SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A CENTRAL UNIVERSITY)
CBCS-NEW, EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2022-2023
B.Tech. III Year (SEMESTER V)
(Mechanical Engineering)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
THEORY									
1.	ME205TPC08	Machine Design-I	3	1	-	30	70	100	4
2.	ME205TPC09	Dynamics Of Machinery	2	1	-	30	70	100	3
3.	ME205TPE03	CAD/CAM	3	-	-	30	70	100	3
4.	ME205TPC10	Fluid and Turbo Machinery	3	1	-	30	70	100	4
5.	ME205THS02	Industrial Engineering & Economics	3	-	-	30	70	100	3
		TOTAL	**14**	**3**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME205PPC01	TOM LAB	-	-	2	30	20	50	1
2.	ME205PPC02	FTMC LAB	-	-	2	30	20	50	1
3.	ME205PRJ01	Modeling & Simulation Lab-I	1	-	2	40	60	100	2
		TOTAL	**1**	**-**	**6**	**100**	**100**	**200**	**4**
		GRAND TOTAL	**15**	**3**	**8**	**250**	**450**	**700**	**21**

Total Credits: **21** Total Contact Hour: **25** Total Marks: **700**

L:LECTURE, T:TUTORIAL, P:PRACTICAL, IA: INTERNAL ASSESSMENT, ESE:END SEMESTER EXAMINATION
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.

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PROPOSED W.E.F. SESSION 2022-2023
B.Tech. III Year (SEMESTER VI)
(Mechanical Engineering)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
THEORY									
1.	ME206TPC11	Machine Design-II	3	1	-	30	70	100	4
2.	ME206TPC12	Heat & Mass Transfer	3	1	-	30	70	100	4
3.	ME206TOE01	Open Elective - 1	3	-	-	30	70	100	3
4.	ME206THS03	Elective from Humanity Science - 1	3	-	-	30	70	100	3
5.	ME206TPE04	Measurement and Metrology	3	-	-	30	70	100	3
6.	ME206MC03	Mandatory Course	-	-	-				-
		TOTAL	**15**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME206PPC01	M&M LAB	-	-	2	30	20	50	1
2.	ME206PPC02	HMT LAB	-	-	2	30	20	50	1
3.	ME206PRJ02	Modeling & Simulation Lab-II	1	-	2	40	60	100	2
		TOTAL	**1**	**-**	**6**	**100**	**100**	**200**	**4**
GRAND TOTAL			**17**	**2**	**6**	**250**	**450**	**700**	**21**

Total Credits: **21** Total Contact Hour: **25** Total Marks: **700**

L:LECTURE, T:TUTORIAL, P:PRACTICAL, IA: INTERNAL ASSESSMENT, ESE:END SEMESTER EXAMINATION
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.

Elective from Humanity Science - 1	
ME206THS03	Principle of Management
ME206THS03	Supply Chain Management
Open Elective - 1 (For other branches)	
ME206TOE01	Automobile Engineering

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CBCS-NEW, SYLLABUS

PROPOSED (W.E.F. SESSION 2022-23)

B. TECH. THIRD YEAR

MECHANICAL ENGINEERING

Programme Outcomes: Graduates will be able to:

PO1: Fundamentals: Apply knowledge of mathematics, science and engineering.
PO2: Problem analysis: Identify, formulate and solve real time engineering problems using first principles.
PO3: Design: Design engineering systems complying with public health, safety, cultural, societal and environmental considerations
PO4: Investigation: Investigate complex problems by analysis and interpreting the data to synthesize valid solution.
PO5: Tools: Predict and model by using creative techniques, skills and IT tools necessary for modern engineering practice.
PO6: Society: Apply the knowledge to assess societal, health, safety, legal and cultural issues for practicing engineering profession.
PO7: Environment: Understand the importance of the environment for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics, and responsibilities and norms of the engineering practice.
PO9: Teamwork: Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.
PO10: Communication: Communicate effectively by presentations and writing reports.
PO11: Management: Manage projects in multidisciplinary environments as member or a team leader.
PO12: Life-long learning: Engage in independent lifelong learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: Mechanical Engineering graduate will be able to understand, apply and provide cost-effective and sustainable solutions to complex engineering problems from domains of design, fluid and thermal, materials and manufacturing, automation and management science.
PSO2: Mechanical Engineering graduate shall be able to exhibit ethical and professional skills through individual or team-work and effective communication in providing solutions by using conventional or innovative, modern analytical and computational tools.
PSO3: Mechanical Engineering graduate will be able to self-discern professional career path including higher studies, innovation and entrepreneurship.

B.TECH IIIRD YEAR / VTH SEM SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME05TPC09	4	-	-	4	30	70	100	4

MACHINE DESIGN –I

Course objective:

1. To provide students with the ability to apply design procedure with specific design tools representing empirical, semi-empirical and analytical approaches.
2. Inbuilt students of using analytical and computer aided design tools to solve real world problems.
3. To provide students the detailed design of mechanical systems that considers realistic examples from the Mechanical Laboratories/Workshop.
4. To design a mechanical power transmission system given the power to be transmitted, speed ratio, orientation and center distance of the shafts.
5. To study the Failure analysis, factor of safety, types of loading, selection of appropriate materials, lubrication, design for manufacturing, fits and tolerance that are used in all the above case-based designs.

Syllabus content:

UNIT – I:

General Considerations: Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.

