material and process of Manufacturing, A.Lindberg Roy, PHI Publication.

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ME4TPC06-MACHINE DRAWING

Unit- I

Drawing conventions,sectional views and sectioning, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs,Convention of gears in mesh,representation of geometrical tolerances on **drawings.**

Machining symbols, Surface roughness, grades , material symbols.

Unit- II

Rivet heads and riveted joints: Lap and butt joint with single and double straps.

Welding joints and their representation, symbols of different joint.

Unit- III

Screw thread and screw fastening, different types of thread profile and nuts, bolts.

Sectional views: keys, cotter joints, knuckle joints

Unit- IV

Shaft coupling, flanged coupling, different types of shaft coupling.

Shaft bearing, bushed bearing, plumber block, foot step bearing.

Pulleys: fast & loose pulleys, stepped pulley's belt pulley, rope pulley.

Unit-V

Assembly drawing of Engine parts like piston, stuffing box, cross-heads, eccentrics, connecting rod: Assembly drawing of stop valve, feed check valve, safely valve, blow off cock.

Assembly drawing of lathe tail stock post.

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Text Books and References Books:

1. **Bhatt.N.D. Machine Drawing**
2. **Gill.P.C. Machine Drawing**
3. **Dhawan RK. Machine Drawing**

ME4T PE11-BUSINESS COMMUNICATION AND PRESENTATION SKILL (Elective)

Unit I

Business communication covering, Role of communication in information age;concept and meaning of communication; skills necessary for technical communication;Communications in a technical organization; Barriers to the process of communication and sola

Unit II

Style and organization in technical communicationcovering, Listening, speaking,reading and writing as skills; Objectivity, clarity, precision as defining features of technicalcommunication; Various types of business writing: Letters, reports, notes, memos; Language andformat of various types of business letters; Language and style of reports; Report writing strategies; Analysis of a sample report

Unit III

Communication and personality development covering, Psychological aspects ofcommunication, cognition as a part of communication; Emotional Intelligence; Politeness and Etiquette in communication; Cultural factors that influence communication; Mannerisms to beavoided in communication; Language and persuasion; Language and conflict resolution;

Unit IV

Language Laboratoryemphasizing Listening and comprehension skills; ReadingSkills; Sound Structure of English and intonation patterns;

Unit V

Oral Presentation and professional speakingcovering, Basics of Englishpronunciation; Elements of effective presentation; Body Language and use of voice duringpresentation; Connecting with the audience during presentation; Projecting a positive image whilespeaking; Planning and preparing a model presentation; Organizing the presentation to suit theaudience and context; Basics of public speaking; Preparing for a speech;

Text books:

1. Fred Luthans, Organizational Behaviour,McGraw Hill
2. Lesikar and petit, Report writing for Business
3. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill
4. Wallace and masters, Personal Development for Life and Work, Thomson Learning

Reference books :

1. Farhathullah, T. M. Communication skills for Technical Students
2. Michael Muckian, John Woods, The Business letters Handbook
3. Herta A. Murphy, Effective Business Communication
4. *MLA* Handbook for Writers of Research Papers

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ME5TPC07 MACHINE DESIGN-I

Unit-I

Steady stresses and variable stresses in machine member: introduction to the design process factors influencing machine design, selection of material based on mechanical properties ,direct, bending and torsional stress equation ,impact and shock loading ,calculation of principle stresses for various load combination ,eccentric loading, factor of safety, stress concentration, fatigue design for variable loading, Soderberg ,Goodman and Gerber relations. Notch sensitivity, cumulative fatigue and effect of mean stress.

Unit-II

Riveted joints: failure of riveted join, strength and efficiency of riveted joint. Design of butt and lap joints for a boiler, eccentrically loaded riveted joint.

Design of thread joints: bolted joint in tension, torque requirement for bolt tightening, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses.

