List of Courses Focus on Employability/Entrepreneurship/Skill Development

Department :*Mechanical Engineering*

Programme Name :*B.Tech.*

Academic Year:2019-20

List of Courses Focus on Employability/Entrepreneurship/Skill Development

Sr.No.	Course Code	Name of the Course
01.	ME01TES02	Engineering Mechanics
02.	ME01PES02	Engineering Mechanics Lab
03.	ME202PES05	Engineering Graphics
04.	ME201PES03	Workshop Technology &Practices
05.	ME03TPC01	Mechanics of Solid-I
06.	ME03TPC02	Kinematics of Machine
07.	ME03TES04	Engineering Thermodynamics
08.	ME04THS31	Business Communication and Presentation Skill
09.	ME04TPC03	Fluid Mechanics
10.	ME03TPC04	Dynamics of Machine
11.	ME04TPC05	Machine Drawing
12.	ME04TPC04	Manufacturing Science-I
13	ME04PPC03	Fluid Mechanics Lab
14.	ME04PPC04	Dynamics of Machine Lab
15.	ME5TPC07	Machine Design-I
16.	ME5TPC08	Mechanics of Solid-II
17.	ME5TPC09	Fluid Machinery
18.	ME5TPC010	Internal Combustion Engine
19.	ME5TPE21	Industrial Engineering
20.	ME6TPC1	Dynamics of Machine
21.	ME6TPC12	Machine Design-II
22.	ME6TPC13	Heat& Mass Transfer
23.	ME6TPC14	Manufacturing Science-II
24.	ME6LPS01	Seminar
25.	ME7TPC15	Power Plant Engineering
26.	ME7TPC16	Refrigeration &Air Conditioning

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27.	ME7TPC17	CAD-CAM
28.	ME7LPC16	Refrigeration& Air Conditioning Lab
29.	ME7LMP01	Minor Project
30.	ME7LPS02	Seminar on Summer Training
31.	ME7TPE43	Theory of Vibration
32.	ME8TPC18	Auto Mobile Engineering
33	ME8TPC19	Turbo Machinery
34	ME-5111	Theory of Vibration
35	MEP001	Machine Design Practical
36	ME-5104	Computer Aided Design
37	ME-5105	Mechatronics
38	MEPHDT01	Mechatronic System Design
39	MEPHDT02	Reliability and Maintenance Engineering
40	MEPHDT03	Composite Materials
41	MEPHDT04	Material Characterization Techniques
42	MEPHDT05	Advanced Machining Processes
43	MEPHDT06	Micro and Precision Manufacturing
44	MEPHDT07	Industrial Automation
45	MEPHDT08	Engineering Design Methodology
46	MEPHDT09	Finite Element Methods in Engineering
47	MEPHDT10	Fracture, Fatigue and Failure Analysis
48	MEPHDT11	Metal Forming and Theory of Plasticity
49	MEPHDT12	Energy Conservation and Waste Heat Recovery
50	MEPHDT13	Advanced Thermodynamics

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SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
FIRST YEAR , MECHANICAL ENGINEERING
SEMESTER I (COURSE-B)
EFFECTIVE FROM SESSION 2018-19

SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	ME01TBS01	MATHEMATICS-II	3	1	0	30	70	100	4
2	ME01TBS02	CHEMISTRY	3	1	0	30	70	100	4
3	ME01TES01	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	30	70	100	3
4	ME01TES02	ENGINEERING MECHANICS	3	0	0	30	70	100	3
PRACTICAL									
1	ME01PBS01	CHEMISTRY LAB	0	0	3	30	20	50	1.5
2	ME01PES01	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	30	20	50	1.5
3	ME01PES02	WORKSHOP & MANUFACTURING PRACTICES	1	0	3	30	20	50	2.5
4	ME01PES03	ENGINEERING MECHANICS LAB	0	0	2	30	20	50	1
5	ME01PMC01	INDUCTION TRAINING PROGRAMME	-	-	2	-	-	-	-
								TOTAL	20.5

IA – INTERNAL ASSESSMENT ESE – END SEMESTER EXAM. L- LECTURE
T-TUTORIAL P-PRACTICAL

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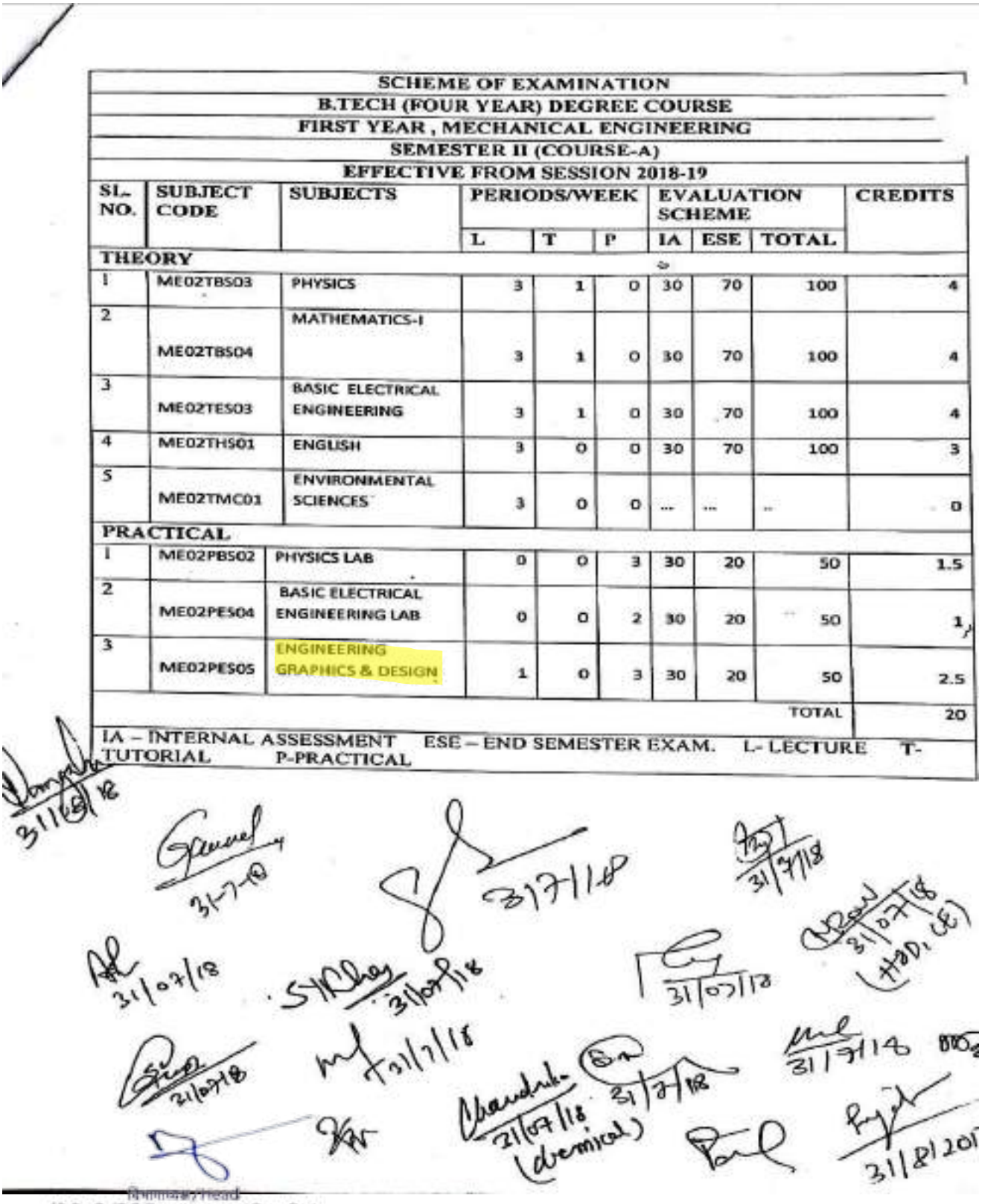
SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
FIRST YEAR , MECHANICAL ENGINEERING
SEMESTER II (COURSE-A)
EFFECTIVE FROM SESSION 2018-19

SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	ME02TBS03	PHYSICS	3	1	0	30	70	100	4
2	ME02TBS04	MATHEMATICS-I	3	1	0	30	70	100	4
3	ME02TES03	BASIC ELECTRICAL ENGINEERING	3	1	0	30	70	100	4
4	ME02THS01	ENGLISH	3	0	0	30	70	100	3
5	ME02TMC01	ENVIRONMENTAL SCIENCES	3	0	0	...	...	..	0
PRACTICAL									
1	ME02PBS02	PHYSICS LAB	0	0	3	30	20	50	1.5
2	ME02PES04	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	30	20	50	1
3	ME02PES05	ENGINEERING GRAPHICS & DESIGN	1	0	3	30	20	50	2.5
								TOTAL	20

IA – INTERNAL ASSESSMENT ESE – END SEMESTER EXAM. L- LECTURE T- TUTORIAL P-PRACTICAL



DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2019-2020

Year: B.Tech. 2ND year
SEMESTER- III

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME03THS02	Elective from Humanity Science HS-02	3	0	-	30	70	100	3
2.	ME03TBS05	Statistical Methods	3	1	-	30	70	100	4
3.	ME03TPC01	Mechanics of Solid-I	3	1	-	30	70	100	4
4.	ME03TPC02	Kinematics of Machine	3	1	-	30	70	100	4
5.	ME03TES04	Engineering Thermodynamics	3	1	-	30	70	100	4
6.	ME03TPE01	Professional Electives-01	3	0	-	30	70	100	3
		Total	**18**	**4**	**-**	**180**	**420**	**600**	**22**
PRACTICALS									
1.	ME03PPC01	Kinematics of Machine Lab	-	-	2	30	20	50	1
2.	ME03PPC02	Mechanics of Solid-I Lab	-	-	2	30	20	50	1
Total			**0**	**0**	**4**	**60**	**40**	**100**	**2**

Total Credits: 24
Total Contact Hour: 26
Total Marks: 700
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME03THS02 Electives from Humanity Science-02	**ME03TPE01 Professional Electives-01**
ME03THS21 Engineering Economics	ME03TPE11 Material Science & Metallurgy
ME03THS22 Work study and ergonomics	ME03TPE12 Powder Metallurgy
ME03THS23 Employee Relations	ME03TPE13 Material Management

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DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2019-2020

Year: B.Tech. 2ND year
SEMESTER- IV

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME04THS03	Elective from Humanity Science HS-03	3	0	-	30	70	100	3
2.	ME04TBS06	Numerical Analysis & Computer Programming	3	1	-	30	70	100	4
3.	ME04TPC03	Fluid Mechanics	3	1	-	30	70	100	4
4.	ME03TPC04	Dynamics of Machine	3	1	-	30	70	100	4
5.	ME04TPC05	Machine Drawing	3	0	-	30	70	100	3
6.	ME04TPC04	Manufacturing Science-I	3	0	-	30	70	100	3
		Total	**18**	**3**	**-**	**180**	**420**	**600**	**21**
PRACTICALS									
1.	ME04PPC03	Fluid Mechanics Lab	-	-	2	30	20	50	1
2.	ME04PPC04	Dynamics of Machine Lab	-	-	2	30	20	50	1
Total			**0**	**0**	**4**	**60**	**40**	**100**	**2**

Total Credits: 23
Total Contact Hour: 25
Total Marks: 700
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

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ME04THS03 Electives from Humanity Science-03
ME04THS31 Business Communication and Presentation Skill
ME04THS32 Renewable energy system and management
ME04THS33 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
ME5TPE02	**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

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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 MECHANICAL ENGINEERING
CBCS,STUDY & EVALUATION SCHEME
W.E.F. SESSION 2018-2019

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.	ME7TPC15	Power Plant Engineering	3	1	0	40	60	100	4
2.	ME7TPC16	Refrigeration & Air Conditioning	3	1	0	40	60	100	4
3.	ME7TPC17	CAD-CAM	3	1	0	40	60	100	4
4.	ME7TPE04	Professional Elective-PE04	3	0	0	40	60	100	3
5.	ME7TOE03	Open Elective-OE03	3	0	0	40	60	100	3
		Total	15	03	0	200	300	500	18
		PRACTICALS							
1.	ME7LPC16	Refrigeration & Air Conditioning Lab	-	-	3	30	20	50	2
3.	ME7LMP01	Minor Project	-	-	4	50	-	50	2
4.	ME7LPS02	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 submit certificate, detailed training report &make presentation during the seventh semester.

Total Credits: 24, Total Contact Hour: 28, Total Marks: 650

*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, one Class Test of 10 marks. Assignment/Quizzes/Group Discussion etc. of 10 marks

L-LECTURE, T-TUTORIAL, P-PRACTICAL,CT-CLASS TEST, E.S.E –END SEMESTER EXAMINATION.