UNIT – II:

Basic Elements Design: Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines. **Couplings:** Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling. **Shaft and Axles:** Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness, Design under continuous loading for fatigue.

UNIT- III:

Threaded fasteners: Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading. **Power Screws:** Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw.

UNIT – IV:

Riveted Joints: Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, eccentrically loaded riveted joint. **Welded joint:** Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, eccentrically loaded joint, welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques.

UNIT – V:

Pulley & Flywheel: Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.

Chain Drives: Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives.

Text/ Reference Books:

1. Machine Design by-J. E. Shigley -McGraw Hill Publications.
2. Design of Machine Elements from V. B. Bhandari, TMH Publications.
3. Machine Design, Spott, TMH Publications.

Course Outcome:

At the end of this course, the students will be able to

1. To familiarize the various steps involved in the Design Process.
2. To understand the principle involved in evaluating the shape and dimensions of a component.
3. To satisfy functional and strength requirements of machine elements.
4. To learn to use standard practices and standard data.
5. To learn to use catalogues and standard machine components.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2									1	1		
CO2	3	2		1								1	2		1
CO3	3	2	2	2			1					1	2		
CO4	3	1	2	2			1						2	1	
CO5	2	1	2	1									2	1	

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205TPC09	2	1	-	3 hours	30	70	100	3

DYNAMICS OF MACHINERY

Course Objectives:

1. Understand the fundamentals of the gyroscope.
2. Classify inertia forces and engine forces.
3. Explain the balancing of rotating and reciprocating masses.
4. Analyze governors and flywheels.
5. Calculates unbalanced vibration & related terminologies.

Syllabus Content:

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

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 & Flywheel: Types of governors, centrifugal governor, spring-controlled governor, Watt, Porter and Proell, Hartnell, Hartung governor, governor effect, Power stability, Inertia effects Turning moment diagram for single and multi-cylinder I.C. Engine, Co-efficient of fluctuation of speed, Coefficient of fluctuation of energy

UNIT-V:

Vibration: One dimensional longitudinal, transverse, and torsional vibration, natural frequency, effect of damping on vibration, types of damping, forced vibration, forces and displacement, Transmissibility, vibration isolation, vibration sensors: seismometer and accelerometer, whirling of shaft with single rotor.

Text/Reference Books:

1. Mechanism of machines By Ghosh and Mallick East West Press
2. Theory of machine by S.S. Ratan TMGH
3. Theory of Machine by Thomas Beven, C.B.S. Publications
4. Theory of Machine by A. G Ambedkar, PHI

5. Theory of Machines by J.E. Shigley, Tata McGraw Hill Publishers

Course Outcome:

Students are able to:

1. Understand the fundamentals of the Gyroscope.
2. Classify inertia forces and engine forces.
3. Explain the balancing of rotating and reciprocating masses.
4. Analyze governors and flywheels.
5. Calculates unbalanced vibration & related terminologies.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1								1	2	2	1
CO2	3	2	2	1								1	2	2	2
CO3	3	2	2	1								1	2	2	1
CO4	3	3	2	1								1	2	2	1
CO5	3	2	2	1								1	2	2	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	TOTAL	Credits
ME205TPE03	3	0	0	3 hrs.	30	70	100	3

CAD/CAM

Course Objectives:

1. To provide the necessary theoretical background and demonstrates the application of computer science to graphics.
2. To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids. To understand the concepts of heat transfer through extended surfaces.
3. To perform and describe positions and orientation of shapes under single transformations including rotations (in multiples of 90 degrees about the point of origin), translations, reflections, and dilations on and off the coordinate plane.
4. To summarize the historical development of CAD/CAM software and CNC Technology.
5. To introduce the students to the standard terminologies, conventions, processes, operations, design and operational characteristics of key hardware components, programming techniques, applications, merits and demerits of Computer Numerical Controlled (CNC) machines.

Syllabus Content:

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 nonparametric 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:

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, coloring, 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. Control system basics- An overview

UNIT-V:

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.

Text/Reference Books:

1. CAD/CAM Theory and Practice-Ibrahim Zeid-Tata McGraw Hill Publications.
2. CAD/CAM-Milkell P. Groover, Emory W. Zimmer-Pearson Education.
3. Theory of mechanism and Machine-Ghosh and Malik-EWP.
4.Computer numeric control- T. Jeyapoovan, Robert Quesada-Pearson Education
5. CAM/CAD principle & Applications-P. N. Rao- Tata McGraw Hill Publications.

Course Outcome:

1. *Understand* and *explain* the core concepts of computer graphics, including viewing, projection, perspective, modeling and transformation in two and three dimensions and to *familiarize* the various software's used in CAD
2. *Understand* the various concepts and characteristics in Geometric Modeling and to d*iscuss* the representation of curves, surface and solid modeling techniques for various real time applications.
3. *Apply algorithms of graphical entity generation and to Calculate Geometric Transformation for 2D and 3D entities*
4. *Explain* the working principles of NC machines, CNC machine and able to *Differentiate* between them.
5. To *Apply and Analyze* the use of NC/CNC systems with different types of coding system for computer assisted mass production.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2								3	2	1
CO2	3	2											3	2	1
CO3	3												3	2	1
CO4	2												3	3	1
CO5	2	2			3							3	3	3	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205TPC10	3	1	2	4 hrs	30	70	100	4

FLUID AND TURBOMACHINERY

Course objective:

- The course aims at giving an overview of different types of fluid machines used for energy transformation, such as hydraulic and steam turbines, gas turbines, compressors, and pumps.
- It focuses on applications in power generation, transport, refrigeration.
- The main purpose of implementing this course in the curriculum is to learn about how the power is transferred in a turbomachine.