Unit-III

Design of cotter and knuckle joints: socket and spigot cotter joints, sleeve and cotter joint Gibb and cotter joint, design of knuckle joints.

Welded joints: stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment. Stress relieving techniques in welding joints.

Unit-IV

Design of Keys and coupling: flat and square keys, woodruff keys, splines, muff coupling, compression coupling, flange coupling, flexible coupling.

Unit-V

Design of shafts: subjected to twisting moment, bending moment, combined twisting moment and bending moment, design of shaft against static load, fluctuating loads, design of shaft on the basis of rigidity. Principle stresses and theories of failure.

Text Books:

1. V.B.Bhandari, Machine Design, TMH
2. Spott, Machine Design, TMH
3. J.Shigley, Machine Design, TMH
4. Khurmi & Gupta, Machine Design, Khanna Publisher

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ME5TPC08 MECHANICS OF SOLID-II

UNIT-I

Fixed Beams: Fixed beam subjected to different types of loads and couples, calculations of fixing moments and reactions at supports, deflection, effect of sinking of support.

Continuous beams: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron's theorem, effect of sinking of supports

UNIT-II

Flexural Loading Unsymmetrical bending, bending of curved bars, shear centre and stress in Thin-Walled open sections.

UNIT-III

Axisymmetric Problems Thick cylinders under internal and external pressure, compound cylinders (shrink fit), rotating disc and cylinders of uniform and variable thickness, thin spherical shells.

UNIT-IV

Torsion: Torsion of non-circular members, General Prismatic bar, rectangular bars and thin walled sections, membrane analogy, Torsion of hollow sections, plastic yielding of circular shafts. Open and closed coiled helical spring. Spiral and leaf spring.

UNIT-V

Energy Methods: Strain energy expression, strain energy under axial loading, under bending & torsional loading, Maxwell Betti's Reciprocal theorem, Catisliglianos theorem and it applications. Displacement methods; force methods, impact loading, open coiled helical spring.

Text Books:

1. Boresi A.P. & Sidebottom O.M., Advance Mechanics of Materials, John Willey and sons
2. Srinath, L.S., Advanced Mechanics of Materials
3. Seeley F.B. & Smith J.O., Advanced Mechanics of Materials
4. Grandall-Dahl, Mechanics of solid, Lardner, TMH
5. Rattan , Strength of material, 2/E McGraw Hill
6. Popov, Mechanics of solid, PHI

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ME5TPC09 FLUID MACHINERY

UNIT – I

Boundary Layer Theory: Boundary Layer Definition and Characteristics, Momentum Equation, Laminar and Turbulent Boundary Layer, Total Drag, Separation and Control.

Flow around Submerged Bodies: Force Exerted by Flowing Fluid on a Body: Drag and Lift; Stream Lined and Bluff Body, Drag on Sphere and Cylinder, Circulation and Lift on Circular Cylinder, Lift of an Air Foil. Induced drag.

UNIT – II

Impact of Free Jets: Impulse Momentum Principle, Force Exerted by the Jet on Stationary Flat and Curved Plate, Hinged Plate, Moving Plate and Moving Curve Vanes, Jet Propulsion of Ship.

Impulse Turbine: Classification of Turbine, Impulse Turbine, Pelton wheel, Construction Working, Work Done, Head Efficiency and Design Aspects, Governing of Impulse Turbine.

UNIT – III

Reaction Turbine: Radial Flow Reaction Turbine, Francis Turbine: Construction, Working, Work done, Efficiency, Design Aspect, Advantages & Disadvantages over Pelton Wheel. Dimensional analysis of fluid machines, model and prototype.

Axial Flow Reaction Turbine: Propeller and Kaplan Turbine, Bulb or Tubular Turbine, Draft Tube, Specific Speed, Unit Quantities, Cavitation, Degree of Reaction, Performance Characteristics, Surge Tanks, Governing of Reaction Turbine.

