

FACULTY OF ENGINEERING

Scheme of Instruction & Examination & Syllabi

**B.E. V to VI Semesters of
Four Year Degree Program in
B.E. (Mechanical Engineering)
with effect from 2026-27**



**Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad**

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V - SEMESTER (MECHANICAL ENGINEERING)
 (Proposed for the Academic Year 2026-2027)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs./Week	CIE	SEE	Duration in Hours	
Theory Courses										
1	PC501ME	Dynamics of Machines	3	-	-	3	30	70	3	3
2	PC502ME	Fluid Mechanics and Hydraulic Machines	3	-	-	3	30	70	3	3
3	PC503ME	Heat Transfer	3	-	-	3	30	70	3	3
4	PC504ME	CAD/CAM	3	-	-	3	30	70	3	3
5	PC505ME	Metal Cutting and Machine Tools	3	-	-	3	30	70	3	3
6	Professional Elective-I		3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC551ME	Fluid Mechanics and Hydraulics Machinery lab	-	-	2	2	25	50	3	1
8	PC552ME	Dynamics of Machines Lab	-	-	2	2	25	50	3	1
9	PC553ME	CAPD & CAM Lab	-	-	2	2	25	50	3	1
10	SD554ME	Skill Development Course (Industrial Product Design)	-	-	2	2	50	-	-	1
Total			18	00	08	26	305	570	27	22

Professional Elective-I		
S.No	Course Code	Course Title
1.	PE511ME	Product Design and Process Planning
2.	PE512ME	Nanomaterials and Technology
3.	PE513ME	Energy Storage and Management System
4.	PE514ME	Renewable Energy Sources
5.	PE515ME	Power Plant Engineering





CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007.

HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7

SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

DYNAMICS OF MACHINES

Course Code: PC501ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To study static and dynamic force analysis of mechanism.
2. To know the working principles and understand concept of gyroscopic couple and flywheels.
3. To apply the concept of static and dynamic balancing for unbalanced rotating and reciprocating masses.
4. To evaluate the natural frequencies of damped and undamped vibrations and understand the concept of vibration isolation and transmissibility.
5. To understand the fundamentals of torsional and transverse vibrations, encoders, and MATLAB for vibration analysis.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze static and dynamic forces in slider crank and other mechanisms;
CO2: Determine the magnitude of gyroscopic couple and its effect on vehicles and design flywheels considering speed and energy fluctuation
CO3: Analyze balancing of rotating and reciprocating masses.
CO4: Evaluate the natural frequencies of single and degree of freedom systems in free and forced vibration mode, also considering the effect of damping.
CO5: Apply vibration analysis methods, encoder concepts, and MATLAB to analyze mechanical vibration systems.

UNIT-I

Static and Dynamic Force Analysis: Static equilibrium: Constraint and Applied forces, Static Force analysis of Single slider crank mechanism without Friction and four bar mechanism.

Dynamic Equilibrium: D'Alembert's Principle, Dynamic force Analysis of Slider Crank Mechanism.

Engine Force Analysis: Piston effort, Force along connecting rod, thrust on sides of cylinder, crank effort. Thrust on bearing. Dynamically Equivalent System for Connecting Rod.

UNIT-II:

Gyroscope: Gyroscopic Couple, gyroscopic effects on aeroplanes, naval ships, two-wheeler and four-wheeler.

Encoder: Types of encoders, working principle and applications of mechanical encoders.

Flywheels: Turning Moment Diagrams for different engines, Functions of flywheel, turning moment diagrams, flywheel analysis for I-C Engines and shearing/punching/riveting machines.

UNIT-III

Balancing of Rotating Masses: Static balancing, dynamic balancing, balancing of several masses rotating in several planes.

Balancing of Reciprocating Masses: primary balancing, shaking forces in single cylinder engine, partial balancing and its effects; hammer blow, variation of traction effort and swaying couple.

UNIT-IV

Vibrations: Vibrations of Single degree freedom system (axial, transverse and torsional); Whirling speed of shafts.

K. Sudeep

Bh

Z

Ushar

Damped Vibrations: Types of damping, Vibrations with viscous damping, damping factor and logarithmic decrement.

Forced Damped Vibrations: Magnification factor, Resonance, Vibration isolation and Transmissibility.

UNIT-V

Torsional Vibrations: Two rotor, three rotor and Geared systems with stepped shaft. Natural frequencies of two-degree freedom systems Modes of vibration.

Transverse vibrations: Approximate methods for determining natural frequencies of Dunkerley's method, Rayleigh's method.

Introduction to MATLAB programming: Syntax, scripting, data visualization; Application to Vibrations.

Suggested Reading:

1. S. S. Rattan, Theory of Machines, 5th ed. New Delhi, India: Tata McGraw-Hill Education, 2019.
2. J. J. Uicker, Jr., G. R. Pennock, and J. E. Shigley, Theory of Machines and Mechanisms. New Delhi, India: Oxford University Press, 2026.
3. R. L. Norton, Kinematics and Dynamics of Machinery, 3rd ed. New York, NY, USA: McGraw-Hill, 2020.
4. A. Ghosh and A. K. Mallik, Theory of Mechanisms and Machines, 3rd ed. New Delhi, India: East-West Press Pvt. Ltd., 2010.
5. T. Bevan, Theory of Machines, 3rd ed. New Delhi, India: CBS Publishers & Distributors, 2005.
6. J. S. Rao and K. Gupta, Theory and Practice of Mechanical Vibrations, 2nd ed. New Delhi, India: Prentice Hall of India, 2010.
7. S. S. Rao, Mechanical Vibrations, 5th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2011.
8. W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 6th ed. Harlow, U.K.: Pearson Education, 2015.

K. Sreedu

HEAD

Chakraborty

SENIOR PROFESSOR

CHAIRPERSON, Department of Mech. Engineering, Board of Studies in Mechanical Engineering, OF ENGINEERING (A), University College of Engineering (A), Osmania University, Hyderabad-07, T.S. Hyderabad-500 007.

FLUID MECHANICS AND HYDRAULIC MACHINES	
Course Code: PC502ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To understand fundamental fluid properties, fluid statics, and buoyancy concepts for analyzing fluids at rest.
2. To apply fundamental laws of fluid flow to analyze flow behavior in pipes and flow measuring devices.
3. To analyze the principles of turbomachinery and evaluate the performance of hydraulic turbines.
4. To apply working principles of reciprocating pumps to analyze their performance characteristics.
5. To analyze the working principles and performance characteristics of centrifugal pumps for practical applications.

Course Outcomes:

- Upon successful completion of this course, the student will be able to:
- CO1:** Analyze fluid properties, pressure distribution, and stability of floating and submerged bodies.
 - CO2:** Apply continuity and Bernoulli's equations to evaluate fluid flow and losses in pipe systems.
 - CO3:** Analyze hydraulic turbines and jet interactions to evaluate performance and efficiency.
 - CO4:** Evaluate performance parameters and operational characteristics of reciprocating pumps.
 - CO5:** Analyze centrifugal pump performance, efficiency, and operating conditions for engineering applications.

UNIT-I

Static Forces on Surface and Buoyancy: Fluids, ideal and real fluids, incompressible and compressible fluids, stream lines, path lines, stream function and velocity potential, fluid statics, action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure, Equilibrium of floating bodies, stability of a submerged body, stability of floating bodies.

Properties of fluids: Density, specific weight, specific gravity, specific volume, viscosity, Newton's law of viscosity, dynamic and kinematic viscosity, pressure.

UNIT-II:

Laws of Fluid Flow: Continuity theorem, Bernoulli's theorem, applications of Bernoulli's theorem, Pitot tube theoretical discharge, actual discharge and coefficient of discharge of Venturi meter, notches-rectangular, triangular, trapezoidal and stepped notches

Viscous Flow: Nature of flow-laminar, turbulent and transient flows, Reynolds number and its significance.

Flow through Pipes: Head losses in pipes, pipe bends, major energy losses, loss of head due to friction in the pipe, Darcy-Weisbach equation, hydraulic gradient and total energy lines, pipes in series and parallel.

K. Sridhar

UNIT-III

Basics of turbo machinery: Types of hydraulic machines, impulse-momentum equation and its applications, layout of hydraulic power plant-working principle, Hydrodynamic force of jets on stationary and moving flat, inclined, and symmetrical curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT-IV

Reciprocating Pumps: Classification and working principle, discharge, slip, coefficient of discharge, power required to drive the pump and efficiency, variation of pressure head due to acceleration of piston and pipe friction, ideal and actual indicator diagrams, separation, safe speed to avoid separation, air vessels, work saved, quantity of water entering into or coming out of air vessels and performance characteristic curves.