Syllabus content:

Unit-1

Fundamentals: Classification, Applications of turbomachines, Performance parameters, Specific speed, Basic laws and equations, Velocity triangles.

Unit-2

Hydraulic turbines: Specific applications, types, construction, working, and performance of various types of hydraulic turbines (Pelton, Francis, and Kaplan turbines), Cavitation in turbines, and water hammer effects, Draft tube: Types, applications, and performance analysis.

Unit -3

Centrifugal pumps: Theory, types, components, and working characteristics, Cavitation, NPSH, Priming, Axial flow pumps, Practical problems, and remedies.

Unit-4

Thermal turbines: Steam turbine basic cycles, impulse and reaction turbines, Multistage turbines, Governing systems, Effects of reheating and regeneration, Application of Mollier diagram, Gas turbine basic cycle, Application of intercooling, reheating and regeneration, Introduction to wind turbines, Power and efficiency calculations.

Unit-5

Air compressors: Radial and axial compressors, Construction and performance analysis, Surging and stalling, Slip.

Text/Reference Books:

1. Jagdish Lal, Hydraulic Machines, S. K. Kataria & Sons
2. S. K. Som & G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH
3. C. P. Kotharaman & R. Rudramoorthy, Fluid Mechanics & machinery, New Age Pub
4. R. Yadav, Steam and Gas Turbine, C.P.H. Publication, Allahabad
5. S.M. Yahya, Turbine, Compressors and Fans, TMH.

6. P.K. Nag, Power Plant Engineering, 3rd edition, Tata McGraw Hill.
7. V. Ganeshan, Gas Turbine, TMH.

Course Outcome

- Introduced the basic energy equations of rotodynamic machines
- Differentiate between impulse and reaction turbine and able to evaluate the performance of hydraulic machines for real time applications.
- Understands the working of centrifugal and axial flow pumps using velocity triangles.
- Utilize knowledge of various modern hydraulic machines for varied industrial applications.
- Understands the operations and problems in air compressors.

Course Outcomes and their mapping with Programme Outcomes:

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205THS02	3	0	0	3	30	70	100	3

INDUSTRIAL ENGINEERING & ECONOMICS

Course Objectives:

1. To understand the basic thoughts of economics and role of decision making in production economics.
2. To gain the basic knowledge of methodologies of engineering economic analysis and inflation, replacement, value and depreciation analysis.
3. To aware from the history & development of industrial engineering and understand the productivity aspects.
4. To learn the process and application of method study and work measurement.
5. To understand the different wage & incentives scheme of workers.

Syllabus Contents:

UNIT-I:

Basic Economics-Introduction to Economics, Type of Economics, Theory of Economics, Principles of Economics and its scope, Law of supply and demand and its type and features, Economic efficiency.

Cost and Decision-Costs, Element of costs-fixed-variable and others, Capital, Assets and its Type, Role of Engineers in Decision Making, Decision Tree and Sequential Investment Decisions, Decision Making Techniques, Cash Flow Diagram.

UNIT-II:

Basic Methodologies of Engineering Economic Analysis- Introduction to Time Value of Money, Simple Interest, Compound Interest, Nominal Interest rate.

Measuring Inflation, equivalence calculation under Inflation, assets replacement and its policy, Comparative Analysis of Alternatives and its methods for analysis, Depreciation- Introduction and its types and methods, value analysis.

UNIT-III:

Introduction history & development of industrial engineering: F.W.Taylor and Frank & Lillian Gilberth their contribution industrial engineering.

Productivity: Productivity definition; means of increasing productivity; productivity vs production, Productivity index and its types, numerical.

UNIT-IV:

Method Study: Definition & basic procedure, selection of jobs, recording technique; and Principle of motion economy.

Work Measurement: Definition, objectives, application, time study equipment, performance rating; allowances; number of cycle to be studied; determination of standard time, numerical.

UNIT-V:

Wage & Incentives: Characteristics of a good wage or incentive systems, method of wage payment. Concept of wage incentive schemes; financial & non-financial; Taylor differential piece rate, Halsey premium plane, Merric's multiple piece rate system. Ergonomics, work space dimension, design of work place, environmental stresses & impacts on human work.

Text/Reference Books:

- Dharmaraj, E. Engineering Economics. Mumbai, IN: Himalaya Publishing House, 2009. ProQuest ebrary. Web. 9 November 2016.
- Morris, W. Thomas. (1960). Engineering economy: the analysis of management decisions. Homewood, Ill.: R. D. Irwin
- Krugman, Paul; Wells, Robin (2012). Economics (3rd ed.).Worth Publishers. p. 2. ISBN 978-1464128738.
- Badiru, A. (Ed.) (2005). Handbook of industrial and systems engineering. CRC Press. ISBN 0-8493-2719-9.
- Malakooti, B. (2013). Operations and Production systems with multiple objectives. John Wiley & Sons.ISBN 978-1-118-58537-5.