UNIT-IV

Centrifugal Pumps: Classification of Pumps, Centrifugal Pump, Construction, Working, Work Done, Heads, Efficiencies, Multistage Centrifugal Pump, Pump in Series and Parallel, Specific Speed, Characteristic, Net Positive Suction Head, Cavitation.

UNIT – V

Reciprocating Pumps: Classification, Component and Working, Single Acting and Double Acting, Discharge, Workdone and Power Required, Coefficient of Discharge, Indicator diagram, Air Vessels.

Fluid system: Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Press, Hydraulic Crane, Hydraulic Lift, Hydraulic Ram, Hydraulic Coupling, Hydraulic Torque Converter, Air Lift Pump, Jet Pump.

Text Books;

1. Massey B.S., Mechanics of Fluid, English Language Book Society (U.K.)
2. S.K. Som & G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH
3. Agarwal, Fluid Mechanics & Machinery, TMH.
4. Kothandraman & Rudra Mourthy, Fluid Mechanics & Machinery, New Age Publication.

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ME5TPC10 INTERNAL COMBUSTION ENGINES

UNIT I

Introduction of internal combustion engines: classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines, application of IC engines.

Air Standard Cycle: Otto cycle, diesel cycle, dual cycle, comparison between otto, diesel and dual cycles, fuel-air cycles and actual-cycles, effect of variable specific heats and dissociation on indicator diagram.

UNIT II

Combustion in S.I. Engines: Flame development and Propagation, ignition lag, effect of air density, temperature, engine speed, turbulence, and ignition timings, physical and chemical aspect of detonation, effect of engine and fuel variable on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., Action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

Carburetor: Principle of carburetion, elements of carburetor, parameters affecting carburetion, air-fuel mixtures, expression for air-fuel ratio.

Fuel ignition system: Battery and coil ignition system, magneto ignition system, firing order, spark advancing.

UNIT III

Combustion in C.I. Engines: Combustion phenomenon in C.I. engines, p- v diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, parameters affecting detonation.

Fuel Injection System: Air and solid injection, fuel pump and injectors.

UNIT IV

Engine Friction and Lubrication: total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system.

Cooling system: Piston and cylinder temperature distribution, parameters affecting engine heat transfer, principles and various methods of cooling.

Two Stroke Engine: Constructional details, scavenging parameters, models and performance of scavenging system, advantages and disadvantages of two stroke engines.

UNIT V

Supercharging: effect of altitude on mixture strength and output of SI engines, low and high pressure supercharging, exhaust, gas turbo-charging, supercharging of two stroke engines. Engine friction and lubrication, Engine cooling system.

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ME6TPC11 DYNAMICS OF MACHINES

UNIT – I

Gyroscope: Gyroscopic forces and couple(Torque), Angular velocity and acceleration of gyroscope, gyroscopic effect on naval ships, gyroscopic effect on airplane and vehicle moving on curved path.

UNIT – II

Inertia force analysis: Effective force and inertia force of a link. D-Alembert's principle and dynamic equilibrium, equivalent offset inertia force, Dynamically equivalent system, velocity and acceleration of piston, inertia forces in reciprocating engine, engine force analysis, inertia of connecting rod, Flywheels, turning moment diagram for single and multi-cylinder I.C. Engine, Co-efficient of fluctuation of speed, Co-efficient of fluctuation of energy.

UNIT – III

Balancing: Static and dynamic balancing, balancing of rotating masses and balancing of reciprocating masses, balancing of locomotives, effect of partial balancing in locomotive balancing of I.C. Engine, balancing of IN-line engine, balancing of V-engine, balancing of radial engine, forward and reverse crank method, balancing of rotors.

UNIT – IV

Governors: Types of governor, centrifugal governor, spring controlled governor, Watt, Porter and Proell, Hartnell, Hartung governor, governor effect, Power stability, Inertia effects. Governor Performance paremeters.