Professional Elective –PE4	Open Elective-OE03
ME7TPE04	ME7TOE03
ME7TPE41 Analysis and Synthesis of Mechanism	**ME7TOE31**Principle of Management
ME7TPE42 Gas Dynamics and Jet propulsion	**ME7TOE32** Optimization in Engineering Design
ME7TPE43 Theory of Vibration	**ME7TOE33** Microprocessors in Automation

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DEPARTMENT OF MECHANICAL ENGINEERING
CBCS,STUDY & EVALUATION SCHEME
W.E.F. SESSION 2018-2019

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.	ME8TPC18	Auto Mobile Engineering	3	0	0	40	60	100	3
2.	ME8TPC19	Turbo Machinery	3	1	0	40	60	100	4
3.	ME8TPE05	Professional Elective-PE05	3	0	0	40	60	100	3
4.	ME8TOE04	Open Elective-04	3	0	0	40	60	100	3
Total			12	1	0	160	240	400	13
PRACTICALS									
4.	ME8LMP02	Major Project	-	-	12	120	80	200	10
Total					12	120	80	200	10

Total Credits: 23, Total Contact Hour: 25, Total Marks: 600
INTERNAL ASSESSMENT- (MSE- Mid Semester Examination of 20 Marks, one Class Test of 10 marks. Assignment /Quizzes/Group Discussion etc. of 10 marks.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, CT-CLASS TEST, E.S.E – END SEMESTER EXAMINATION

Professional Elective –PE5	Open Elective –OE4
ME8TPE05	ME8TOE04
ME8TPE51 Total Quality Management	ME8TOE41 Supply Chain Management
ME8TPE52 Cryogenic Engineering	ME8TOE42 Operation Research
ME8TPE53 Robotics and Robot Applications	ME8TOE43 Maintenance Management
ME8TPE54 Finite Element Analysis	ME8TOE44 Intellectual Property Rights

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Department of Mechanical Engineering, School of Engineering & Technology, GGV, Bilaspur (C.G.)

SCHEME OF STUDY AND SYLLABUS

M. Tech (Machine Design) 1st year

w.e.f. 2019-2020

Semester: -I

S. No.	Course Code	SUBJECT	CONTACT HOURS /WEEK	EVALUATION SCHEME			Credits
(THEORY)				INTERNAL ASSESSMENT	ESE	SUB TOTAL	
1.	ME-5101	Advanced Engineering Mathematics	3	40	60	100	3
2.	ME-5110	Advance Mechanics of Solid	3	40	60	100	3
3.	ME-5111	Theory of Vibration	3	40	60	100	3
4.	ME-	Elective-I	3	40	60	100	3
5.	ME-	Elective-II	3	40	60	100	3
		Total	**15**	**200**	**300**	**500**	**15**
(PRACTICALS)							
6.	ME-P001	Machine Design Practical	3	30	20	50	2
		Total	**18**	**230**	**320**	**550**	**17**

Total credit =17, Total Marks = 550, Contact Hours= 18

List of Electives approved for the semester for the Machine Design Specialization

1. ME-5102 Theory of Elasticity
2. ME-5103 Systems Dynamics
3. ME-5104 Computer Aided Design
4. ME-5105 Mechatronics
5. ME-5106 Advanced Mechanism Design
6. ME-5107 Experimental Mechanics and Non Destructive Testing
7. ME-5108 Engineering Design
8. ME-5109 Design of Pressure Vessels and Piping

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DEPARTMENT OF MECHANICAL ENGINEERING
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EVALUATION SCHEME OF Pre-Ph. D COURSE WORK

EFFECTIVE FROM SESSION 2018-19

SN.	Name of the Subject	Subject Code	Periods / Week L – T – P	ESE Duration	ESE MARKS Max.	ESE MARKS Min. 50%	Credits
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	-	-	-	-	-
Total			9 – 3 – 0	-	300	-	12

LIST OF ELECTIVES SN	Name of the Subject	** Subject Code	LIST OF ELECTIVES SN	Name of the subject	** Subject Code
1	Mechatronic System Design	MEPHDT01	8	Engineering Design Methodology	MEPHDT08
2	Reliability and Maintenance Engineering	MEPHDT02	9	Finite Element Methods in Engineering	MEPHDT09
3	Mechanics Of Composite Materials	MEPHDT03	10	Fracture, Fatigue and Failure Analysis	MEPHDT10
4	Material Characterization Techniques	MEPHDT04	11	Metal Forming and Theory Of Plasticity	MEPHDT11
5	Advanced Machining Processes	MEPHDT05	12	Energy Conservation and Waste Heat Recovery	MEPHDT12
6	Micro and Precision Manufacturing	MEPHDT06	13	Advanced Thermodynamics	MEPHDT13
7	Industrial Automation	MEPHDT07			

L: Lecture, T: Theory, P: Practical, ESE: End Semester Examination

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SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE201TES01 / CE202TES03	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	ENGINEERING MECHANICS	3	1	-	15	15	30			

Course Learning Objectives:

To learn about

- The concepts Force systems, free body diagrams, resultant of forces and equations of equilibrium, Supports and support reactions and calculation of Centroid
- The Concept of moment of inertia of plane figures, Laws and applications of friction
- The Analysis of the truss and determination of axial forces by Method of Joints
- Motion of a body and their relationships and application of D Alembert's principle in rectilinear and curvilinear motions

Course Content:

UNIT- 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems

UNIT-2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies.
Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; Simple Trusses; Zero force members.

UNIT 3: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

UNIT-4: Virtual Work and Energy Method-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency.
Review of particle dynamics- Rectilinear motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-5: Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems, D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CE2011ES01/ CE202PES04	L	T	P	IA	MSE	TOTAL	20	50	1
Subject:	ENGG MECHANICS LAB	-	-	2	30	--	30			

Course Learning objectives:

- To perform the practical giving basic understanding to fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- To perform the practical giving basic understanding to fundamental application of mechanics like screw jack, winch crab and simple wheel and axle

Course Content:

List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

Course Outcome: At the end of the course students will be able to:

- Verify the fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- Analyze the friction coefficient between two surfaces
- Calculate the efficiency of screw jack, winch crab and wheel and axle

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	ME201PES02 / ME202PES04	L	T	P	IA	MSE	TOTAL	20	50	2
Subject:	WORKSHOP TECHNOLOGY & PRACTICES	1	0	2	30	--	30			

Course Learning Objectives:

- To impart student knowledge on various hand tools for usage in engineering applications.
- Be able to use analytical skills for the production of components.
- Design and model different prototypes using carpentry, sheet metal and welding.
- Make electrical connections for daily applications.
- To make student aware of safety rules in working environments.

Course Content:

Lectures & videos:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

Textbooks/References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishersprivate limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
(iv)Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc-Graw Hill House, 2017.

Course Outcomes: At the end of the course students will be able to:

- Make half lap joint, Dovetail joint and Mortise &Tenon joint
- Produce Lap joint, Tee joint and Butt joint using Gas welding
- Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools
- Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	ME201PES01/ ME202PES03	L	T	P	IA	MSE	TOTAL	20	50	3
Subject:	ENGINEERING GRAPHICS	1	0	3	30	--	30			

Course Learning Objectives:

- To learn the basic of Engineering Drawing and Orthographic Projections
- To learn the Sections and Sectional Views of Right Angular Solids
- To learn the Isometric Projections covering and overview of Computer Graphics

UNIT 1: Introduction Engineering Graphics and Engineering Curves: Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Engineering Curves - Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids, Involutes and trochoid.

UNIT 2: Projection of Points, Straight lines and Planes: Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Projections of regular planes, inclined to both planes

UNIT 3: Projections Solids: Introduction, Type of solid, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

UNIT 4: Section of Solids and Development of Surfaces: Sectioning of regular solids - Section planes perpendicular to one plane and parallel or inclined to other plane - Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT 5: Isometric Projections and Orthographic Views: Principles of Isometric Projections-Isometric Scale- Isometric Views Conventions-Plane Figures, Simple and Compound Solids, Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric projections, vice-versa. Introduction to perspective projection.