Course Outcomes:

After studying, the students are able to:

1. Understand and implement the basic concepts of economics and decision making in production economics.
2. Apply the basic methodologies for economic analysis of industrial and depreciation problems.
3. Understand the history & development of industrial engineering and apply the concept of productivity to improve organizational performance.
4. Apply method study and work measurement tools to bring economy in production problems.
5. Understand and optimize the wage & Incentives scheme.

Course Outcomes and their mapping with programme outcomes:

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	2	2		2		3	2	2	1	-
CO2	2	2	-	2	2	2	3		3		2	2	2	1	-
CO3	2	2	-	-	2	2	2		2		3	2	2	1	-
CO4	2	2	3	-	2	2	2		2		3	2	2	2	-
CO5	2	2	-	1	2	2	2		2		3	2	1	1	-

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205PPC01	-	-	2	2 hours	30	20	50	1

TOM LAB

Course Objectives:

1. Able to calculate gyroscopic couple.
2. Analyze static and dynamic balancing of the balancing apparatus.
3. To understand the basic concept and working of governors.
4. To understand the fundamentals of vibrations.
5. To calculate the gear ratio epicyclic gear train.

Syllabus Content:

List of Experiments:

1. To find out a gyroscopic couple with Gyroscope apparatus.
2. To Perform & find out Static & Dynamic balancing conditions on Balancing Apparatus.
3. To perform experiments of Watt Governor & find out the Relation between sleeve height & speed.
4. To perform experiments of Porter Governor & find out the Relation between sleeve height & speed.
5. To perform experiments of Proell Governor & find out the Relation between sleeve height & speed.
6. To perform experiments of Hartnell Governor & find out the Relation between sleeve height & speed.
7. To perform the experiment of a Single pendulum.
8. To perform the experiment of the Compound pendulum.
9. To perform an experiment on the Whirling of shaft.
10. To find out gear ratio in an epicyclic gear train.

List of Equipment/Instruments/Machines/Software Required:

1. **Gyroscope apparatus**
2. **Static & Dynamic Balancing Apparatus**
3. **Governor Apparatus**
4. **Universal Vibration Apparatus**
5. **Whirling of shaft Apparatus**
6. **Epicyclic Gear Train**

Course Outcome:

Students are able to:

1. Ability to calculate the gyroscopic effects.
2. Analyze static and dynamic balancing of the balancing apparatus.
3. Understand the concept and applications of various governors.
4. Able to understand the various principles of vibration systems.
5. Calculate the gear ratio of an epicyclic gear train.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1						1				2	2	1
CO2	2	2	1						1				2	2	2
CO3	3	2	1						1				2	2	1
CO4	2	2	1						1				2	2	1
CO5	2	2	1		1				1				2	2	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205PPC02	**-**	**-**	**2**	**2 hrs**	**30**	**20**	**50**	**1**

Fluid and Turbomachinery Lab

Course outcome

Analyse the performance characteristics of hydraulic turbines

Analyse the performance characteristics of hydraulic pumps.

Experiment description

1 To study the Pelton wheel turbine

2 Study of Francis turbine

3 Study of the Kaplan turbine

4 Study of centrifugal pump

CO/PO Mapping
(S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	-	-	-	-	-	-	-	-	-	3	1	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	3	1	-

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME205PRJ01	1	-	2	3-Hours	40	60	100	2

MODELLING AND SIMULATION – I LAB

Course Objectives

1. To practice basic programming features in SCILAB/MATLAB
2. To write program codes for solving elementary level problems in mechanical engineering
3. To develop GUI based codes for solving elementary problems in mechanical engineering
4. To apply the fundamentals of various courses and solve elementary engineering problems using computers

List of Laboratory activities

1. Introduction to SCILAB/MATLAB – features
2. Simple constructs
3. Loop constructs
4. Engineering mathematics-based problem-1
5. Engineering mathematics-based problem-2
6. Mechanics problem-1
7. Mechanics problem-2
8. Fluid flow problem – 1
9. Fluid Flow problem – 2
10. Designing problem using GUI

Text/Reference Books

1. An Engineer's Guide to MATLAB, EB Magrab, GC Walsh, Prentice Hall
2. MATLAB for Engineers, H Moore, Pearson
3. Creating GUI in MATLAB, Mathworks

Course Outcomes

At the end of the course, the student shall be able to
CO1: apply basic programming concepts in SCILAB/MATLAB to solve simple problems
CO2: develop simple programming codes in SCILAB/MATLAB for solving elementary problems
CO3: design simple GUI for solving elementary problems in mechanical engineering

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	-	1	1	-	3	2	2	2
CO2	3	3	2	2	3	-	-	-	2	1	-	3	3	3	3
CO3	3	3	3	2	3	-	-	-	2	1	-	3	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

B.TECH IIIRD YEAR / VITH SEM SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME06TOE21	4	-	-	4	30	70	100	4

MACHINE DESIGN –II

Course objective:

1. To apply the concepts of stress analysis, theories of failure and material science.
2. To analyze, design and/or select commonly used machine components.
3. To illustrate to students the variety of mechanical components available and emphasize the need to continue learning.
4. To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.

Syllabus content:

UNIT – I:

Springs: 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's equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication. Design of gear trains.

UNIT- III:

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

UNIT – IV:

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 Typeand Clearance Type.

Journal Bearings: Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication, Sommerfeld 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. Pulleys for Flat & V-Belts, Wire rope and stress in wire ropes.