UNIT-V

Centrifugal pumps: Classification and working principle, Comparison over reciprocating pumps, Velocity triangles, Head equivalent of work done, Efficiencies, Pressure rise, Minimum starting speed, Specific speed, Physical significance, Model testing, Conditions of similarity, Priming, Performance characteristic curves.

Suggested Reading:

1. Modi, P.N. & Seth, S.M., Hydraulics & Fluid Mechanics Including Hydraulic Machines, Standard Book House, 22nd Edition, 2019.
2. A.K. Mohanty, Fluid Mechanics, PHI Learning Pvt. Ltd., 2nd Edition, 2019.
3. S.K. Som, Gautam Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill Education, 4th Edition, 2023.
4. Bansal, R.K., Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 10th Edition, 2022.
5. Gupta, V., & Gupta, S.K., Fluid Mechanics and Its Applications, New Academic Science, 2012.


CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Department of Mech. Engineering
 Osmania University, Hyderabad-7
 Hyderabad-500 007.


HEAD
 Department of Mech. Engineering
 Osmania University, Hyderabad-7
 Hyderabad-500 007.


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

HEAT TRANSFER	
Course Code: PC503ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To understand the fundamental principles and laws governing heat transfer by conduction, convection, and radiation.
2. To analyze steady and unsteady heat conduction problems in different geometries and boundary conditions.
3. To study convection heat transfer mechanisms and apply dimensional analysis and empirical correlations.
4. To comprehend radiation heat transfer concepts and evaluate heat exchange between surfaces.
5. To analyze and design heat exchangers and understand phase change processes like boiling and condensation.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Apply heat transfer laws to solve conduction problems in various geometries and conditions.
CO2: Analyze transient heat conduction using lumped systems and graphical methods like Heisler charts.
CO3: Evaluate convection heat transfer using dimensional analysis and empirical correlations.
CO4: Calculate radiation heat exchange between surfaces and analyze thermal radiation systems.
CO5: Design and analyze heat exchangers and assess heat transfer during boiling and condensation processes.

UNIT-I

Conduction: Modes of Heat Transfer, Laws of Heat Transfer - Fourier, Newton, Stefan-Boltzmann General conduction equation in cartesian, cylindrical and spherical coordinates, One dimensional steady state conduction through slabs, hollow cylinders and spheres with and without heat generation, Effects of variable thermal conductivity in heat transfer of one dimensional steady state conduction of plate, cylinders and spheres, Steady state heat transfer through composite slabs, cylinders and spheres, Critical radius of insulation.

UNIT-II:

Fins: Heat transfer analysis of tips with heat dissipation environment - rectangular straight and pin fins, Application of fin to temperature measurement, unsteady state conduction, Lumped parameter, analysis of a body with negligible internal temperature gradients, Transient heat transfer analysis of finite slab with specified temperature and convective boundary conditions, Use of Grober and Heisler charts for solving problems of infinite slabs, cylinders and spheres.

UNIT-III

Free and forced convection: Dimensional analysis and its use in free and forced convection, Buckingham theorem, Physical significance of different dimensionless numbers, Application of Von-Karman integral equation for the analysis of thermal

K. Suresh

boundary layer in forced convection of flat plate, Reynold's analogy for flow over plane surfaces, calculation of heat transfer for flow over plates, cylinders, spheres and for flow through tubes in free and forced convection using empirical formulae.

UNIT-IV

Radiation: Definition of absorptivity, reflectivity and transmissivity, Concept of black-body and emissivity. Kirchhoff's law, Planck's black body spectral distribution, Wien's and Steffan Boltzmann law, Monochromatic and total emissive power, radiant heat exchange between two gray surfaces, Shape factor, Thermal circuit for radiant heat exchange between infinite parallel plates and between concentric, cylinders, Enclosures with black and gray surfaces, Radiation shields and re-radiation surfaces.

UNIT-V

Heat Exchangers: Classification and applications of heat exchangers in industry, Analysis and design of counter flow and parallel flow heat exchanger, Fouling factors, solving problems for multi pass heat exchanger using non dimensional parameter plots.

Change of Phase: Boiling-pool boiling regimes nucleate pool boiling, effect of surface wettability on bubble contact angle, Critical heat flux, boiling in forced convection, Condensation: Film condensation, Drop wise condensation, Condensation film thickness, Heat transfer coefficient in film condensation.

Suggested Reading:

1. J. P. Holman, Heat Transfer, 10th ed. New Delhi, India: McGraw-Hill Education, 2010.
2. R. K. Rajput, Heat and Mass Transfer, 5th ed. New Delhi, India: S. Chand & Company Ltd., 2018.
3. R. Yadav, S. Yadav, and R. Yadav, Heat and Mass Transfer. Allahabad, India: Central Publishing House, 2019.
4. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, 6th ed. New Delhi, India: New Age International (P) Ltd., 2019.
5. S. C. Arora and S. Domkundwar, A Course in Heat and Mass Transfer, 10th ed. New Delhi, India: Dhanpat Rai & Sons, 2018.

Data Handbook:

1. Heat and Mass Transfer Data Book by C. P. Kothandaraman and S. Subramanyan, published by New Age International.
--

Note : 1. Solution of **Numerical problems** using Heat Transfer data book should be practiced.

2. Standard data book is allowed in University exam.


K. Suddu
 HEAD
 Department of Mech. Engineering
 Board of Studies in Mechanical Engineering
 Osmania University,
 Hyderabad-500 007.


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

CAD/CAM	
Course Code: PC504ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To Understand CAD fundamentals, product life cycle, CAD software, hardware, and databases.
2. To learn geometric, surface, solid, and assembly modeling techniques.
3. To Understand NC systems and develop basic part programs using APT and macros.
4. To Study CNC, DNC, adaptive control systems, and industrial robots.
5. To Understand Group Technology, CAPP, CAQC, AI, and CAD/CAM integration.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Explain CAD fundamentals, software, hardware, and databases.
CO2: Apply geometric, surface, solid, and assembly modeling methods.
CO3: Develop basic NC/CNC part programs using APT and macros.
CO4: Analyze CNC, DNC, adaptive control systems, and industrial robot applications.
CO5: Evaluate GT, CAPP, CAQC, AI, and CAD/CAM integration in manufacturing.

Unit-I
CAD Fundamentals, Product life cycle in conventional and computer-based manufacturing system, Hardware integration and networking. CAD Software: Definitions of system software and application software. Graphic Standards and Exchange Formats. CAD database and structure.
Unit-II:
Geometric modeling: 3-D wire frame modeling: wire frame entities and their definitions, Interpolation and approximation of curves, synthetic curves and curve fitting. Definitions of cubic, Bezier, and B-spline curves. Surface modeling: Definitions of basic surfaces, surface of revolution, blends, intersection, and Cubic, Bezier, B-spline surfaces. Solid Modeling: Solid entities, Boolean operations, B-rep and C-rep approaches. Feature based modeling: Concepts and applications, Assembly modeling.
Unit-III
Numerical Control of machine Tools: Features and elements of NC. Positional, paraxial and contouring types. Definitions of axes, punched type, formats of tape preparation. Definitions of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, tool length and cutter radius compensation. Manual and computer aided part programming (APT) for simple components. Programming with MACROS.
Unit-IV
CNC, DNC and adaptive control systems. Their types, typical configurations and relative features. Industrial Robots: Classification based on manipulator configurations, relative characteristics, Online and offline programming methods, controls and drives, applications.
Unit-V





Group Technology: Organization, G.T. layout, part classification and coding, CAPP: Variant and Generative approaches and their relative features. Computer Aided Quality Control: Computer in quality control, Contact and non-contact inspection, optical and non-optical computer aided testing, Experts systems. Artificial intelligence, CAD/CAM integration

Suggested Reading:

1. I. Zeid, CAD/CAM: Theory and Practice, 2nd ed. New Delhi, India: Tata McGraw-Hill Education, 2009.
2. M. P. Groover and E. W. Zimmers, Jr., CAD/CAM: Computer-Aided Design and Manufacturing. New Delhi, India: Pearson Education, 1984.
3. P. N. Rao, CAD/CAM: Principles and Applications, 4th ed. New Delhi, India: McGraw-Hill Education, 2023.
4. M. P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 4th ed. Harlow, U.K.: Pearson Education, 2020.
5. P. Radhakrishnan, S. Subramanyan, and V. Raju, CAD/CAM/CIM, 3rd ed. New Delhi, India: New Age International Publishers, 2008.


CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007


HEAD
 Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

METAL CUTTING & MACHINE TOOLS	
Course Code: PC505ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To understand cutting tool materials, tool geometry, and mechanics of metal cutting processes.
2. To apply concepts of cutting temperature, tool wear, tool life, and machining economics.
3. To have the knowledge of construction and working of machine tools and perform various machining operations.
4. To describe the finishing processes and gear/thread manufacturing techniques.
5. To gain the capacity, design principles of jigs and fixtures and analyze unconventional machining processes.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze chip formation, tool geometry, and mechanics of metal cutting using theoretical models.
CO2: Evaluate tool performance, tool life, and optimize machining parameters for cost and productivity.
CO3: Apply machine tool operations and select appropriate machines and mechanisms for manufacturing processes.
CO4: Analyze grinding and finishing processes along with gear and thread manufacturing techniques.
CO5: Apply jigs and fixtures design principles and evaluate unconventional machining processes for industrial applications.

UNIT-I

Cutting Tool Materials: High carbon steel, HSS, Stellites, Carbides, Coated carbides, Diamonds, Tool material properties; **Tool Geometry:** Nomenclature of single point cutting tool by ASA & ORS systems. Geometry of drills, milling cutters; **Chip Formation:** Types of chips, BUE, Chip breakers; **Machining:** Orthogonal and oblique cutting, Mechanics of metal cutting, Merchant's analysis, Shear angle, Solutions of Merchant and Lee & Shafer.

UNIT-II:

Thermal Aspects of Metal Cutting: Sources of heat and heat distribution, various methods of measurement of temperature, Cutting fluids and applications; **Tool Wear, Tool Life and Machinability:** Types of wear, mechanism of tool wear, Tool life & Machinability, Machinability index. Taylor's tool life equation;
Economics of Machining: Optimum Cutting Speeds for maximum production rate and minimum cost.

UNIT-III

Machine Tools: Constructional features and specifications of machine tools, various operations on Lathe, Types of Lathes - capstan and turret Lathes; Drilling, Milling and Boring machines. Indexing methods, differences between shaper, planer and slotter, Tool holding and work holding devices Quick return mechanisms.

k. Sadeeq
 Bh
 I
 Chakr

UNIT-IV

Grinding Machines: Types of grinding, Abrasives and bonds used for grinding wheels. Specification and selection of grinding wheels; Broaching, Lapping, Honing, Polishing, Buffing, Super Finishing and Burnishing.

Screws and Gear Manufacturing: Tapping, Chasers, Thread rolling, Thread milling, Thread grinding. Gear shaping, Gear hobbing, Gear shaving and grinding.

UNIT-V

Jigs and Fixtures: Design principles for location and clamping. Quick clamping devices Types of Jigs and fixtures. Applications of Jigs and Fixtures.

Unconventional Machining: Principle of working, merits, demerits and applications of USM, AJM, EDM, ECM, LBM and EBM.

Suggested Reading:

1. B. L. Juneja and G. S. Sekhon, Fundamentals of Metal Cutting and Machine Tools, 2nd ed. New Delhi, India: Wiley Eastern Ltd., 2003.
2. P. N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, vol. 2, 4th ed. New Delhi, India: Tata McGraw-Hill Education Pvt. Ltd., 2019.
3. A. Ghosh and A. K. Mallik, Manufacturing Science, 2nd ed. New Delhi, India: Affiliated East-West Press Pvt. Ltd., 2010.
4. P. K. Mishra, Non-Traditional Machining Processes, 3rd ed. New Delhi, India: Narosa Publications, 2016.
5. V. K. Jain, Advanced Machining Processes, 2nd ed. New Delhi, India: Allied Publishers Pvt. Ltd., 2016.
6. A. Bhattacharyya, Metal Cutting: Theory and Practice, 4th ed. Kolkata, India: New Central Book Agency (P) Ltd., 2018.
7. S. Radzevich, Gear Manufacturing, 2nd ed. Boca Raton, FL, USA: CRC Press, 2017.





CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Department of Mech. Engineering
 Osmania University, Hyderabad-500 007.

HEAD
 Department of Mech. Engineering (A)
 COLLEGE OF ENGINEERING
 Osmania University, Hyderabad-7

SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

PRODUCT DESIGN AND PROCESS PLANNING	
Course Code: PE511ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand the Product Design and Process Design Functions and evaluation techniques.
2. To assess the importance of Design and Human-Machine Interaction (Ergonomics Consideration).
3. To understand the fundamentals of new product development, intellectual property rights, and systems engineering concepts for engineering applications.
4. To develop key features of new product design and marketing strategies.
5. To analyze the overall concept of Process Planning and value engineering in manufacturing.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Apply Systems Thinking and innovation techniques like Brainstorming and Delphi Technique to develop and select suitable product designs.
CO2: Evaluate and select projects using design principles, Human-Machine Interaction, and Ergonomics for improved usability and efficiency.
CO3: Apply product development, patent awareness, and systems engineering principles to support engineering design and decision-making.
CO4: Analyze and plan new products by integrating design, manufacturing, quality, and marketing functions using effective product strategies.
CO5: Apply process planning, cost estimation, and techniques like Value Engineering and Concurrent Engineering for efficient manufacturing.

Unit-I

Product Design and Process Design functions: Selection of right product, Systematic procedure of product innovation, Factors contributing to successful technological innovation - need for creativity and innovation, Techniques of innovation-like brain storming and Delphi techniques.

Unit-II:

Project Selection and Evaluation: Function of design – Design with Human Machine Interaction (HMI). Collection of ideas and purpose of project. Selection criteria – screening ideas for new products using evaluation techniques. Principles of ergonomics.

Unit-III

New Product Development: Introduction to New product development & Product Life Cycle. Patents, definitions, patent search, patent laws, international code for patents –Intellectual Property Rights (IPR).
System Engineering Concepts: Reliability, Maintainability and Availability, Risk Management, Industrial Applications and Case Studies.

Unit-IV

New – Product Planning: Interaction between the functions of design, manufacture, quality & testing and marketing. Steps for introducing new products after evaluation. Product Design Practice and Industry – *Product Strategies, Analysis of the Product, The Three S's*.

Unit-V

k. Sadeeq

Process-Planning: Process planning, process sheets. Selection of manufacturing process, estimation of machining time in various cutting operations – estimation of costs for manufacture. Value engineering in product design, group technology, concepts of concurrent engineering.

Suggested Reading:

1. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, 7th ed. New Delhi, India: PHI Learning Pvt. Ltd., 2023.
2. B. W. Niebel and A. B. Draper, Product Design and Process Engineering. New York, NY, USA: McGraw-Hill, 1974.
3. G. E. Dieter and L. C. Schmidt, Engineering Design: A Materials and Processing Approach, 5th ed. New York, NY, USA: McGraw-Hill Education, 2013.
4. H. Nystrom, Creativity and Innovation. New York, NY, USA: John Wiley & Sons, 1979.
5. B. Twiss, Managing Technological Innovation. London, U.K.: Pitman Publishing, 1992.
6. H. B. Waton, New Product Planning. Englewood Cliffs, NJ, USA: Prentice Hall Inc., 1992.


 CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007


 HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-1


 SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

NANOMATERIALS AND TECHNOLOGY	
Course Code: PE512ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To introduce nanoscale concepts, properties, and approaches in nanotechnology.
2. To study different nanomaterials and their characteristics along with analytical techniques.
3. To understand synthesis, properties, and applications of various nanostructures.
4. To learn physical and chemical methods used for synthesis of nanomaterials.
5. To gain knowledge of Nano fabrication techniques and MEMS processes.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Explain nanoscale phenomena and distinguish between top-down and bottom-up approaches.
CO2: Identify various nanomaterials and apply characterization techniques like XRD, SEM, and TEM.
CO3: Analyze synthesis methods and applications of nanoparticles, nanowires, and nanotubes.
CO4: Apply physical and chemical synthesis techniques for nanomaterial preparation.
CO5: Understand and evaluate Nano fabrication and MEMS techniques for device

Unit-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in Nano Technology. Metal Nanocrystals, Semiconductor nanomaterials, Carbon nano tubes.

Unit-II:

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, Smart materials, metals, Ferroelectric materials, Polymer materials, GaAs, GaN & InP (III-V) group materials, Nano tribology and Materials, Principles and analytical techniques of XRD, SEM, TEM and STM/AFM.