Flywheel: Turning moment diagram for single and multi cylinder internal combustion engine, coefficient fluctuation of speed, coefficient of fluctuation of energy, flywheel

UNIT – V

Introduction to Vibration: One dimensional longitudinal, transverse, and torsional vibrations, natural frequency, effect of damping on vibrations, types of damping, different types of damping. Forced vibration, forces and displacement, transmissibility, vibration isolation, vibration sensors: seismometer and accelerometers Whirling of shafts with single rotor.

Text Books:

1. S.S.Ratan, Theory of machine, TMH.
2. J.E.Shingley, Theory of machines, McGraw Hill
3. A.Ghosh & A.K. Mallik, Theory of mechanisms and machines, EWP Press
4. Thomas Bevan, The Theory of machines, CBS Publisher
5. J.S.Rao & R.V. Dukkipati, Mechanisms and machines Theory, Wiley Eastern Limited

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ME6TPC12 MACHINE DESIGN-II

UNIT – I

Spring: Spring Materials and Their Mechanical Properties. Equation for Stress and Deflection, Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring.

UNIT – II

Gears : Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears, Law of Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth, Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication. Design of gear trains.

UNIT-III

Helical Gears : Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth, Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears.

Bevel Gears: Bevel Gears, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth.

UNIT – IV

Bearings: Rolling Contact Bearings, Types of Ball and Roller Bearings, Selection of Bearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, Shaft Scales – Contact Type and Clearance Type.

Journal Bearings: Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication, Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing Materials.

UNIT – V

Clutches and Brakes: Friction Clutches, Friction Materials, Torque Transmitting Capacity, Single & Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes.

Belt Drive: Flat and V-belts, Belt Constructions, Geometrical Relationships for Length of the Belt, Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts, Adjustment of Belt Tensions. Wire rope and stress in wire ropes.

Chain Drives: Chain drives, roller chains, geometric relationships, dimensions of chain components polygonal effect, power rating of roller chains.

Text Books:

1. V.B. Bhandari, Design of Machine Elements, TMH Publications.
2. Shigley, Machine Design, McGraw Hill Pub.
3. R. Phelan, Principles of Mechanical Design, Mc Graw Hill Pub.
4. Spotts, Machine Design, PHI
5. Norton, Machine Design

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Department of Mechanical Engineering

ME6TPC13 HEAT AND MASS TRANSFER

Unit-I

Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal transfer, thermal diffusivity, overall heat transfer coefficient.

Conduction: The thermal conductivity off solids, liquids and gases, factors in influencing conductivity measurement. The general differential equation of conduction, one dimensional study state conduction, linear heat flow through a plane and composite wall, tube and sphere critical thickness of insulation, effect of variable thermals conductibility, conduction with heat generation in flat and cylinders.

Unit-II

Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins. general conduction analysis, fins of uniforms and non-uniform cross section area. Heat dissipated by a fin. Effectiveness and efficiency of fin. Approximate solution. Design a fins for maximum heat transfer. Solution for different boundary condition. Use of fins analysis for measuring temperature error of thermometer.

Transient/ unsteady state heat conduction: Introduction to unsteady state heating and cooling, system with negligible internal resistance, lumped capacity method and its validity. Unsteady state conduction through finite and semi-infinite slab without surface resistance, convention boundary conditions. Solution through Heisler's chart.

Unit-III

Forced Convection: Physical mechanics of forced convention. Dimensional analysis for forced convention, velocity and thermal boundary, layer, flow over plates, flow across cylinders and spheres, flow in tubes, Reynolds's analogy.

Natural Convection: Physical mechanism of natural convention, Dimensional analysis of natural convention, empirical relationship for natural convention.

Unit-IV

Boiling and Condensation: Boiling heat transfer, pool boiling, boiling regimes and boiling curve, next transfer, correlations in pool boiling. Condensation heat transfer , film condensation, derivation for the average heat transfer coefficient 'h' for the case of laminar film condensation over vertical.