Text/ Reference Books:

1. Machine Design by-J. E. Shigley -McGraw Hill Publications.

2. Design of Machine Elements from V. B. Bhandari, TMH Publications.
3. Principles of Mechanical Design, R. Phelan, McGraw Hill Pub.

Course Outcome:

At the end of this course, the students will be able to

1. To familiarize the various steps involved in the Design Process.
2. To understand the principle involved in evaluating the shape and dimensions of a component.
3. To satisfy functional and strength requirements of machine elements.
4. To learn to use standard practices and standard data.
5. To learn to use catalogues and standard machine components.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2									1	1		
CO2	3	2		1								1	2		1
CO3	3	2	2	2			1					1	2		
CO4	3	1	2	2			1						2	1	
CO5	2	1	2	1									2	1	

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	TOTAL	Credits
ME206TPC12	3	1	0	4 hrs.	30	70	100	4

HEAT & MASS TRANSFER

Course Objectives:

1. To understand the basic modes of heat and mass transfer.
2. To understand and solve conduction, convection and radiation problems.
3. To understand the concepts of heat transfer through extended surfaces.
4. To learn the thermal analysis and area requirement of heat exchangers.
5. To understand the basic concepts of phase change heat transfer(boiling/condensation).

Syllabus Content:

UNIT-I:

Introduction to modes and mechanisms of heat transfer, Fourier's law, Electrical analogy, Overall heat transfer coefficient, Conduction heat transfer in rectangular, cylindrical and spherical solids, 1-D steady state heat transfer with & without heat generation, critical radius of insulation, Unified view of momentum, heat and mass transfer.

UNIT-II:

1-D steady state heat conduction in Extended surfaces, Lumped Capacitance and 1-D transient models, Semi-infinite wall, Error in Temperature measurement, Diffusion mass transfer in 1-D steady state.

UNIT-III:

Convection: Forced and free convection - mass, momentum and energy conservation equations, scaling analysis and significance of non-dimensional numbers, velocity & thermal boundary layers, heat transfer in external and internal laminar and turbulent flows, and use of correlations.

UNIT-IV:

Convective mass transfer; Boiling and Condensation: physical phenomena and correlations; Heat Exchanger types and analysis: LMTD and Effectiveness-NTU method

UNIT-V:

Radiation heat transfer: Properties, laws, configuration factors, radiation shields, three-surface network of diffuse gray surfaces.

Text/Reference Books:

1. Heat and Mass Transfer, Cengel, McGraw Hill
2. Heat & Mass Transfer, DS Kumar, Katsons
3. Heat Transfer, JP Holman, McGraw Hill
4. Heat Transfer, SP Sukhatme, Tata McGraw Hill
5. Heat & Mass Transfer, SC Sachadeva, EEE

Course Outcome:

1. Able to understand and solve steady state and transient heat conduction problems in simple geometries.

2. Able to design and analyze the performance of heat exchangers.
3. Able to design and analyze the performance of extended surfaces.
4. Evaluate heat transfer coefficients for simple natural convection and forced convection situations.
5. Calculate the radiation heat exchange between surfaces (black and gray).

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2	1	1
CO2	3	2	2										3	1	1
CO3	3	2	2										3	1	1
CO4	3	2	1										2	1	1
CO5	3	2	1										2	1	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME06TPC	3	-	-	3 hours	30	70	100	3

AUTOMOBILE ENGINEERING

Course Objectives:

- To develop the basic concept of structure of an automobile.
- To analyze the various sub systems associated with automobiles.
- To develop the concept of different types of loads, resistances & safety features present in automobiles.
- To analyze the functions of individual components associated with vehicles.
- To develop the knowledge on modern technology implemented in vehicles.

Syllabus Content:

Unit-1:

Introduction: Main units of automobile chassis & body, different systems of the automobile, description of the engine components. Resistance to motion, tractive effort & traction, road performance curves.

Braking system: Hydraulic braking system, braking of vehicles when brake is applied to rear, front and all four-wheel, theory of internal shoe brake, disc brake, power brake & antilock braking system.

Unit-2:

Transmission system: Layout of transmission system, main function of the different components of transmission system, traditional & modern transmission system, clutch, four-wheel drives. Hotchkiss & torque tube drive.

Gear box: Sliding mesh, constant mesh & synchromesh gear box, overdrive, torque converter, semi & fully automatic transmission. Hook's joint, Propeller shaft, differential, rear axles, types of rear axles, front axles and front wheel drive.

Unit-3:

Front wheel geometry & steering system: Camber, Castor, Kingpin inclination, toe-in & toe-out, condition for true rolling motion of wheels during steering. Components of steering mechanism, power steering.

Wheels & tires: Types of wheels, Slip angle, under & over steering, tire specification, tubeless tire.

Unit-4:

Suspension & Safety system: Types of suspension system, leaf spring, coil spring & torsion bar. Telescopic type shock absorber, pneumatic suspension system, air bag, crash resistance & passenger comfort.

Unit-5:

Modern Vehicle Technology: Fuel cells technology for vehicles, Types of fuel cells, Current state of the technology, Potential & challenges, Latest engine technology.

Text/Reference Books:

1. Automobile Engineering, K.K. Ramalingam, Scitech Publications Pvt Ltd.
2. Automobile Technology, Dr. N.K. Giri, Khanna Publishers.
3. Automobile Engineering, Prof. Amitosh De, Galgotia Publications Pvt Ltd.
4. Modern Transmission Systems, A.W.Judge, Chapman & Hall Ltd.
5. Automotive Mechanics-Principle & Practice, Josepe Heitner, East West Press.
6. Torque Converter, P.M.Heldt, Chilton Book Co.