Unit-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles. One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

Unit-IV**Synthesis of Nanomaterials:**

Physical Methods: Physical Vapor Deposition (PVD), Inert gas condensation, Arc discharge, DC sputtering, Ion sputtering, Ball Milling, Molecular beam epitaxy, Electro-deposition, **Chemical Methods:** Metal nanocrystals by reduction, Sol- gel, Solvothermal synthesis, Photochemical synthesis, Electrochemical synthesis, Nanocrystals of semiconductors.

Unit-V

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

Dr. Farid Ali

Suggested Reading:

1. A. K. Bandyopadhyay, Nanomaterials. New Delhi, India: New Age International Publishers, 2007.
2. T. Pradeep, Nano: The Essentials – Understanding Nanoscience and Nanotechnology, 2nd ed. New Delhi, India: Tata McGraw-Hill Education, 2017.
3. C. C. Koch, Ed., Nanostructured Materials: Processing, Properties and Applications, 2nd ed. Norwich, NY, USA: William Andrew (Elsevier), 2006.
4. W. I. Atkinson, Nanotechnology. Mumbai, India: Jaico Publishing House, 2009.
5. C. P. Poole, Jr. and F. J. Owens, Introduction to Nanotechnology, 2nd ed. Hoboken, NJ, USA: John Wiley & Sons, 2007.
6. G. Cao and Y. Wang, Nanostructures and Nanomaterials: Synthesis, Properties and Applications, 2nd ed. Singapore: World Scientific Publishing Co., 2011.





CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007

HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7

SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

ENERGY STORAGE AND MANAGEMENT SYSTEM	
Course Code: PE513ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand different types of batteries and energy storage systems used in electric vehicles and their applications.
2. To study battery characteristics, performance parameters, and design considerations for EV applications.
3. To analyze battery modeling and simulation techniques for various rechargeable batteries.
4. To learn battery selection, management systems, and thermal control strategies in EVs and HEVs.
5. To understand safety aspects, environmental impacts, and recycling methods of batteries.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze different battery technologies and energy storage systems for engineering applications.
CO2: Apply battery design parameters and evaluate performance for electric vehicle requirements.
CO3: Apply modeling and simulation techniques to model battery modeling and performance.
CO4: Analyze battery management systems, state estimation, and thermal management for safe operation.
CO5: Evaluate battery safety, environmental impacts, and recycling methods for sustainable energy systems.

UNIT-I

Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System. Applications

UNIT-II:

Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications, operating conditions, nominal and maximum characteristics; Efficiency of batteries; Electrical parameters- Heat generation- Battery design parameters, Performance criteria for Electric vehicles batteries. **Vehicle propulsion factors:** Power and energy requirements of batteries, Meeting battery performance criteria, setting new targets for battery performance

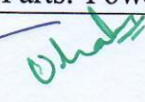
UNIT-III

General approach to modeling batteries, simulation model of a rechargeable Li-ion battery, simulation model of a rechargeable Ni-Cd battery, Parameterization of the Ni-Cd battery model, Simulation examples.

UNIT-IV

Selection of battery for Evs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system,
Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter,

K. Gadey

load, communication channel, Battery Pack Safety, Battery Standards and Tests.

UNIT-V

Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. **Ruptures:** Mechanical stress and pressure tolerance of cells, safety vents, **Explosions:** Causes of battery explosions, explosive process, **Thermal Runway:** High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries. **Phase Change Materials:** Classification, Properties, Advantages, Limitations & Applications.

Suggested Reading:

1. X. Tan, A. Vezzini, Y. Fan, N. Khare, Y. Xu, and L. Wei, Battery Management System and Its Applications, 1st ed. Hoboken, NJ, USA: John Wiley & Sons, 2022.
2. N. Tiwari and S. Yadav, Electric and Hybrid Vehicle (Green and Sustainable Transportation). New Delhi, India: S. K. Kataria & Sons, 2024.
 - a. V. Pop, H. J. Bergveld, D. Danilov, P. P. L. Regtien, and P. H. L. Notten, Battery Management Systems: Accurate State-of-Charge Indication for Battery-Powered Applications. Dordrecht, Netherlands: Springer, 2008.
3. J. Larminie and J. Lowry, Electric Vehicle Technology Explained, 2nd ed. Chichester, U.K.: John Wiley & Sons, 2012.
4. M. Ehsani, Y. Gao, and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, 3rd ed. Boca Raton, FL, USA: CRC Press, 2018.
5. Y. Wu, Ed., Lithium-Ion Batteries: Fundamentals and Applications. Boca Raton, FL, USA: CRC Press, 2015.
6. C. D. Rahn and C.-Y. Wang, Battery Systems Engineering. Hoboken, NJ, USA: John Wiley & Sons, 2013.

Additional Reading

1. <http://nptel.ac.in/courses/108103009>.

K. Sreedu
CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500007

[Signature]
HEAD
Department of Mech. Engineering
SCHOOL OF ENGINEERING (A)
Osmania University, Hyderabad-7

[Signature]
SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

RENEWABLE ENERGY SOURCES	
Course Code: PE514ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand the concepts, classification, and potential of renewable energy sources (RES).
2. To study solar energy systems, collectors, and photovoltaic technologies.
3. To analyze wind energy conversion systems and their performance parameters.
4. To learn the principles and applications of geothermal and biomass energy systems.
5. To understand ocean energy sources such as tidal, wave, and OTEC systems and their impacts.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Explain the importance and classification of renewable energy sources and assess their potential.
CO2: Analyze solar thermal and photovoltaic systems for energy conversion applications.
CO3: Evaluate wind energy systems and calculate performance parameters.
CO4: Apply knowledge of geothermal and biomass energy for practical energy generation.
CO5: Assess ocean energy systems and evaluate their economic and environmental feasibility.

UNIT-I

Statistics on conventional energy sources and supply in developing countries, Definition- Concepts of RES, Limitations of RES, Criteria for assessing the potential of NCES. Classification of RES- Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

UNIT-II:

Solar Energy-Energy available from Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

UNIT-III

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion – Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors- Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

UNIT-IV

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features- Atmospheric exhaust and condensing, exhaust types of conventional steam turbines. Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

UNIT-V

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power plants, Operational of small cycle

K. Sadey

experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

Suggested Reading:

1. G. D. Rai, Non-Conventional Energy Sources, 5th ed. New Delhi, India: Khanna Publishers, 2011.
2. N. L. Panwar, S. L. Narnaware, and S. Narnaware, Renewable Energy Sources. New Delhi, India: New India Publishing Agency, 2016.
3. N. Kumari, R. P. Saini, and D. P. Kothari, Wind and Solar Energy Systems. Singapore: Springer Nature Singapore, 2024.
4. D. Sharma, K. K. Samar, and N. Rathore, Textbook on Renewable Energy and Green Technology. Jodhpur, India: Agrotech Publishing Academy, 2020.
5. G. Dwivedi, G. Saini, A. K. Shukla, and D. B. Pal, Eds., Clean Energy Technologies: Status and Perspective of Next-Generation Fuels. Singapore: Springer Nature Singapore, 2025.


 CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007


 HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7


 SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

POWER PLANT ENGINEERING	
Course Code: PE515ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand different sources of energy and power generation systems used in thermal, hydro, gas, and nuclear plants.
2. To study the working principles and layouts of steam, gas, hydro, and nuclear power plants.
3. To analyze combustion processes, fuel handling systems, and auxiliary equipment in power plants.
4. To learn hydrological concepts and operational principles of hydroelectric power generation.
5. To evaluate power plant economics and environmental impacts of power generation systems.

Course Outcomes:

- Upon successful completion of this course, the student will be able to:
- CO1:** Identify and explain various energy resources and power generation systems used in India.
- CO2:** Analyze the working and performance of steam, gas, hydro, and nuclear power plants.
- CO3:** Evaluate combustion systems, fuel handling techniques, and auxiliary plant equipment.
- CO4:** Apply hydrological and operational principles for hydroelectric power generation.
- CO5:** Assess economic factors and environmental effects associated with power plants and propose control measures.