Computer Aided Drafting: Introduction to computer aided drafting package to make 2-D drawings. Demonstration purpose only - not to be included in examinations.

Textbooks/References:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. CAD Software Theory and User Manuals

Course Outcomes:

1. At the end of the course, the student shall be able to
2. Draw engineering curves, orthographic projections of lines, planes and solids.
3. Draw sections of solids including cylinders, cones, prisms and pyramids.
4. Make development of surfaces, Orthographic and Isometric projections
5. Overview of Computer Graphics.

ME3TPC01 -KINEMATICS OF MACHINES

UNIT-1 Mechanism 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-2 Velocity 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-3 Gear 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

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

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

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

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; Reading
Skills; 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

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

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.

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.

Text Books and References Books:

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

Department of Mechanical Engineering

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

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

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.

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.

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

Department of Mechanical Engineering

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, McGraw Hill Pub.
4. Spotts, Machine Design, PHI
5. Nortan, Machine Design

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,

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

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

ME7TPC15 POWER PLANT ENGINEERING

Course Objectives

- To impart knowledge on sources of energy and types of power plants
- To understand construction and working of Steam Power Plants, Hydro Electric power station, diesel powe station, and Nuclear Power Station.
- To impart knowledge about various performance characteristics and its analysis
- To impart knowledge about variable load problem
- To impart knowledge about terms and factors associated with power plant economics

Course Outcomes

- Demonstrate a basic understanding of various types of power plants.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems associated with power plants.
- Compare different energy resources and choose the most appropriate based on local conditions
- Perform simple techno-economical assessments of energy resources
- Design power plant that meet specific energy demands, that are economically feasible and have a minimal impact on the environment

UNIT-I

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam andheating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

UNIT-II

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

UNIT-III

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

UNIT-IV

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems

UNIT-V

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

ME7TPC16 REFRIGERATION & AIR CONDITIONING

Course Objectives

1. Learning the basic principles and different methods of producing refrigeration effect.
2. Study of various refrigeration cycles and evaluate performance using P-h, T-s charts and/ or refrigerant property tables.
3. Comparative study of different refrigerants with respect to properties, applications and environmental issues.
4. Understand the basic air conditioning processes on psychometric charts, calculate cooling load for window A.C. and to study how to calculate load on different types of A.C.
5. Study of the working principle of various components, used in refrigeration and air conditioning systems.

Course Outcomes

1. Estimate the cooling load for air conditioning systems used for various applications.
2. Calculate the various properties of moist air by conducting test on Window A.C.
3. Estimate refrigeration effect and coefficient of performance by conducting test on vapor compression refrigeration system.
4. Able to know the properties, applications and environmental issues of different refrigerants.
5. Use of P-h, T-S and Psychrometric charts to solve refrigeration and Air conditioning design problems
6. Explain the working principle of various components of Vapour Compression refrigeration system.

UNIT I

Principles of Refrigeration:Thermodynamics of refrigeration Carnot, reversed carnot cycle, heat pump, and refrigerating machine coefficient of performance unit refrigeration methods conventional refrigeration systems. Air refrigeration system Bell Coleman cycle COP capacity work and refrigerant flow requirements in Bell Coleman cycle.

UNIT II

Vapor compression system: Simple cycle- comparison with carnot cycle, theoretical and actual cycles-COP-effect of operating parameters on COP wet, dry and superheated compression-sub cooling actual cycle representation on TS and PH diagrams, Ozone depletion and global warming issues, simple problems Advanced vapor compression and evaporation systems cascading simple problems.

UNIT III

Vapor absorption refrigeration systems:Simple cycle's actual cycle ammonia water and lithium bromide water systems- COP Electrolux system. Refrigerant and their properties. Nomenclature suitability of refrigerants for various applications unconventional refrigeration methods vortex tube, steam jet, magnetic refrigeration and thermoelectric refrigeration applied refrigeration house hold refrigerator unit air conditioners and water coolers ice plant cold storage.

UNIT – III

Production of low temperature - cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics. Nonconventional refrigeration system-thermo-electric refrigeration, vortex tube, steam jetrefrigeration system.

Refrigerants: classification, properties & selection of refrigerants.

UNIT – IV

Refrigeration system components: water and air cooled condensers, evaporative condensers expansion devices capillary tube constant pressure expansion valve thermostatic expansion valve float valve and solenoid valve evaporators, natural convection coils flooded evapoartors direct expansion coils. Reciprocating compressors single stage and multistage compressors work done optimum pressure ratio effect of intercooling volumetric efficiency, effect of clearance isothermal and adiabatic efficiency Rotodynamic compressors screw and vane type compressors principle of operation hermetic semi hermetic and open type refrigeration compressors.

UNIT V

Principles of air conditioning: Psychrometry and psychrometric chart, human comfort, effective temperature comfort chart. Applied psychrometry sensible heat factor psychrometric process problems. Winter air conditioning heating load calculations humidifiers and humidistat. Summer air conditioning cooling load calculations year round air conditioning unitary and central systems principles of air distributions design of air duct systems.

Text Books:

1.Refrigeration and Air Conditioning C. P. Arora - TMH.
2.Refrigeration and Air Conditioning – Manohar Prasad – New-Age International Pub
3. Refrigeration and Air Conditioning – Arora&Domkundwar – DhanpatRai& Sons
4. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub
5. Stoecker W.F. and Jones J.W., Refrigeration and air conditioning, McGraw Hill.
6. Jordan and Prister, Refrigeration and air conditioning, Prentice Hall of India

ME7TPC17COMPUTER AIDED DESIGN & MANUFACTURING (CAD/CAM)

Course Objectives

- To introduce the student to CAD/CAM terminology & its capabilities.
- To become familiar with CAD/CAM software, Graphical user interface & basic tools.
- To recognize geometric and graphical elements of engineering design problems
- To apply a "hands-on" understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects
- Integrate the CAD system and the CAM system by using the CAD system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information.

Course Outcomes

- Understand the various CAD/CAM and CNC processes.
- Generate and verify the tool path and NC programs for milling and drilling manufacturing processes.
- Recognize various types of Curves, surface and Solid and their application as used in geometric modeling.
- Write and prove sample part programs for CNC machining
- Plan and execute the production activity control, which actually deals with operations in the shop floor.

UNIT-I

Basics of CAD:Basics fundamental of Computer Graphics, Principle of computer graphics, Product life cycle, Concept of Computer Aided Design (CAD) and architecture, Hardware and software, Color management,

Raster graphics, Graphics standard, Graphic primitives, lines, andCircle Drawing algorithms, Software documentations, CAD standards GKS, OpenGL, Data exchange standards- IGES, STEP, CALS etc, Communication standards.Standards for vexchange images.