Course Outcome:

1. To understand and analyze the basic concept of functioning of different sub systems associated with automobiles.
2.To apply and investigate the different design aspect associated with the development of an automobile.
3.To analyze the different theoretical concept associated with the working of various parts like engine, transmission, clutch, brakes.
4. To investigate the working of steering and suspension system.
5. To perform the diagnosis associated with the identifying the problems in automobiles.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1							3	3	3	3
CO2	3	2	3	2	1							3	3	3	3
CO3	3	3	3	3	2							3	3	3	2
CO4	3	3	3	3	3							3	3	3	2
CO5	3	3	3	3	3							3	3	3	2

Weightage**: 1- Slightly, 2- Moderately, 3- Strongly.**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME206THS03	3	0	0	3	30	70	100	3

PRINCIPLES OF MANAGEMENT

Course Objectives:

1. Understand the skills, functions of managers and organization's types cum environments.
2. Nature, purpose and process of planning.
3. Understand the various motivation and leadership styles.
4. Recognize the various types of organizational structure and basic of job design.
5. Understand the various types of controlling processes.

Syllabus Contents:

UNIT-I

Definition of management, science or art, manager vs entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

UNIT-III

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

UNIT-IV

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text/Reference Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.
4. Dipak B, Principles of Management, Pearson Education, 2011.
5. Mitra J.K, Principles of Management, First Edition, Oxford university press, india, 2018, pp. 1-216.

Course Outcomes:

After studying this course, the students would be able to:

1. Use the skills, functions of managers in controlling environment of many organizations.
2. Construct planning sheet and apply it.
3. Understand and apply the various motivation and leadership styles.
4. Design the various types of organizational structure and job design schemes.
5. Solve the various types of controlling processes.

Course Outcomes and their mapping with programme outcomes:

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	2	2	2	1	2	-	2	-	2	1	-
CO2	1	1	-	2	-	-	3	-	3	-	2	-	2	1	-
CO3	-	-	-	-	-		2		2	-	3	-	2	1	-
CO4	-	-	3	-	1	-	2	-	2	-	3	-	2	2	-
CO5	1	-	-	1	2	-	2	1	3	-	3	-	1	1	-

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME206THS03	3	0	0	3	30	70	100	3

SUPPLY CHAIN MANAGEMENT

Course Objectives:

1. Describes the strategic framework to analyze supply chains.
2. Define the supply chain network distribution networks and applications to e-business.
3. Explain the planning, demand forecasting and aggregate planning a supply chain.
4. Define the planning and inventories, uncertainty management in a supply chain.
5. Understand the designing and planning transportation networks in a supply chain.

Syllabus Contents:

UNIT-I:

Building a Strategic Framework to Analyze Supply Chains: What Is a Supply Chain. The Objective of a Supply Chain, The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains.

Supply Chain Performance: Achieving Strategic Fit and Scope, Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.

UNIT-II:

Designing the Supply Chain Network Designing Distribution Networks and Applications to e-Business: The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design Options for a Distribution Network, e-Business and the Distribution Network, Distribution Networks in Practice.

Network Design in the Supply Chain: The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, the role of IT in Network Design, Making Network Design Decisions in Practice

Network Design in an Uncertain Environment: The Impact of Uncertainty on Network Design, Discounted Cash Flow Analysis, Representations of Uncertainty, Evaluating Network Design Decisions Using Decision Trees, AM Tires: Evaluation of Supply, Chain Design Decisions Under Uncertainty, Risk Management and Network Design 175, Making Supply Chain Decisions Under Uncertainty in Practice.

UNIT-III:

Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: The Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of a Forecast and Forecasting Methods, Basic Approach to Demand Forecasting, Time-Series Forecasting

Methods, Measures of Forecast Error, Forecasting Demand at Tahoe Salt, The Role of IT in Forecasting, Risk Management in Forecasting, Forecasting in Practice.

UNIT-IV:

Planning Supply and Demand in a Supply Chain: Managing Predictable Variability Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: Aggregate Planning in a Supply Chain: The Role of Aggregate Planning in a Supply Chain, the Aggregate Planning Problem, Aggregate Planning Strategies, Aggregate Planning Using Linear Programming, Aggregate Planning in Excel, The Role of IT in Aggregate Planning, Implementing Aggregate Planning in Practice

Planning Supply and Demand in a Supply Chain: Managing Predictable Variability: Responding to Predictable Variability in a Supply Chain, Managing Supply, Managing Demand Implementing Solutions to Predictable Variability in Practice.

UNIT-V:

Building a Strategic Framework to Analyze Supply Chains: What Is a Supply Chain. The Objective of a Supply Chain, The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains.

Supply Chain Performance: Achieving Strategic Fit and Scope, Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing. Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: The Planning Supply and Demand in a Supply Chain: Managing Predictable Variability Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: Aggregate Planning in a Supply Chain.

Text/Reference Books:

- Supply Chain Management: Janat Shah, Pearson Publications.
- Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI.
- Supply Chain Management: A.S. Altekar PHI Second Ed.
- Logistics Management: James Stock and Douglas Lambert. McGraw Hill International Ed.
- Supply Chain Management for Global Competitiveness: Ed.B.S.Sahay McMillan Publication
- Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication.
- Logistics Management: Bowersox TMH.