Heat Exchangers: Different type of heat exchanger. Determination of heat exchanger performance, heat exchanger transfer unit, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

Unit-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and nonblack bodies, Kirchhoff's law; intensity of radiation,

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radiation exchange between black surface, geometric configuration factors. Grey body relation exchange between surface of unit configuration factors.

Introduction to mass Transfer: Mass and mole concentrations, molecular diffusion, eddy diffusion, molecular diffusion from an evaporating fluid surface, introduction to mass transfer in laminar and turbulent convection combined heat and mass transfer.

Text Books:

1. S.P. Sukhatme, Heat transfer, TMH
2. Arora & Domkundwar, Heat & Mass Transfer, Dhanpat Rai Publications
3. C P Arora, Heat Transfer, TMH
4. R.C. Sachdeva, Heat & Mass Transfer, New Age
5. J.P. Holman, Heat Transfer, TMH
6. Yunus A. Cengel, Heat Transfer-A Practical Approach

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Department of Mechanical Engineering

ME6TPC14 MANUFACTURING SCIENCE-II

Unit-I

General purpose machine tools: Constructional details of lathe, drilling, milling, shaping, planning machines. Tooling, attachment and operation performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation. Capston and turret lathes, single and multiple spindle automates, operation planning and tool layout.

Jigs and Fixtures: Degree of freedom, principles of location and clamping, locating, clamping and indexing devices, principles of design, design of simple jigs and fixtures.

Unit-II

Mechanics of metal cutting: Classification of metal removal process and machines, geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS & NRS and interrelationship. Mechanism of chip formation and types of chips, chip brakers. Orthogonal and oblique cutting. Cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting.

Unit-III

Machinability: Concept & evaluation of Machinability, tool life and mechanisms of tool failure, cutting parameter, Machinability index, factors effecting Machinability. Cutting Fluids-Types, selection and application methods. Cutting tool material-Requirement of tool material, classification of tool material and their properties.

Unit-IV

Grinding Processes & Gear Cutting: Abrasives: natural and synthetic, manufacturing nomenclature, Selection of grinding wheels, wheel mounting and dressing , surface and cylindrical grinding, their constructional detail and processes. Principle of gear generation, gear cutting by milling machines, gear shaping and gear hobbing machines processes.

Unit-V

Non Conventional Machining: Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by EDM, LBM, EBM, ECM, USM, AJM processes, benefits, generation application and survey of non-conventional machining process.

Text Books:

1. P.N. Rao, Manufacturing technology(Vol.-I & II), TMH
2. S. Kalpakjian & S.R. Schmid, Manufacturing Engg. And technology, Addision Wesley Longman, New Delhi
3. A. Ghosh & A.K. Mallik , Manufacturing science, East West Press Pvt. Ltd., New Delhi
4. Degamo, Manufacturing Engg. And Technology, PHI
5. Sen & Bhattacharya, Manufacturing Science-II

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MEPHDT01-MECHATRONIC SYSTEM DESIGN

Mechatronics System design:

Introduction to Mechatronics-Integrated design issues- Key elementsand design processes-Physical system modelling - Electrical systems-Micro processor based controller and micro electronics- Mechanicaltranslation and rotational systems-Electromechanical coupling-Fluidsystem

Actuating devices:

Direct current motor, Permanent magnet stepper motor, Mechanicalactuation, Hydraulic and pneumatic power actuation devices, Linearand latching linear actuators, Rotatory actuators, Piezo electricactuators, Actuator parameters and characteristics.

Sensors and Transducers:

An introduction to sensors and transducers, sensors for motion andposition, Force torque and tactile sensors, Flow sensors, Temperaturesensing devices, Ultrasonic sensors, Range sensors, Active vibrationcontrol using magnetostructive transducers, Lasers and Optomechatronics based devices.

Software and Hardware components in Mechatronics systems:

Signals , system and controls, system representation, Signalconditioning and devices, PLC, system representation, linearization ofnonlinear systems, Time delays and measurement of systemperformance, Elements of Data acquisition and control systems, realtime interfacing.