UNIT- II

Geometric Modeling of Curves, Surface and Solid: Basics representation of curves, Parametric and non-parametric curves, Mathematical representation of curves, Hermitecurves, Bezier curves,B-spline curves and rational curves.

Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces, Basic concept of solid modelling technique, CSG and B-rep method for solid generation.

UNIT – III

Geometric Transformation: Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation, Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations,Visual realism- hidden line-surface-solid removal algorithms, shading, colouring, computer animation,Concurrent Engineering

UNIT – IV

Basics of CAM: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, problems with conventional, NC, CNC.

Part Programming: Introduction to NC part programming, manual part programming, Computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

UNIT- V

Advance Manufacturing System:Concept of distributed numeric control (DNC) system, and its advantages and disadvantages of over NCand CNC, Concept of computer integrated method (CIM), Flexible manufacturing system(FMS), benefits and applications of CIM and FMS, Group Technology(GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), Automated guided vehicle(AGV).

Text Books:

1. Principles of Computer Gra[hics, W. M. Neumann and R.F. Sproul, McGraw Hill
2. Computer Graphics, D. Hearn and M.P. Baker, Prentice Hall Inc
3. Production System & Automation, Groover, Prentice Hall, India
4. CAD/CAD Theory & Practice-I.Zeid& R. Sivasubramanium, TMH
5. CAD/CAM. Groover& Zimmer, Prentice Hall, India
6. Computer Graphics & CAD, Ramamurthy, T.M.H.
7. Industrial Robotics & CIM, Surendra Kumar I.B.H.
8. CAD/CAM, P.N.Rao, Prentice Hall, India.
9. CAM T.C. Chang & Wang, Pearson.

Reference Books:

1. Mastering CAD CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
2. CAD/CAM Principles, C. McMohan and J. Browne, Pearson Education

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ME7TPE43 THEORY OF VIBRATION

Course Objectives

- To understand the fundamentals of Vibration
- To be able to mathematically model real-world mechanical vibration problems

Course Outcomes

- Ability to apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems.
- Ability to model reciprocating and oscillatory motions of mechanical systems
- Ability to model undamped and damped mechanical systems
- Ability to model free and forced vibrations
- Ability to model single- and multi-degree of freedom systems
- Ability to analyze of discrete vibrating systems.

UNIT I

Element of vibration system: lumped mass, stiffness and damping, simple harmonic motion, vector representation.
Single degree of freedom system: equation of motion by energy method & Newton law of motion, general solution, free and forced vibration.

UNIT II

Damped and undamped motion- Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating and reciprocating unbalance, vibration absorber, Seismic instruments. Transient vibration: - impulse response, Convolution integral, Fourier analysis.

UNIT III

Multi degree freedom system: Equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of modes, modal analysis, Lagrange's equation.

UNIT IV

Natural frequency numerical solution: Rayleigh's method

UNIT V

Continuous system: Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh's quotient, Rayleigh's-Ritz method.

Text Books:

1. Tse.S,Morse R Rolland T , Hinkle, Ivan E. "Mechanical vibrations theory and applications Published by Allyn and Bacon ,Tne
2. Thomson T. Milliam "theory of vibrations with applications" Prentice Hall of India
3. HartogDen ,J.P. "mechanical vibrations" Tata McGraw Hills, 4th edition 1956)

Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255).

UNIT IV

Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features.

UNIT V

Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, ZTransforms, Digital Filters, Implementation of Digital Algorithm.

Text Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHILearning Private Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino,Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, RameshGaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall

ME7LPC16 REFRIGERATION & AIR CONDITIONING LAB

Course Objectives

- Learning the fundamental principles and different methods of refrigeration and air conditioning
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.

Course Outcomes

- Study of refrigerant compressors, expansion devices used in vapour compression refrigeration system, thermostat with range and differential setting, charging of refrigeration system
- Trial on pilot ice plant to evaluate cycle performance and actual coefficient of performance
- Participate in a group atmosphere for the understanding of an industrial refrigeration system.
- Communicate effectively both verbally and in written form through the preparation of journal report and practical presentation.

ME7LMP01 MINOR PROJECT

Course Objectives

- To offer students a glimpse into real world problems and challenges that need Mechanical Engineering knowledge
- To enable students to create very precise specifications of the IT solution to be designed.
- To introduce students to the vast array of literature available of the various research challenges in the field of Mechanical Engineering

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- To create awareness among the students of the characteristics of several domain areas where Mechanical Engineering information can be effectively used.
- To enable students to use all concepts of Mechanical Engineering in creating a solution for a problem

Course Outcomes

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

- Identify a topic in advanced areas of Mechanical Engineering.
- Review literature to identify gaps and define objectives & scope of the work.
- Generate and implement innovative ideas for social benefit.
- Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.

ME7LPS02 SEMINAR ON SUMMER TRAINING

Course Objectives

- Prepare graduates with a broad knowledge of mechanical engineering technology practices applicable to many different industry types.
- Prepare graduates with key knowledge and skills in applied design, analysis, manufacture, test, and assembly of mechanical systems.
- To provide the students with in depth knowledge about career fields and develops the job-related skills.
- Prepare graduates to be productive contributors in professional practice, graduate school, or some other career path.
- Prepare graduates who know how to act in a professional manner, can continue to learn, and are capable of adapting to a continuously changing work environment.
- Prepare graduates who can communicate effectively and who can contribute as members of a team.

Course Outcomes

- Identify and compare technical and practical issues related to the area of course specialization.
- Outline annotated bibliography of research demonstrating scholarly skills.
- Prepare a well organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.
- Prepare and conduct oral presentations.

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MERTPC18AUTO MOBILE ENGINEERING

Course Objectives

- Understand the basic structure of an automobile
- Understand construction of suspension system
- Understand transmission system and its elements
- Understand braking system, steering system and electrical system

Course Outcomes

- Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.
- Acquire knowledge and hands-on competence in the design and development of automobile.
- Graduates will demonstrate the ability to identify and solve automobile engineering maintenance problems.

UNIT I

Introduction of an automobile, component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction &specifications. Wheel andtyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factor affecting tyre life.

UNIT-II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box synchro mesh gear box, cylindrical gear box, torque converter, propeller shaft, universal joint, hooks joint, final drive, differential, performance of gear box.

UNIT III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch, and fluid fly wheel. Suspension system: function and requirement, leaf spring, torsion bar, telescopic shock absorber.

UNIT IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder,self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

UNIT V

Front axle and suspension wheel alignment purpose, factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.
Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection(MPFI),component of MPFI, Different sensors of MPFI system; vehicle air conditioning, Catalytic connectors, engine troubles & repairs.

Text Books:

1. Automobile Engineering Kripal Singh Vol. I, II
2. Automobile Mechanics Joseph Heitner.
3. Automobile Engineering Giri N.K
4. Automobile Engineering by Shrinivasan T.M.G.H.