Course Outcomes:

After studying, the students are able to:

1. Build the strategic framework to analyze supply chains.
2. Define and design the supply chain network distribution networks and applications to e-business.
3. Construct the planning, demand forecasting and aggregate planning a supply chain.
4. Apply the planning and inventories, uncertainty management in a supply chain.

5. Solve the designing and planning transportation networks in a supply chain.

Course Outcomes and their mapping with programme outcomes:

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2		3		3	-	3	1	2	1	1
CO2	1	2	2	2	2	-	3	-	3	-	3	1	2	1	1
CO3	1	2	3	2	2		2		2	-	3	1	2	1	1
CO4	1	3	3	3	3	-	2	-	2	-	3	1	2	2	1
CO5	1	2	2	2	2	-	2	1	3	-	3	1	1	1	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME206TPE04	3	-	-	3 hours	30	70	100	3

MEASUREMENT AND METROLOGY

Course Objectives:

1. To provide an understanding of measurement system and its functional elements.
2. To impart knowledge of measurement of pressure and measurement of strain.
3. To impart knowledge of flow measurement, vibration measurement and data acquisition system.
4. To study about linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. To study about interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

Syllabus Content:

UNIT-I:

Generalized Measurement System: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, static and dynamic performance characteristics of measurement devices, Calibration, Error- concept and sources, statistical analysis of errors, Sensors and Transducers– Types of sensors, type of transducers and their characteristics.

UNIT-II:

Measurement of pressure: Pressure standard, Bourdon tubes, Diaphragm and bellows, Measurement of very low pressure- McLeod gauge and Pirani gauge.

Measurement of Strain: Type of strain gauges and their working, temperature compensation. Strain rosettes. Measurement of temperature by thermometers, bimetallic, thermocouples, thermistors and pyrometers-total radiation and optical pyrometry.

UNIT-III:

Measurement of flow: Variable head meters, hot wire and magnetic meters, ultrasonic flow meters.

Vibration measurement: Seismic instruments, vibration pickups.

Data acquisition system: Introduction to data acquisition systems, single and multi- channel systems, Input – output devices signal transmission and Processing.

UNIT-IV:

Metrology: Standards of measurement; Limits, Fits and Tolerances; Linear and angular measurement devices and systems limit gauges, gauge blocks. Measurement of geometric forms like straightness, flatness, roundness and circularity, surface texture measurement, principles and application of optical projectors, tool makers microscope, autocollimators etc. Go-NO GO Gauge

UNIT-V:

Sheet-metal working: Metrology: Principle and use of interferometry, Comparators, Screw Threads Measurement, and Measurement of Gears tooth. Coordinate measuring machine (CMM): need, construction, types and application.

Role of sheet metal Components, description of cutting processes-blanking, piercing, stripper and stock guide, description of forming processes like bending, cup drawing, coining, embossing.

Text/Reference Books:

1. Mechanical Measurements, Thomas G. Beckwith, Pearson Education.
2. Mechanical Measurements and Control, D.S. Kumar, S.K. Kataria and Sons.
3. Engineering Metrology, R.K. Jain, Khanna Publishers.
4. Metrology and Quality Control, A.M. Badadhe, Technical Publication.
5. Measurement systems, Application Design, E. O. Deoblein, McGraw hill.
6. Engineering Metrology, K.J. Hume, MacDonald and Company.
7. Engineering Metrology, I.C. Gupta, Dhanpat Rai and Sons.
8. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers.

Course Outcome:

Students will try to learn:

1. Describe the functional elements of measurement system and its performance characteristics
2. Describe measurement of pressure, strain and temperature.
3. Describe flow measurement, vibration measurement and data acquisition system.
4. Describe linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. Describe interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1								3	3	3	3
CO2	3	2	3	2								3	3	2	3
CO3	3	3	3	3								3	3	3	2
CO4	3	3	3	3								3	3	2	2
CO5	3	3	3	3								3	3	3	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME206PPC01	-	-	2	2 hours	30	20	50	1

MEASUREMENT AND METROLOGY LAB

Course Objectives:

1. To provide an understanding of measurement system and its functional elements.
2. To impart knowledge of measurement of pressure and measurement of strain.
3. To impart knowledge of flow measurement, vibration measurement and data acquisition system.
4. To study about linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. To study about interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

LIST OF EXPERIMENTS:

1. Measurement of length, height, diameter by Vernier Callipers, Vernier Height Gauge, Micrometres
2. Measurement of various angles using Bevel Protractor, Sine Bar & Combination Set.
3. Determination of the Surface Flatness and Contour using Interferometer.
4. Determination of the Effective diameter of screw threads by using two wire & three wire methods.
5. Measurement of Gear Elements using Profile Projector and image analyser.
6. Measurement of Tool Angles of a Single Point Cutting Tool by using Tool Makers Microscope.
7. Measurement of Pressure Using Bourdon Pressure Gauge.
8. Measurement of Displacement Using LVDT.
9. Measurement of Temperature Using Thermistor.
10. Measurement of Angle Using Angular Sensor.
11. Measurement of Torque Using Torque Transducer
12. Measurement of Temperature Using Thermo Couple
13. Experimentation using Data Acquisition System.