Unit-I
Introduction to Sources of Energy-Resources and Development of Power in India. Steam Power Plant: Plant layout, working of different Circuits, Fuel and handling equipment, types of coal, coal handling, choice of handling equipment, coal storage, ash handling systems.
Unit-II:
Combustion Process: Properties of coal- overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers, and heat rejection, corrosion and feed water treatment. Gas Turbine Power Plant: Introduction -Classification-Layout with Auxiliaries-Principles of working of closed and open cycle gas turbines
Unit-III
Hydro Electric Power Plant: Water Power-Hydrological cycle, flow measurement- drainage area Characteristics-Hydrographs-storage and pond age- classification of dams and spill ways
Unit-IV
Nuclear Power Station: Nuclear fuel-breeding and fertile materials -Nuclear reactor-reactor Operation- Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas-cooled reactor. Radiation hazards and shielding - radioactive waste disposal.
Unit-V

K. Sudeep

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, average load and load factor, delivery factor-related exercises Effluents from power plants and impact on environment -Pollutants and Pollution Standards -Methods of pollution control.

Suggested Reading:

1. R. K. Rajput, A Textbook of Power Plant Engineering, 5th ed. New Delhi, India: Laxmi Publications, 2015.
2. S. C. Arora and S. Domkundwar, A Course in Power Plant Engineering. New Delhi, India: Dhanpat Rai & Sons.
3. R. Yadav, Steam and Gas Turbines and Power Plant Engineering, 7th ed. Allahabad, India: Central Publishing House, 2007.
4. P. K. Nag, Power Plant Engineering, 4th ed. New Delhi, India: McGraw-Hill Education (India), 2014.
5. M. M. El-Wakil, Powerplant Technology. New York, NY, USA: McGraw-Hill, International ed., 2002.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

FLUID MECHANICS & HYDRAULIC MACHINERY LAB	
Course Code: PC551ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives:

1. To Understand the governing equations and fundamental principles of fluid flow.
2. To Apply theoretical concepts of fluid mechanics to practical laboratory experiments.
3. To Demonstrate experimental procedures related to fluid flow, pumps, and turbines.
4. To Analyze the functioning of flow measuring devices, hydraulic pumps, and turbines.
5. To Evaluate the performance characteristics of hydraulic machines through experimental data.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Illustrate the construction and working of hydraulic machines.
CO2: Apply Bernoulli's principle in flow measurement devices used in hydraulic systems.
CO3: Analyze the working principles and operational characteristics of pumps and turbines.
CO4: Interpret experimental results and correlate them with theoretical concepts.
CO5: Evaluate the performance of pumps and turbines using characteristic curves.

List of Experiments:

1. Performance and characteristic curves of Self Priming pump.
2. Performance and characteristic curves of Centrifugal/ Submersible pump.
3. Performance and characteristic curves of Reciprocating pump.
4. Performance and characteristic curves of Gear pump.
5. Impact of Jets on Vanes.
6. Performance and characteristic curves of Pelton Wheel.
7. Performance and characteristic curves of Francis Turbine.
8. Performance and characteristic curves of Kaplan Turbine.
9. To determine coefficient of discharge of venturi meter.
10. To determine coefficient of discharge of orifice meter.
11. To Determine Reynolds Number of fluid using Reynolds Apparatus.
12. Study of Hydraulic Circuits.
13. Study of pneumatic Circuits.
14. Characteristics Curves test on turbo Wheel.
15. Study of Positive displacement and Rotodynamic pumps with the help of models.
16. Verification of Bernoulli's principle.

Note: Minimum ten experiments should be conducted in the semester.

K. Sudeep [Signature] [Signature]

DYNAMICS OF MACHINES LAB	
Course Code: PC552ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives

1. To understand the effects and importance of kinematic and dynamic analysis of mechanisms.
2. To understand effects of vibration on Single degree of freedom vibration systems.
3. To study the effect of gyroscopic couple and performance of governors and cams.
4. To carry out the static and dynamic analysis of four bar mechanisms and drives.
5. To analyze balancing of rotating masses and determine critical speeds and inertia properties of mechanical systems.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Evaluate performance characteristics of centrifugal governors and compare their Stability.
CO2: Estimate the Gyroscopic couple and its effect on a Precessing rotating member.
CO3: Determine the magnitude, location and orientation of a balancing mass required to balance the unbalance rotating system and verify the static and dynamic balancing.
CO4: Sketch the CAM profiles for different combinations of CAM and Follower and examine the operating speed limit for each combination.
CO5: Determine the time response of single and two-degree freedom systems with free and forced vibrations and evaluate the critical speed of the shaft.

List of Experiments:

1. Performance Characteristics and stability of Watt Governor
2. Performance Characteristics and stability of Porter Governor
3. Performance Characteristics and stability of Proell Governor
4. Performance Characteristics and stability of Hartnell Governor
5. Effect of Gyroscopic Couple on a rotating disc.
6. Static and Dynamic Balancing of Rotating Masses.
7. Longitudinal vibration of Spring-Mass System.
8. Torsional Vibration of Single Rotor System.
9. Torsional Vibration of Double Rotor System.
10. Whirling Speed of Shaft.
11. Free and Forced Vibration of Simply Supported Beam.
12. Free and Forced Vibration of Cantilever Beam.
13. Jump speed of cam with various cam and follower combinations
14. Cam Profile
15. Moment of Inertia of Flywheel.

Note:

1. Minimum ten experiments should be conducted in the semester.
2. Six sigma concepts to be applied to measurements of the experimental outcomes.

K. Suresh

[Signature]

[Signature]

CAPD & CAM LAB	
Course Code: PC553ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives

1. To develop skills in 3D part modeling and engineering drawings with GD&T.
2. To understand limits, fits, tolerances, surface finish, and production drawing preparation.
3. To prepare process sheets and perform basic CNC turning operations.
4. To perform CNC turning and milling operations using interpolation techniques.
5. To develop NC programs using CAM software and integrate CNC machines with robots and material handling systems.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Create 3D part models and engineering drawings with GD&T specifications.
CO2: Apply limits, fits, tolerances, and surface finish standards in production drawings.
CO3: Prepare process sheets and execute basic CNC turning operations.
CO4: Perform CNC turning and milling operations using appropriate machining cycles and interpolation.
CO5: Generate NC programs using CAM software and implement basic CNC automation and integration.

Computer Aided Production Drawing:

1. Part modelling from given assembly drawings using any solid modelling package.
2. Geometrical dimensioning and tolerance representation on part drawings.
3. Conventional practices indicating Dimensional, Form & Position tolerances.
4. Calculation of limits, suggestion of suitable fits for mating parts with Interference detection.
5. Surface finish, surface treatments- specification and indication methods on the drawings.
6. Generation of production drawings in 2D from part models representing Limits, fits, Tolerances, Surface finish, geometrical and form tolerance etc.
7. Preparation of Process sheet incorporating Tool work orientation diagrams.

Computer Aided Manufacturing:

8. Facing and Plain Turning Operation using CNC Lathe machine.
9. Step Turning and Taper Turning operation using CNC Lathe.
10. Contouring or Profile Turning using linear and circular interpolation on CNC Lathe.
11. Pocketing and 2-D Contouring operations using CNC milling machine.
12. Simulation and Development of NC code using CAM software.
13. Programming for integration of various CNC machines, robots and material handling system.

Note: Minimum ten experiments should be conducted in the semester.

K. Sudeep

CAPD & CAM LAB	
Course Code: PC553ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives

1. To develop skills in 3D part modeling and engineering drawings with GD&T.
2. To understand limits, fits, tolerances, surface finish, and production drawing preparation.
3. To prepare process sheets and perform basic CNC turning operations.
4. To perform CNC turning and milling operations using interpolation techniques.
5. To develop NC programs using CAM software and integrate CNC machines with robots and material handling systems.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Create 3D part models and engineering drawings with GD&T specifications.
CO2: Apply limits, fits, tolerances, and surface finish standards in production drawings.
CO3: Prepare process sheets and execute basic CNC turning operations.
CO4: Perform CNC turning and milling operations using appropriate machining cycles and interpolation.
CO5: Generate NC programs using CAM software and implement basic CNC automation and integration.

Computer Aided Production Drawing:

1. Part modelling from given assembly drawings using any solid modelling package.
2. Geometrical dimensioning and tolerance representation on part drawings.
3. Conventional practices indicating Dimensional, Form & Position tolerances.
4. Calculation of limits, suggestion of suitable fits for mating parts with Interference detection.
5. Surface finish, surface treatments- specification and indication methods on the drawings.
6. Generation of production drawings in 2D from part models representing Limits, fits, Tolerances, Surface finish, geometrical and form tolerance etc.
7. Preparation of Process sheet incorporating Tool work orientation diagrams.