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ME8TPC19TURBO MACHINERY

Course Objectives

1. The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as steam turbines, gas turbines, compressors. It will focus on applications in power generation, transport, refrigeration.
2. Analyze the performance of turbo machinery.

Course Outcomes

1. Learning of basic principles, governing equations and applications of turbomachines
2. Determine the velocity triangles in turbomachinery stages.
3. Analyze energy transfer through graphical and analytical methods in turbo machines.
4. Able to know the compounding of steam turbine.
5. Able to know the effect of compressibility for flow of air and steam through nozzles/ducts.

UNIT I

Gas dynamics: Isentropic flow, Shock waves, fanno& Raleigh lines, lines converging diverging nozzles flow, adiabatic flow with friction in conducts. Frictionless flow & steady isothermal flow through ducts with heat transfer, design performance of steam nozzle.

UNIT II

General analysis of turbo machines: Turbo machines, compressible flow machines, incompressible flow machine, turbine & compressor stages, radial stages, mixed flow stages, impulse stages, reaction stages multi stage machine, polytropic& isentropic efficiency Euler energy equation, work & efficiency of turbine stages, optimum performance of stage, effect of degree of reaction. Steam turbines-Impulse turbines, velocity diagram, influence of ratio of blade speed & steam speed on blade efficiency in single stage turbine efficiency, impulse blade section, choice of blade angles.

UNIT III

Impulse-reaction turbine: Impulse-Reaction turbines, degree of reaction, height of reaction blading, stages efficiency of impulse-Reaction turbines with half degree of reaction, various losses in steam turbines. State points &reheat factors: State point locus, h-s charts for multi stages turbines, condition curve, reheat factor, internal efficiency. Governing: requirement of steam turbine, Governing, function of governing, nozzles & throttle governing method & their effect on performance, William's line.

UNIT IV

Gas turbine: Principles of Gas turbine, open & closed cycle, Efficiency &work out put, reheat cycle with heat exchanger, regenerative cycle, performance of practical Gas turbine cycle, compressor & turbines efficiency, pressure losses, mechanical losses, performance from design point of view, calculation for simple &practical cycle, polytrophic Efficiency,general performance of simple cycle.

UNIT V

Turbo compressors: Centrifugal & axial flow Compressor, Components comparison, theory &performance of Compressor, multi stage Compression with inter cooling, surging & chocking, H.P. Requirement, Efficiency, blade-angles, surging & stalling, losses and redial equilibrium theory

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ME- 5104 COMPUTER AIDED DESIGN

Basics of CAD, CAD system evaluation criteria, Principle of computer graphics, Hardware and software, Color management, Raster graphics, Graphics standard, Graphic primitives, lines, Circle and ellipse algorithms, Windowing, clipping and view port, Software documentations.

Coordinate systems, Fundamental of transformations, Concatenation and Homogeneous transformations, two and three dimensional geometric transformations, Projections.

Basics of curves, Parametric and non-parametric curves, Analytical and synthetic curves, Continuity of curves, Mathematical representation of curves, Wire frame models, Wire frame entities, Parametric representation of synthetic curves, Hermite cubic splines, Bezier curves, B-splines, Rational curves. Curve manipulation: Displaying, Segmentation, Trimming, Intersection.

Mathematical representation of surfaces, Surface model, Surface entities, Surface representation, Parametric representation of surfaces, Plane surface, Rule surface, Surface of revolution, Tabulated cylinder. Hermitebi-cubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface, Sculptured surface.

Mathematical representation of solid, Solid modeling, Solid representation, Boundary representation (B-rep), Constructive solid geometry (CSG), Analytic solid modelling, Introduction of Finite Element Method (FEM). One dimensional FEM.

Reference Books

1. Zeid I. & Subramanian R. S., *CAD/CAM Theory and practice*, Tata McGraw Hill.
2. Zeid I., *Mastering CAD/CAM*, Mc Graw Hill International.
3. Groover M.P. &Zimmers E., *CAD/CAM: Computer-Aided Design and Manufacturing*, Pearson Education.
4. Rao P.N., *CAD/CAM Principles and Applications*, Tata McGraw Hill.
5. Alavala, *CAD/CAM Concepts and Applications*, Prentice Hall of India.
6. Krishnamurthy N., *Introduction to Computer Graphics*, Tata McGraw Hill.
7. Newman W.M. &Sproull R.F., *Principles of Interactive Computer Graphics*, Tata McGraw Hill.

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ME-5105 MECHATRONICS

Introduction: Definition of mechatronics. Mechatronics in manufacturing, products and design. Review of fundamentals of electronics.

Mechatronics Elements: Data conversion devices, sensors, microsensors, transducers, signal processing devices, relays, contactors and timers.

Processors/Controllers: Microprocessors, microcontrollers, PID controllers and PLCs.

Drives and mechanisms of an automated system: Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Hydraulics system: Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps. Design of hydraulic circuits.

Pneumatic system: Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.

CNC Technology and Robotics: CNC machines and part programming. Industrial Robotics.

Reference books:

1. Boucher, T. O., Computer automation in manufacturing - an Introduction, Chapman and Hall, 1996.
2. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988
3. Deb, S. R., Robotics technology and flexible automation, Tata McGraw-Hill, New Delhi, 1994.
4. Boltan, W., Mechatronics: electronic control systems in mechanical and electrical engineering, Longman, Singapore, 1999.

ME-5106 ADVANCED MECHANISMS DESIGN

Kinematics of Mechanism: Introduction, Kinematics Fundamental, Analysis and synthesis; types, Numbers and Dimension, Degree of Freedom, types of Motion, Links, Joints and Kinematic Chains, Mechanism and structures, Numbers Synthesis, Paradoxes, Isomers, Linkage Transformation, 'Inversion, TheGrash of conditions' compliant Mechanism.

Graphical Conditions: Function, Path and Motion Generation, Limiting Conditions, Dimensional synthesis, Quick Return Mechanism, coupler curves' cognates. Straight Line Mechanism, Dwell Mechanism.

Hill.
4. Clive L. Dym and Shames I.H., "Solid Mechanics: A Variational Approach" Engineering Science Series.
5. Boresi, A.P., and Sidebottom, O.M., "Advance Mechanics of Materials", John Willey and sons.
6. Seeley, F.B. and Smith, J.O., "Advanced Mechanics of Materials".

ME- 5111 THEORY OF VIBRATION

Element of vibration system: - lumped mass, stiffness and damping, simple harmonic motion, vector representation.

Single degree of freedom system: - equation of motion - energy method, Newton law based, general solution, free and forced vibration, damped and undammed motion, equivalent damping, logarithmic decrement, damping measurement, rotating and reciprocating unbalance, vibration, absorber, Seismic instruments

Transient vibration: - impulse response, Convolution integral, Fourier analysis.

Multi degree freedom system: - equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonalty of modes, modal analysis, Lagrange's equation.

Natural frequency numerical solution: - Rayleigh's method, Dunkerley's method, Holzer method, Transfer matrix, Iteration method.