***MEMS* and Microsysterns:**

Microsystems and miniaturization- lithography technique- Microactuators- actuation using shape memory alloys, piezo electric crystalsand electrostatic forces- micro valves and pumps-micro sensors-Overview on applications of Robotics in automobiles and otherindustries.

Text books:

1) W. Bolton, Mechatronics, Pearson publications (ISBN 978-81-3176253-3)
2) DevdasShett, Richard A. Kolk, Mechatronics System Design,Brooks/Cole, Thomson learning(ISBN 0-534-95285-2).

Reference Books:

1) John Watton, Fundamentals of Fluid power and control, Cambridge University Press (ISBN 9780521762502)
2) AndrejzM.Pawlak, Sensor and Actuators in Mechatronics, Taylor and Francis (ISBN-13:978-0-8493-9013-5)
3) Tai-Ran Hsu, MEMS and Microsystems design and manufacture,Tata McGraw-Hill(ISBN0-07-048709-X)
4) Stephen A.Campbell, The Science and Engineering ofmicroelectronic fabrication, Oxford university press(ISBN 0-19-568144-4)

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MEPHDT02- RELIABILITY AND MAINTENANCE ENGINEERING

Fundamentals of reliability: Scope of reliability engineering,concept of bath tub curve, types of failure data, reliabilityestimations, constant failure rate models, time dependent failurerate models, concept of failure on demand, reliability estimation ofseries/parallel/mixed/complex system configuration, concepts ofavailability and maintainability.

Design for Reliability: Capturing user's reliability requirements,reliability and/or redundancy allocation/optimization, designmethods, FMEA/FMECA, reliability testing (burn-in testing,
reliability assurance testing, reliability growth testing, acceleratedlife testing), fault tree analysis.

Availability Assessment: Markov modeling approach foravailability estimation.

Maintenance Management: Corrective, preventive and predictivemaintenance. Age and time based preventive maintenance,opportunistic maintenance, concepts of imperfect maintenance,concept of TPM and RCM, maintenance optimization.

Remaining useful life prediction of equipments subject tocondition monitoring: ANN models, ARMA models, Markovmodels, proportional hazard models.

Suggested Books

1. Charles Ebeling, An Introduction To Reliability and Maintainability Engineering. Waveland PrInc; 2 Har/Cdredition, 2009.

2. Igor Bazovsky, Reliability Theory and Practice, DoverPublications (October. 2004).

3. Patrick O'Connor, Practical Reliability Engineering, JohnWiley & Sons Inc.2002.

4. Gregg K. Hobbs, Accelerated Reliability Engineering: HALTand HASS. Wiley .2000.

5. G. Vachtsevanos, F.L. Lewis, M. Roemer, A. Hess and B. Wu,Intelligent Fault Diagnosis and Prognosis for EngineeringSystems. John Wiley & Sons, 2006.

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MEPHDT04-MATERIAL CHARACTERIZATION TECHNIQUES

Introduction: Requirement of different techniques of materialcharacterization for different situations. Mechanical and physicalcharacterization.

Optical Metallographic Techniques: Observation ofmicrostructure. Preparation of samples (polishing, etching etc.)

Mechanical Characterization Processes: Measurement ofhardness. Measurement of fracture toughness through nanoindentation.Adhesion test. Surface profilometry. Tribological studies of materials.

Physical Characterization Processes: Introduction to differentmethods and their applications. X- Ray Diffraction methods for phase identification, residual stresses, texture analysis etc.; Electro-optical andrelated techniques like SEM, TEM, EDS, WDS/EPMA etc.;Surface analysis and related techniques like XPS, AFM etc.;Spectroscopic techniques.

Suggested Books

1. C. R. Brundle, Charles A. Evans, Shaun Wilson,Encyclopedia of materials characterization: surfaces,interfaces, thin films, Material Characterization Series, Surfaces, Interfaces, Thin Films. Butterworth-Heinemann.