Computer Aided Manufacturing:

8. Facing and Plain Turning Operation using CNC Lathe machine.
9. Step Turning and Taper Turning operation using CNC Lathe.
10. Contouring or Profile Turning using linear and circular interpolation on CNC Lathe.
11. Pocketing and 2-D Contouring operations using CNC milling machine.
12. Simulation and Development of NC code using CAM software.
13. Programming for integration of various CNC machines, robots and material handling system.

Note: Minimum ten experiments should be conducted in the semester.

K. Fayed

INDUSTRIAL PRODUCT DESIGN (SDC)	
Course Code: SD554ME	CIE: 50 marks
Instruction: 2P/1L periods per week	SEE: -
Duration of SEE: -	Credits : 1

Course Objectives:

1. To understand the industrial product design and development process.
2. To Apply design thinking and creativity to solve engineering problems.
3. To Develop ergonomic, functional, and manufactural product designs.
4. To create 3D CAD models and engineering drawings of products.
5. To develop prototypes and validate product performance.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Apply design thinking methodologies to industrial product development.
CO2: Develop conceptual designs considering functionality, ergonomics, aesthetics, and sustainability.
CO3: Create detailed 3D CAD models and production drawings of industrial products.
CO4: Select suitable materials and manufacturing processes for product realization.
CO5: Design, prototype, and present an industrial product that meets user and manufacturing requirements.

Week**Topics to be covered**

- 1 Introduction to Industrial Product Design, Product Development Process, Design Thinking
- 2 Product Design Process: Market Research, Customer Requirements, Product Specifications
- 3 Concept Generation: Brainstorming, Morphological Charts, TRIZ, Concept Screening
- 4 Ergonomics, Anthropometry, Human Factors, Product Aesthetics
- 5 Materials Selection and Manufacturing Processes for Product Design
- 6 CAD Modeling of Product Components (SolidWorks/Creo/Fusion 360)
- 7 Assembly Modeling, Design Intent, Parametric Design
- 8 Design for Manufacturing (DFM) and Design for Assembly (DFA)
- 9 Product Rendering, Visualization, and Technical Documentation
- 10 Rapid Prototyping and Additive Manufacturing (3D Printing)
- 11 Product Testing, Validation, Reliability, and Design Improvement
- 12 Sustainable Product Design, Eco-design, and Product Life Cycle
- 13 Intellectual Property Rights (IPR), Patents, Product Costing, and Commercialization
- 14 Mini Project: Design, Prototype, and Presentation of an Industrial Product

K. Suddu

Suggested Reading

1. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, 6th ed. New Delhi, India: PHI Learning Pvt. Ltd., 2014.
2. V. B. Bhandari, Design of Machine Elements, 4th ed. New Delhi, India: McGraw-Hill Education (India), 2017.
3. P. C. Sharma and D. K. Agrawal, Machine Design. New Delhi, India: S. K. Kataria & Sons.
4. N. Siddheshwar, P. Kannaiah, and V. V. S. Sastry, Machine Drawing. New Delhi, India: Tata McGraw-Hill Education.
5. N. D. Bhatt and V. M. Panchal, Engineering Drawing, 54th ed. Anand, Gujarat, India: Charotar Publishing House Pvt. Ltd.
6. P. C. Sharma, Production Engineering. New Delhi, India: S. Chand Publishing.
7. R. K. Jain, Production Technology, vols. I and II, 19th ed. New Delhi, India: Khanna Publishers, 2019





CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007

HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7

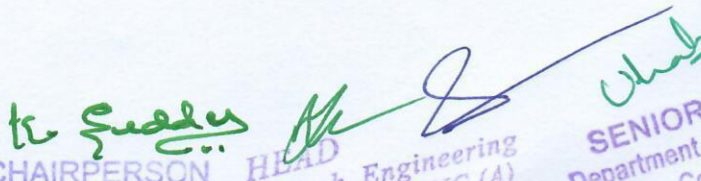
SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI - SEMESTER (MECHANICAL ENGINEERING)
(Proposed for the Academic Year 2026-2027)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs./Week	CIE	SEE	Duration in Hours	
Theory Courses										
1	PC601ME	Machine Design	3	-	-	3	30	70	3	3
2	PC602ME	Metrology and Instrumentation	3	-	-	3	30	70	3	3
3	PC603ME	Refrigeration and Air Conditioning	3	-	-	3	30	70	3	3
4	PC604ME	Finite Element Analysis	3	-	-	3	30	70	3	3
5	PC605ME	Industrial Engineering	3	-	-	3	30	70	3	3
6	Professional Elective-II		3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC651ME	Metrology and Machine Tools Lab	-	-	2	2	25	50	3	1
8	PC652ME	Computer Aided Engineering Lab	-	-	2	2	25	50	3	1
9	PW653ME	Mini Project	-	-	4	4	25	50	-	2
10	PW753ME	Summer Internship*	-	-	-	-	-	-	-	-
Total			18	00	08	26	255	570	24	22

Professional Elective-II		
S.No.	Course Code	Course Title
1.	PE621ME	Computational Fluid Dynamics.
2.	PE622ME	Energy Sciences and Engineering
3.	PE623ME	Machine Learning Applications
4.	PE624ME	Industry 4.0
5.	PE625ME	Modern Machining and forming methods

NOTE: *At the end of Semester-6, students should undergo Summer Internship of minimum 4 weeks and Credits will be awarded in Semester-7.


CHAIRPERSON **HEAD**
 Board of Studies in Mechanical Engineering
 Department of Mech. Engineering
 Osmania University
 Hyderabad-500 007


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

MACHINE DESIGN	
Course Code: PC601ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To Understand the design and analysis of mechanical springs.
2. To Apply design principles of gears under strength and wear criteria.
3. To Analyze and design sliding and rolling contact bearings.
4. To Design major I.C. engine components.
5. To Design curved beams and analyze chain drive systems.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze helical coil springs and leaf springs for mechanical systems
CO2: Evaluate kinematic transmission systems using gears
CO3: Select bearing system for specific applications
CO4: Design various IC engine components
CO5: Determine load carrying capacity of curved beams

UNIT-I

Mechanical Springs: function of springs, Types of springs and materials used. Eccentric, Buckling and Surge of Compression Springs. Stress, Energy and Deflection of Helical Springs, Springs in Series and Parallel connection, Concentric or Composite Springs. Leaf Springs: Construction of Leaf Springs Equalized, Stress in Spring Leaves

UNIT-II:

Gears: Types of gears and materials used. Standards for gear specifications. design of Spur gears, Helical and Bevel Gears based strength criterion -Lewis equation, Wear considerations, Static and dynamic tooth load, Types of gear tooth failure and preventive measures. Proportions and force analysis of worm gears.

UNIT-III

Bearings: Materials used for Bearings. Classification of Bearings. Viscosity of Lubricants Theory of Hydrostatic and Hydrodynamic lubrication. Design of sliding contact bearings - for axial and thrust loads *Rolling Contact Bearings:* Different types of rolling element bearings and their constructional details. Static and Dynamic load carrying capacity, Load-life relationship.

UNIT-IV

I.C. Engine Parts: Design of piston, connecting rod and crank shafts when the crank is at dead centre.

K. Saddy



UNIT-V

Curved beams: Theory of bending of members with initial curvature - rectangular, circular and Trapezoidal sections. Design of crane Hooks, Machine frames and C-clamps. Chain drives- Advantages and disadvantages over other drives.

Suggested Reading:

1. V. B. Bhandari, Design of Machine Elements, 5th ed. New Delhi, India: McGraw-Hill Education (India), 2020.
2. J. E. Shigley, C. R. Mischke, R. G. Budynas, and K. Nisbett, Mechanical Engineering Design, 11th ed. New York, NY, USA: McGraw-Hill Education, 2020.
3. P. Kanniah, Machine Design, 2nd ed. Chennai, India: Sci-Tech Publications, 2014.
4. P. C. Sharma and D. K. Aggarwal, Machine Design, rev. ed. New Delhi, India: S. K. Kataria & Sons, 2019.
5. V. B. Bhandari, Design Data Book, 2nd ed. New Delhi, India: McGraw-Hill Education (India), 2019.

Data Handbook:

1. K. Balaveera Reddy and K. Mahadevan —Design Data Handbook for Mechanical Engineers in Si and Metric Units, 14th Edition, CBS Publishers & Distributors, 2018.
2. Design Data: Data Book of Engineers By PSG College.
3. Design data handbook by S. Md. Jalaludeen, Anuradha Publications

Note : 1. Solution of Numerical problems using Design data book should be practiced.
2. Standard Design data book is allowed in University exam.