Continuous system:- Vibration of stretched cord, torsional vibration, longitudinal .vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh's quotient, Rayleigh' s-Ritz method.

Reference Books

1. Tse.S, Morse R Rolland T. Hinkle. Ivan E. "mechanical vibrations theory andApplication" Published by Alllyn and Bacon,Tne.
2. Thomson T. Milliam "theory of vibrations with applications" Prentice Hall of India
3. HartogDen,J.P. "mechanical vibrations" Tata McGraw Hills, 4thedition 1956)
4. Meirovitch L. "elements of vibaration analysis McGraw Hills -1956
5. Anderson R.A. "fundamentals of vibration" Mecmillan press 1967
6. Kbstad N.O. o'fundamentals of vibration analysis" McCrraw Hills -1956

7. Robert K. Vierck'aibration analysis" Published by Harper & Row
8. Timoshenko S., Young D.H. & Ileavev W.Jr. "vibration problem in engineetirg 4th ed,It{ew York Wilay 1974
9. Mecrovitch,L., *analytical methods in vibration" published by macmillam(1967)

MEP001 Machine Design Practical: Computational Lab

List of Experiments:

1. 3D modeling of different components using CAD software.
2. Assembly drawings of machine tools using CAD software.
3. Surface modeling of different mechanical components in CAD software.
4. Presenting different orthographic/isometric views of 3D models in CAD software.
5. To know the history and features of MATLAB & the local environment of MATLAB.
6. Find the roots of equations, find the values at different points and plot the graph.
7. Find the derivative of an equation in MATLAB.
8. Find the area enclosed between the curves in MATLAB.
9. Find the addition, subtraction, multiplication, transpose and inverse of matrices.
10. Find the rank, eigen vector and eigen values of matrices.
11. Write a program to find the roots of an equation using Bi-section method, Regula-falsi method and Newton Raphson method.
12. Plot the surface for an equation.

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ETPHDT00-RESEARCH METHODOLOGY IN ENGINEERING

Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, developing a research question-Choice of a problem.

Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series Analysis. Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods.

Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis.

Use of statistical software SPSS in research. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.

Reference Books

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, VishwaPrakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0, 2006
3. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.

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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 Microsystems:

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, Cambridgeuniversity press (ISBN 9780521762502)
2) AndrejzM.Pawlak, Sensor and Actuators in Mechatronics Design,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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MEPHDT03-MECHANICS OF COMPOSITE MATERIALS

Introduction:- Definition of composites; classification of composites; Fibers and matrix materials and their properties; generalized Hook's law- orthotropic, transversely isotropic and isotropic materials; constitutive equations under plane stress condition for orthotropic materials, restrictions on elastic constants of orthotropic materials.

Macro mechanics of Lamina:-Stress-strain relations for a lamina of arbitrary orientation, invariant properties of an Orthotropic lamina, strength of an Orthotropic lamina, experimental determination of strength and stiffness, Biaxial strength theories of an Orthotropic lamina: maximum stress theory, maximum strain theory, Tsai-Hill theory, Tsai-Wu Tensor theory.

Micromechanics of Lamina:-Mechanics of materials approach to stiffness (determination of E_1, E_2, U_{12}& G_{12}); mechanics of materials approach to strength; tensile and compressive strength in fiber directions,elasticity approach to stiffness, some results of exact solution.

Micromechanics of Laminate: -Classical lamination theories (CLT) - laminate stress, laminate stiffness- A-B-D matrix and their implication, symmetric and non-symmetric laminates interlaminate stress, limitations of classical lamination theory.

Short Fiber Composites: -Theories of stress-transfer, average fiber stress, modulus prediction, strength prediction, effect of matrix ductility, Ribbon –Reinforced composites.

Reference books:

1. "Modern Composite Materials" by L J Broutman and R M Krock,
2. "Composite Materials – Science and Engineering" by K K Chawla,
3. "Mechanisms and Mechanics of Composite Fracture" by R B Bhagat and S G Fishman,
4. "An Introduction To Composite Materials" by D Hull, "STRUCTURAL COMPOSITE MATERIALS" by F C Campbell,
5. "Composite Materials" by Berthelot, "Electrostatic Discharge Sensitivity of Composite Energetic Materials" by Michelle L Pantoya and Chelsea Weir

Suggested Books

1.Jones, R M, Mechanics of Composite Materials, Scripta Book Co.

2. Agarwal, B D and Broutman, J. D, Analysis and Performance of Fiber Composites, New York, John Willey and Sons, 1990

3. Mallik, P. K, Fiber reinforced composites: materials, manufacturing and design, New York- Marcel and Dekker, 1993 (2nd edition)

4. Arthur, K Kaw, Mechanics of Composite Materials, CRC Press, 1997.

5. Reddy J N, Mechanics of Laminated Composite Plates, CRC Press

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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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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 Publication.
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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MEPHDT08 ENGINEERING DESIGN METHODOLOGY

Fundamentals: principles of design, systematic approach, need analysis and design of specification; Conceptual design: developing function structure, developing concepts by systematic search with physical principles, classifying schemes; Concept selection: matrix methods, necessity methods, probability methods, fuzzy set based methods, case study on consumer product; Embodiment design: basic rules, system modeling, preliminary design calculations and material selection, design considerations like force alignment, vibration etc., failure modes and effects analysis, design for manufacturability and assembly, case studies on design of machines; Optimal and robust design: design problem formulation for analytical and numerical solution, design of experiments, Taguchi's method; Response surface method Reverse engineering; Physical prototyping; Lab: conceptual design, reverse engineering, design of simple sensors and actuators, hydraulic and pneumatic systems, motors and controller, product teardown and redesign, embodiment design, CAE analysis, prototyping, design project.

Suggested Books:

[1] Yousef Haik, Engineering Design Process, Vikas Publishing house, New Delhi, 2003.

[2] G. Pahl, and W. Beitz, Engineering Design – A Systematic Approach, Springer – Verlag, 1996

[3] K. Otto and K. wood, Product Design – techniques in reverse engineering and new product development, Pearson Education, New Delhi, 2004.

[4] A. Ertas and J. C. Jones, The Engineering Design Process, 2nd ed., John Wiley and Sons, 1996.

[5] A. Kusiak, Engineering Design – Products, Processes and Systems, Academic Press, 1999.

[6] C. L. Dym and P. Little, Engineering Design – A Project based Introduction, John Wiley, 2000.

[7] G. E. Dieter, Engineering Design – A Materials and Processing Approach, 3rd ed., McGraw-Hill International, 2000.