2. B.D. Cullity, Elements of X-Ray Diffraction (3rd Edition),Prentice Hall

3. Said Jahanmir, Friction and Wear of Ceramics, CRC Press

4. P J Goodhew, J Humphreys, R Beanland, ElectronMicroscopy and Analysis, 3rd edition, Taylor and Francis,London

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MEPHDT05-ADVANCED MACHINING PROCESSES

Introduction: Types of advanced machining processes (AMPs); evolution, and need. Mechanical Type AMPs: process principle and elements;Mechanism of material removal, parametric analysis; Shape andmaterial applications; Operational characteristics; Limitations ofUSM, AJM, WJM, AWJM processes.

Advanced Fine Finishing Process: Process principle, processequipment, parametric analysis, Applications of Abrasive FlowMachining (AFM), Magnetic Abrasive Finishing; MagnetoRheological Abrasive Finishing (MRF) processes.

Chemical Type AMPs: Process principle and details ofChemical Machining (CHM); Photo-Chemical Machining (PCM),and Bio-Chemical Machining processes (BCM).

Electro Chemical Type AMPs: ECM-Process principle,mechanism of material removal; Kinematics and dynamics anddynamics of ECM; Tooling design; Choice and analysis of process parameters; Surface finish and accuracy.

Thermal Type AMPs: Working principle; Power circuits;Mechanism of material removal; Process parameters andcharacteristics; Surface finish and accuracy, Shape andmaterials applications, limitations of EDM, LBM, EBM, IBM,PAM processes.

Derived and Hybrid AMPs: Introduction of processes likerotary ultra sonic machining (RUM), electro stream drilling(ESD), shaped tube electro machining (STEM), wire electro discharge machining (WEDM), electro chemical grinding (ECG),electro chemical honing (ECH), electro chemical debarring(ECD), and electro-chemical spark machining (ECSM).

Suggested Books:

1. G.F. Benedict, Nontraditional Manufacturing Processes,Marcel Dekker, Inc. New York, 1987.

2. V.K. Jain Advanced Machining Processes, AlliedPublishers, New Delhi, 2002.

3. A. Ghosh, and A.K. Mallik, Manufacturing Science,Affiliated East-West Press Ltd, New Delhi, 1985.

4. P.C. Pandey, and H.S. Shan, Modern MachiningProcesses, Tata McGraw-Hill Publishing Co. Ltd. NewDelhi, 1980.

5. J.A. McGeough, Advance Methods of Machining,Chapman and Hall, London, 1988.

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Mechanical Type AMPs: process principle and elements;Mechanism of material removal, parametric analysis; Shape andmaterial applications; Operational characteristics; Limitations ofUSM, AJM, WJM, AWJM processes.

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Derived and Hybrid AMPs: Introduction of processes likerotary ultra sonic machining (RUM), electro stream drilling(ESD), shaped tube electro machining (STEM), wire electro discharge machining (WEDM), electro chemical grinding (ECG),electro chemical honing (ECH), electro chemical debarring(ECD), and electro-chemical spark machining (ECSM).

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2. V.K. Jain Advanced Machining Processes, AlliedPublishers, New Delhi, 2002.

3. A. Ghosh, and A.K. Mallik, Manufacturing Science, Affiliated East-West Press Ltd, New Delhi, 1985.

4. P.C. Pandey, and H.S. Shan, Modern MachiningProcesses, Tata McGraw-Hill Publishing Co. Ltd, NewDelhi, 1980.

5. J.A. McGeough, Advance Methods of Machining,Chapman and Hall, London, 1988.

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MEPHDT06-MICRO AND PRECISION MANUFACTURING

Micro-manufacturing: Introduction to different mili-machining,micro machining, Nano-machining processes, Micro and nanofinishing processes, Micro-forming, Micro-joining techniques, nano-technology processes, the related process mechanism,process parameters of these processes and their applications toproduction of miniaturized components.