K. Suley
CHAIRPERSON
Board of Studies in Mechanical Engineering,
Osmania University
Hyderabad-500 007

th
HEAD ENGINEERING (A)
COLLEGE OF ENGINEERING
Osmania University, Hyderabad-7

Ushat
SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

METROLOGY AND INSTRUMENTATION	
Course Code: PC602ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand the principles of engineering metrology and measurement systems for quality assurance.
2. To understand the principles of conventional and digital metrology techniques for dimensional inspection and quality control.
3. To learn methods for form measurement, surface roughness, and gear/thread metrology.
4. To understand instrumentation systems, transducers, and strain measurement techniques.
5. To study measurement of physical parameters like pressure, temperature, and vibration using sensors.

Course Outcomes:

- Upon successful completion of this course, the student will be able to:
- CO1:** Apply metrology principles and standards for precise measurement and quality control.
- CO2:** Apply conventional and digital inspection techniques for dimensional measurement and quality control.
- CO3:** Analyze surface finish, form errors, and perform thread and gear measurements.
- CO4:** Evaluate performance of instrumentation systems and apply transducers for measurement.
- CO5:** Measure physical parameters such as pressure, temperature, and displacement using appropriate sensors.

UNIT-I

Introduction to Engineering Metrology, Role of metrology in quality assurance, Linear and Angular measurements – Slip gauges and End bars – Gauge material and manufacturing methods, Different types of Micrometers, Height gauges, Tomlinson gauges. Precision polygon, Sine bar, Auto collimator. Geometrical Dimensioning & Tolerances, Limits & Fits. **ISO system:** Types of interchangeability Taylor's Principle or plain limit gauges, Use of Plug, Ring and Snap gauges. Indicating type limit gauges.

UNIT-II:

Comparators: Dial indicator, Sigma and Mechanical comparator, free flow and Back pressure type Pneumatic comparator. Optical projector, Chart gauges, screen gauges and measuring methods. Tool maker's Microscope applications. Form measurements – Measurement of Straightness and Flatness. Roundness measurement with bench centers and talyrond.

Digital Inspection: 3D scanning, camera-based inspection, machine vision, Coordinate Measuring Machine (CMM) for complex geometries, dimensional inspection, defect detection, and industrial applications.

UNIT-III

Surface Roughness Measurements, Profilometer, Taylor Hobson Talysurf. Application of Thread metrology - 2 wire, 3 wire method and best wire methods, Gear measurement – Gear tooth thickness, Parkinson gear tester, General geometric tests for testing machine tools – Lathe, drill and Mill.

K. Faddu

UNIT-IV

Elements of instrumentation system. Static and Dynamic characteristics. Instrument types - zero, first and second order instruments, Types of errors. Displacement transducers. LVDT. Strain measurement -Wire and foil type resistance strain gauges. Rosette Gauges. Bonding procedure. Lead resistance compensation. Adjacent arm and self-compensating gauges. Proving ring. Strain gauge load cells, measurement of axial load and torsion by strain gauges. Piezo-electric load cell.

UNIT-V

Introduction to Seismic Transducers -displacement and acceleration measurement, Pressure measurement -Bourdon pressure gauge, bulk modulus gauge, pirani gauge, Temperature measurement by thermo couples. Laws of thermo electricity. Types of materials used in thermocouples. Protection tubes. Extension wire. Series and parallel circuits. Ambient temperature compensation.

Suggested Reading:

1. I. C. Gupta, Engineering Metrology. New Delhi, India: Dhanpat Rai Publications, 2019.
2. N. V. Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, 2nd ed. New Delhi, India: Oxford University Press, 2013.
3. R. K. Jain, Engineering Metrology, 21st ed. New Delhi, India: Khanna Publishers, 2018.
4. E. O. Doebelin, Measurement Systems: Application and Design, 6th ed. New York, NY, USA: McGraw-Hill, 2011.
5. T. G. Beckwith, R. D. Marangoni, and J. H. Lienhard V, Mechanical Measurements, 6th ed. Boston, MA, USA: Pearson, 2013.
6. D. P. Eckman, Industrial Instrumentation. Hoboken, NJ, USA: John Wiley & Sons, 1996.
7. K. J. Hume, Engineering Metrology. New Delhi, India: Kalyani Publishers, 1985.


CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007


HEAD
 Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

REFRIGERATION AND AIR CONDITIONING	
Course Code: PC603ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To Understand fundamentals of refrigeration, refrigerants, and air refrigeration systems.
2. To Apply principles of vapour compression refrigeration systems and analyze their performance.
3. To Understand vapour absorption and non-conventional refrigeration systems and their applications.
4. To Understand psychrometric properties and principles of human comfort in air conditioning systems.
5. To Apply cooling load calculations and design of air conditioning systems for various applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze refrigeration cycles, refrigerant properties, and air refrigeration systems.
CO2: Apply vapour compression system analysis to evaluate performance under different operating conditions.
CO3: Analyze vapour absorption and non-conventional refrigeration systems and compare their performance.
CO4: Apply psychrometric principles to analyze air conditioning processes and human comfort conditions.
CO5: Analyze and design air conditioning systems with appropriate load calculations for practical applications.

UNIT-I

Introduction to Refrigeration: Definition of refrigeration and air conditioning, necessity and methods of refrigeration, unit of refrigeration, C.O.P., reversed Carnot cycle.

Properties of Refrigerants: Survey, designation, desirable thermodynamic, chemical and physical properties, classification of refrigerants, conventional, modern refrigerants and commonly used refrigerants (CFCs, HCFCs, HFCs, HFOs, natural refrigerants, R-134a, R-404A, R-410A, R-32, R-290 and R-600a). Ozone depletion potential (ODP), global warming potential (GWP), greenhouse effect.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle, Open and Dense air system, Application to aircraft refrigeration, Simple cooling system and Bootstrap refrigeration system, Regenerative cooling system and Reduced ambient cooling system.

UNIT-II:

Vapour compression system: Working principle and essential components of Simple vapor compression Refrigeration cycle, Compressor, condenser, evaporator, and expansion devices, Analysis of cycle, C.O.P, Representation of the cycle on T-S, P-H and H-S charts. Performance improvement of simple vapour compression refrigeration cycle by means of flash chamber and accumulator Dry and wet compression, Effect of operating conditions like evaporating pressure, condenser pressure, Liquid sub-cooling and Vapor super heating, Performance of the system. Compound compression with water inter cooler and Flash intercooler.

K. Suddu

UNIT-III

Vapour Absorption Refrigeration System: Simple absorption systems, COP, Practical ammonia absorption refrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system

Steam Jet Refrigeration: Principle of working, Analysis of the system, Advantages, limitations and applications.

Non-Conventional Refrigeration Systems: Principle and operation of Thermoelectric Refrigeration Systems, Pulse tube refrigeration system.

UNIT-IV

Psychrometry: Psychrometric properties, Psychrometric chart, construction, Representation of Psychrometric processes on the chart.

Introduction to Air Conditioning: Requirements of comfort air conditioning, Thermodynamics of human body, Metabolism, Body defense and Human tolerance, ASHRE comfort chart and Effective temperature.

UNIT-V

Cooling Load Calculations in Air Conditioning: Concept of bypass factor, Sensible heat factor, Apparatus Dew Point, Room Sensible Heat Factor (RSHF), Gross Sensible Heat Factor (GSHF), Different heating and cooling loads, Problems.

Design of air conditioning systems: All fresh air, Re-circulated air with bypassed air, Design of Summer, winter and Year round air conditioning systems, Applications of Refrigeration and Air conditioning Food Preservation, Transport air conditioning, and Industrial applications.

Suggested Reading:

1. C. P. Arora, Refrigeration and Air Conditioning, 3rd ed. New Delhi, India: McGraw-Hill Education (India), 2010.
2. S. C. Arora and S. Domkundwar, A Course in Refrigeration and Air Conditioning, 8th ed. New Delhi, India: Dhanpat Rai & Sons, 2019.
3. V. K. Jain, Refrigeration and Air Conditioning. New Delhi, India: S. Chand & Company, 2018.
4. W. F. Stoecker and J. W. Jones, Refrigeration and Air Conditioning, 2nd ed. New York, NY, USA: McGraw-Hill, 1982.
5. R. K. Rajput, Refrigeration and Air Conditioning, 4th ed. New Delhi, India: S. K. Kataria & Sons, 2019.
6. R. S. Khurmi and J. K. Gupta, Refrigeration Tables with Charts, 3rd ed. New Delhi, India: S. Chand Publishing, 2023.