Course Outcome:

Students will try to learn:

1. Describe the functional elements of measurement system and its performance characteristics
2. Describe measurement of pressure, strain and temperature.
3. Describe flow measurement, vibration measurement and data acquisition system.
4. Describe linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. Describe interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1								3	3	3	3
CO2	3	2	3	2								3	3	2	3
CO3	3	3	3	3								3	3	3	2
CO4	3	3	3	3								3	3	2	2
CO5	3	3	3	3								3	3	3	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	TOTAL	Credits
ME206PPC02	-	-	2	3 hrs.	30	20	50	1

HEAT AND MASS TRANSFER LAB

Course Objectives:

1. To understand and identify various modes of heat transfer and their applications in various heat transfer equipment.
2. Apply the theoretical concepts to perform heat transfer analysis experimentally.

Syllabus Content:

List of Experiments:

1. To find the thermal conductivity of insulating powder and metal rod.
2. To find the critical radius of insulating material.
3. To determine the overall and individual film heat transfer coefficient in finned tube heat exchanger.
4. Study and calculate the efficiency of fin in natural and forced convection.
5. To study about parallel flow and counter flow heat exchanger.
6. To find average surface heat transfer coefficient for a pipe and plot the surface temperature distribution along the length of pipe.
7. To study about emissivity measurement apparatus.
8. To study about the regenerative heat exchanger.
9. To determine total thermal resistance & thermal conductivity of composite wall.
10. To determine the overall & individual film heat transfer coefficient in 1:2 shell & tube heat exchanger.
11. To determine the thermal conductivity of lagging material.
12. To study about dropwise and film wise condensation.
13. To estimate the film heat transfer coefficient between the medium in which the body is heated.
14. To find the effectiveness of U-Tube finned heat exchanger.
15. To determine the overall & individual film heat transfer coefficient for the condensation of vapour on a vertical pipe.
16. To determine the Stefan Boltzman constant.
17. To determine the surface heat transfer coefficient for a vertical tube losing heat by natural convection.
18. To determine the surface heat transfer coefficient for a vertical tube losing heat by forced convection.
19. To estimate the film heat transfer coefficient for axial and radial convection phenomenon.
20. To find the effectiveness of cross flow heat exchanger.

List of Equipment/Instruments/Machines/Software Required:

1. Heat transfer From Pin Fin
2. Parallel Flow & Counter Flow H.E.
3. Heat Transfer in Force Convection
4. Emissivity Apparatus
5. Regenerative Heat Exchanges
6. Vertical Condenser

7. Composite Wall Apparatus
8. Lagged Pipe Apparatus
9. Critical Radius of Insulating Material
10. Heat Conduction Apparatus
11. Heat Transfer through Natural Convection
12. Unsteady Heat Transfer
13. Stefan Boltzmann Apparatus
14. Drop wise & Filmwise Condensation
15. Thermal Conductivity of Insulating Powder
16. Thermal Conductivity of Metal Rod
17. Finned Tube Heat Exchanges
18. Shell & Tube Heat Exchangers
19. U-Tube Finned Heat Exchanges
20. Cross- Flow Hear Exchanges
21. Radiation Heat Transfer Apparatus

Course Outcome:

1. Investigate experimentally the thermal conductivity of insulating material, lagged pipe and metal rod.
2. Conduct the transient heat conduction experiment and obtain variation of temperature with time of the spherical and cylindrical objects.
3. Obtain the value of convective heat transfer coefficients in forced convection and natural convection experiments.
4. Able to obtain radiation properties such as emissivity of a test plane and Stefan-Boltzmann's constant experimentally.
5. Understand the phenomenon of boiling and condensation.
6. Estimate the effectiveness of different types of heat exchangers.
7. Estimate the effectiveness of pin fin under natural and forced convection situations.
8. Perform critical radius of insulation of a lagged pipe.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1							1				2	1	
CO2	3	1							1				2	1	
CO3	3	2	2	1					1				2	1	1
CO4	3	2	1						1				2	1	
CO5	3	1							1				2	1	
CO6	3	2	2	1					1				2	1	1
CO7	3	2	2	1					1				2	1	1
CO8	3	1							1				2	1	

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME206PRJ02	1	-	2	3-Hours	40	60	100	2

MODELLING AND SIMULATION – II LAB

Course Objectives

1. To learn the basic features of part modelling
2. To learn basic features, methods and metrics of mesh generation
3. To perform analysis of simple systems in mechanical engineering domain

List of Laboratory activities

1. Concept of planes and sketches – how to create planes and sketches
2. Solid from Sketches, Using primitives
3. Design Modeler concepts – Using Frozen, Hidden, Suppressed, Active
4. Meshing – Simple geometries, features
5. Meshing – Complex geometries
6. Advanced Meshing features
7. Static Structural analysis
8. Vibration analysis
9. Analysis of Fluid flow in pipes or ducts
10. Steady state thermal analysis
11. Conjugate heat transfer
12. Fluid-structure interaction
13. Modeling & simulation of manufacturing processes etc.

Reference Books

1. ANSYS Theory Manual
2. ANSYS Tutorials

Course Outcomes

At the end of the course, the student shall be able to:
CO1: use basic modelling features in creating a solid model
CO2: understand mesh metrics and develop suitable mesh
CO3: apply suitable components for analysis of mechanical systems

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	3	-	-	-	3	3	-	3	3	3	3
CO2	1	1	1	2	3	-	-	-	3	3	-	3	3	3	3
CO3	3	3	3	2	3	-	-	-	3	3	-	3	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**