Micro-machines: - Introduction, Mesoscopic domain, Biological systems, cells as machines, Role of proteins, Physics of micro mechanism, Future prospects.

Precision manufacturing: Introduction, concept of accuracy, tolerance and fits, influence of different factors on themaintainability of accuracy of the machine tools and the product, compensation of thermal errors and location errors, effects ofvibration and tool wear, dimensioning and dimensional chains.

Metrology and Characterization Techniques for Micro and Precision Manufactured Products: Profilometric, Microscopic, diffractometric, and electron beam based techniques.

Suggested Books

1. I. Fujimasa, "Micromachines: A New Era in MechanicalEngineering", Oxford Science Publications.
2. J. Paulo Davim, Mark J. Jackson, "Nano andMicromachining", Wiley-ISTE
3. N.P. Mahalik, "Micromanufacturing and Nanotechnology",Springer
4. P.C. Pandey and H.S. Shan, "Modern MachiningProcesses", Tata McGraw Hill Publica tion.
5. V. K. Jain (Ed.), Introduction to Micromachining, NarosaPublishing House, New Delhi, 2010.
6. Yi Qin, Micromanufacturing Engineering and Technology,Elsevier, 2010 (ISBN 13: 978-0-8155-1545-6)
7. R.L. Murty, "Precision Engineering in Manufacturing", New Age International Publishers.
8. C. R. Brundle, Charles A. Evans, Shaun Wilson,Encyclopedia of materials characterization: surfaces,interfaces, thin films, Material Characterization Series, Surfaces, Interfaces, Thin Films, Butterworth-Heinemann.

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MEPHDT07-INDUSTRIAL AUTOMATION

Basic Concepts: Introduction of Mechanization andAutomation, Classification and Strategies of Automation, Reasons for and Arguments against Automation. Mechanical, Electrical, Hydraulic, and Pneumatic Devices and Controls.

High Volume Manufacturing or Hard Automation: AutomatedFlow Lines, Types of Automatic Transfer Mechanisms, Designand Fabrication Considerations, Analysis of Automated Flow Lines.

Assembly Automation: Assembly Systems and their Types, Manual Assembly Lines and Line Balancing, AutomatedAssembly Lines and their Types, Automatic Assembly Transfer Systems, Automatic Feeding and Orienting Devices: Vibratoryand Mechanical Feeders and their types, Orientation of Parts,Performance and Economics of Assembly Systems, Feasibility Study for Assembly Automation.

Design for Assembly: Design for Manual Assembly, Design forHigh-Speed Automatic Assembly, Design for Robotic Assembly.

Programmable Automation: Brief Introduction of NumericalControl (NC), Computer Numerical Control (CNC), Machining Centers, Programmable Robots, Direct Numerical Control(DNC), and Adaptive Control.

Flexible Automation: Introduction of Group Technology (GT), Steps in Implementing GT, Part Families and Machine CellFormation, Introduction of Flexible Manufacturing Systems (FMS).

Suggested Books:

1. M. P. Groover, "Automation, Production systems and Computer Integrated Manufacturing", Prentice-Hall Inc. Englewood Cliffs, 1987. [Indian Edition from Prentice Hall ofIndia, New Delhi].

2. G. Boothroyd "Assembly Automation and Product Design", Marcel Dekker, New York, 1992.

3. G. Boothroyd, P. Dewhurst, and W. Knight "Product Designfor Manufacture and Assembly (2nd Edition)", Marcel Dekker, New York, 2002.

4. G. Boothroyd, C. Poli, and L. E. Murch, "Automatic Assembly", Marcel Dekker Inc. New York, 1982.

5. G. Boothroyd, and A. H. Redford, "Mechanized Assembly: Fundamentals of Parts Feeding, Orientation andMechanized Assembly", McGraw Hill Publishing Co. Ltd., London, 1968

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