[8] E. Kroll, S. S. Condoor and D. G. Jonsson, Innovative Conceptual Design – Theory and Application of Parameter Analysis, Cambridge Univ. Press, 2001

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MEPHDT09 FINITE ELEMENT METHODS IN ENGINEERING

Introduction: Historical background, basic concept of the finite element method, comparison with finite difference method; Variational methods: calculus of variation, the Rayleigh-Ritz and Galerkin methods; Finite element analysis of 1-D problems: formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its postprocessing. Applications in heat transfer, fluid mechanics and solid mechanics. Bending of beams, analysis of truss and frame. Finite element analysis of 2-D problems: finite element modelling of single variable problems, triangular and rectangular elements; Applications in heat transfer, fluid mechanics and solid mechanics; Numerical considerations: numerical integration, error analysis, mesh refinement. Plane stress and plane strain problems; Bending of plates; Eigen value and time dependent problems; Discussion about preprocessors, postprocessors and finite element packages.

Suggested Books:

[1] J N Reddy, An introduction to the Finite Element Method, McGraw-Hill, New York, 1993.

[2] R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3d ed., John Wiley, New York, 1989.

[3] K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, NJ, 1982.

[4] T J T Hughes, The Finite Element Method, Prentice-Hall, Englewood Cliffs, NJ, 1986

5] O C Zienkiewicz and R L Taylor, The Finite Element Method, 3d ed. McGraw-Hill, 1989.

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MEPHDT10-FRACTURE, FATIGUE AND FAILURE ANALYSIS

Griffith's theory of brittle failures; Irwin's stress intensity factors; Linear elastic fracture mechanics: The stress analysis of crack tips, Macroscopic theories in crack extension, Instability and R-curves, Crack tip plasticity, K as a failure criterion, Mixed mode of fracture, Analytical and Experimental methods of determining K; Elastic plastic fracture mechanics: Crack tip opening displacement, J Integrals, Crack growth resistance curves, Crack tip constraint under large scale yielding, creep crack growth; Microscopic theories of fracture: Ductile and cleavage fracture, ductile-brittle transition, inter-granular fracture; Fatigue crack propagation: Fatigue crack growth theories, crack closure, Microscopic theories of fatigue crack growth; Application of theories of fracture mechanics in design and materials development

Suggested Books:

[1] T. L. Anderson, Fracture Mechanics Fundamentals and Applications, CRC Press, 1994

[2] D. Brock, Elementary Engineering Fracture Mechanics, Maritinus Nijhoff Publishers, 1982.

[3] S. T. Rolfe and J. M. Barson, Fracture and Fatigue Control in Structures, PHI, 1977

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MEPHDT11- METAL FORMING AND THEORY OF PLASTICITY

Introduction to metal forming. Stress and Strain: stress and strain behavior of materials, plastic and tangent modulus, work hardening, plastic instability in tensile test, empirical stress-strain equations, effect of pressure, strain-rate and temperature, analysis of stress tensor, eigen values, decomposition into deviatoric and hydrostatic components, octahedral stresses, analysis of strain and strain-rates, stress equilibrium and virtual work, objective stress rates. Plasticity: the criteria of yielding, isotropic and anisotropic hardening, rules of plastic flow, Levy-Mises and Prandtle-Reuss equations, anisotropic flow rule, Hill's 1948 and 1979 yield criteria for anisotropic yielding. Upper bound theorem and its application in processes like rolling, wire drawing, extrusion, forging and machining. Lower bound theorem with a few applications. Slab method and its application in process like asymmetric rolling, forging, wire drawing and extrusion. Elastoplastic sheet bending. Analysis of autofrettaging. Theory of slipline field and its application in metal forming and machining. Heat transfer analysis in manufacturing. Workability and dynamic materials model.

Suggested Books:

1. Chakrabarty, J., Theory of plasticity, McGraw Hill Book Company, Singapore, 1998.
2. Johnson, W. and Mellor P.B., Engineering plasticity, Von Nostrand Reinhold Company, London, 1972.
3. Bhattacharyya, A., Metal cutting: theory and practice, New Central Book, Kolkata, 1984.
4. Incropera, F.P. and DeWiit, D.P., Fundamentals of heat and mass transfer, John Wiley & Sons, Singapore.
5. Prasad, Y.V.R.K., Sasidhara, S., Hot working guide: a compendium of processing maps, ASM International, Materials Park, OH, 1997

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MEPHDT12-ENERGY CONSERVATION AND WASTE HEAT RECOVERY

Energy resources and use. Potential for energy conservation. Optimal utilization of fossil fuels. Total energy approach. Coupled cycles and combined plants. Cogeneration systems. Exergy analysis. Utilization of industrial waste heat. Properties of exhaust gas. Gas-to-gas, gas-to-liquid heat recovery systems. Recuperators and regenerators. Shell and tube heat exchangers. Spiral tube and plate heat exchangers. Waste heat boilers: various types and design aspects. Heat pipes: theory and applications in waste heat recovery. Prime movers: sources and uses of waste heat. Fluidized bed heat recovery systems. Utilization of waste heat in refrigeration, heating, ventilation and air conditioning systems. Thermoelectric system to recover waste heat. Heat pump for energy recovery. Heat recovery from incineration plants. Utilization of low grade reject heat from power plants. Need for energy storage: Thermal, electrical, magnetic and chemical storage systems. Thermo-economic optimization.

Suggested Books:

[1] J. H. Harlock, Combined Heat and Power, Pergaman Press, 1987

[2] F. Kreith and R. E. West, Energy Efficiency, CRC handbook, CRC Press,1999

[3] Kays and London, Compact Heat Exchangers, 3rd edition, McGraw-Hill, New York.

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MEPHDT13 ADVANCED THERMODYNAMICS

Review of Basics: First law and Second law analysis – concept of entropy – principle of increase of entropy – entropy generation – Availability – concept of exergy – exergy analysis of combustion processes. Helm Holtz function – Gibb's function. Thermodynamic relations, Maxwell's relations, T-ds equations , specific heat relations, energy equation, Joule Thomson effect, Clausius Claperyon Equation. Criteria for Equilibrium – Gibb's phase rule – Conditions for stability. Compressibility factor, fugacity and activity, computation from the generalized charts, dependence of fugacity and activity on pressure and temperature, chemical – equilibrium. Phase rule – ideal and real solution of gases, liquids, equilibrium system. Statistical Thermodynamics: Thermodynamics probability, Maxwell statistics, Entropy and probability, Degeneracy of energy levels, Partition functions. Kinetic Theory of Gases: "Introduction, basic assumption, molecular flux, equation of state for an ideal gas" Perfect gas model, Distribution of translational velocities distribution function, molecular collisions and mean free path, equipartition of energy.

Text Books:

1. A.S. Michael, *Thermodynamic for Engineers*, Prentice Hall, 1972
2. P. K. Nag, *Engineering Thermodynamics*, McGraw Hill, 1995
3. Yungus A. Cengel and Michael A. Boles 'Thermodynamics: An Engineering Approach

Reference books:

1. G.J. Van Wylen & R.E. Sonntag, *Fundamentals of Classical Thermodynamics*, Willy Eastern Ltd. 1989
2. J.P. Holman, *Thermodynamics*, 4th Ed., McGraw Hill, 1988
3. F. W. Sears & G.L. Shalinger, Thermodynamics.