Data Handbook:

1. Banwait, S. S., and S. C. Laroia. *Properties of Refrigerant and Psychrometric Tables & Charts (In S.I. Units)*. 25th ed., Birla Publications, 2019.
2. R.S Khurmi & J. K. Gupta. Refrigeration Tables with charts (In S.I Units). S. Chand Publications, 2023.

Note : 1. Solution of Numerical problems using Refrigeration data book should be practiced
2. Standard refrigeration and psychrometric data book is allowed in University exam.

K. Suresh
CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500007

[Signature]
HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7

[Signature]
SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

FINITE ELEMENT ANALYSIS	
Course Code: PC604ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To introduce the fundamentals of the Finite Element Method and its engineering applications.
2. To develop the ability to analyze one-dimensional and structural elements using FEM.
3. To understand finite element analysis of two-dimensional and axisymmetric problems.
4. To apply FEM to heat transfer and numerical integration problems.
5. To introduce dynamic, buckling, nonlinear FEM, and commercial FEM software.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Explain the basic concepts and applications of FEM.
CO2: Apply FEM to analyze one-dimensional and structural problems.
CO3: Analyze two-dimensional and axisymmetric problems using FEM.
CO4: Apply FEM to heat transfer and numerical integration problems.
CO5: Use FEM software to solve engineering problems and interpret the results.

UNIT-I

Introduction to Finite Element Method: Introduction to Finite Element Method (FEM), Historical development and applications of FEM, Basic concepts and terminology: continuum, discretization, nodes, elements, degrees of freedom, Types of finite elements (1D, 2D and 3D), Steps involved in FEM analysis, Engineering applications of FEM, Introduction to pre-processing, solution and post-processing. One Dimensional problems: Finite element modeling, Local, natural and global coordinates and Quadratic shape functions.

UNIT-II

Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of plane truss with number of unknowns not exceeding two at each node. Introduction to frames with two translations and a rotational degree of freedom at each node.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element.

UNIT-III

Two-Dimensional Finite Element Analysis: Plane stress, plane strain concepts, finite element modeling of two dimensional stress analysis with Constant Strain Triangle (CST) element. Finite element modeling of axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT-IV

Two dimensional four noded Iso-parametric formulation, Numerical integration (Gauss Quadrature).

Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of Composite Wall.

K. Sadek



UNIT-V

Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam. Introduction to buckling analysis. Introduction to nonlinear FEM, Contact analysis (Basics), Meshing techniques and mesh quality and convergence, Introduction to commercial FEM software (ANSYS).

Suggested Reading:

1. N. S. Gokhale, S. S. Deshpande, S. V. Bedekar, and A. N. Thite, Practical Finite Element Analysis. Pune, India: Finite to Infinite Publications Pvt. Ltd., 2008.
2. T. R. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, 4th ed. Noida, India: Pearson Education, 2011.
3. S. S. Rao, The Finite Element Method in Engineering, 6th ed. Oxford, U.K.: Butterworth-Heinemann (Elsevier), 2017.
4. O. C. Zienkiewicz, R. L. Taylor, and J. Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, 8th ed. Oxford, U.K.: Butterworth-Heinemann (Elsevier).
5. J. N. Reddy, An Introduction to the Finite Element Method, 4th ed. New York, NY, USA: McGraw-Hill Education, 2019.
6. G. Ramamurty, Applied Finite Element Analysis. New Delhi, India: I. K. International Pvt. Ltd., 2010.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

INDUSTRIAL ENGINEERING	
Course Code: PC605ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits: 3

Course Objectives:

1. To understand fundamental concepts and approaches of management and decision-making processes.
2. To understand the principles of Work Study and Production Planning & Control for improving productivity, work efficiency, and production planning.
3. To analyze production planning, scheduling, and control techniques in manufacturing systems.
4. To understand the fundamentals of Quality Control, Six Sigma, and Lean Manufacturing for continuous quality improvement and waste reduction in manufacturing systems.
5. To understand quality control methods and decision theory under different environments.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1. Explain management principles and apply decision-making techniques in organizational contexts.
CO2. Apply Work Study and Production Planning & Control techniques to analyze work methods, measure performance, and optimize manufacturing operations.
CO3. Apply production planning and control techniques for effective manufacturing operations.
CO4. Apply Quality Control tools, Six Sigma techniques, and Lean Manufacturing principles to analyze and improve manufacturing processes.
CO5. Use quality control tools and decision theory methods to improve organizational performance.

UNIT-I

Management: Introduction to Management, Scientific Management, Systems approach to Management, MBO, and Decision Making Process.

Personnel Management: Functions of personnel management, types of training, Job evaluation and Merit rating.

UNIT-II:

Work Study: Introduction to method study, steps in method study, Recording techniques- Flow process chart, String diagram, Therbligs, Principles of motion economy.

Work measurement: Stop watch time study, Standard time calculation. Work sampling-procedure, applications, advantages and disadvantages, Wages and incentives, types of Incentive plans.

Production Planning & Control: Definition, Objectives, Importance and Functions of Production Planning & Control. Routing, Scheduling, Dispatching, Follow-up and progress Report.

UNIT-III

Inventory Control: Importance of inventory control, types of inventory models Inventory costs deterministic inventory models Basic EOQ models, production model without shortages,

K. S. Sagar

Purchase model with instantaneous replenishment and with shortages production model with shortages Inventory model with price breaks, Fixed order quantity system, periodic review system. Case Studies.

UNIT-IV

Quality Control: Concept of quality, evolution of quality control, assignable and chance causes of variation, Variable Control charts (X and R charts), P chart and C chart, Acceptance Sampling & OC curves.

Six Sigma: Introduction, principles, DMAIC, DPMO, Sigma level, roles and applications.

Fishbone Diagram: Cause-and-effect diagram, 6M approach, root cause analysis.

Lean Manufacturing: Lean principles, eight wastes, 5S, Kaizen, JIT, Kanban, Push or Pull System, Poka-Yoke, benefits and industrial applications.

UNIT-V

Decision Theory: Introduction, Decision, Decision Making & Decision Theory, Types of Decisions, decision making process, Types of Decision making Environment:

Decision making under Uncertainty- Criterion of Optimism or Maximax, Criterion of Pessimism or Maximin, Minimax decision criteria.

Suggested Reading:

1. M. Mahajan, Industrial Engineering and Production Management, 3rd ed. New Delhi, India: Dhanpat Rai & Sons, 2017.
2. S. K. Sharma and S. Sharma, Industrial Engineering and Organization Management. New Delhi, India: S. K. Kataria & Sons, revised ed., 2019.
3. S. D. Sharma, Operations Research. Meerut, India: Kedarnath Ramnath & Co., 2014.
4. S. Kalavathi, Operations Research, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd., 2017.
5. V. K. Kapoor, Operations Research, 9th ed. New Delhi, India: S. Chand, 2014.
6. S. K. Sharma and S. Sharma, A Course in Industrial Engineering & Operations Management. New Delhi, India: S. K. Kataria & Sons, 2016.

K. Suresh
CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007

[Signature]
HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad

[Signature]
SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

COMPUTATIONAL FLUID DYNAMICS	
Course Code: PE621ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To Understand the governing equations of fluid flow and their physical significance.
2. To Apply numerical methods to discretize and solve fluid flow equations.
3. To Analyze discretization techniques such as finite difference, finite volume, and finite element methods.
4. To Apply CFD tools to simulate fluid flow problems and interpret results.
5. To Evaluate accuracy, stability, and convergence of numerical solutions in CFD simulations.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Explain governing equations of fluid flow and their role in CFD modeling.
CO2: Apply numerical methods to discretize and solve basic fluid flow problems.
CO3: Analyze different discretization schemes and their impact on solution accuracy.
CO4: Perform CFD simulations using commercial/open-source software and interpret results.
CO5: Evaluate numerical errors, stability, and convergence of CFD solutions.

UNIT-I

Governing Equations of Fluid Flow: Introduction to CFD, need and applications. Review of fluid mechanics fundamentals. Governing equations: continuity, momentum (Navier–Stokes), and energy equations. Physical significance of each term.

Types of flows: steady/unsteady, laminar/turbulent, compressible/incompressible.

Boundary conditions: Dirichlet, Neumann, and mixed boundary conditions.

UNIT-II:

Mathematical and Numerical Foundations: Classification of partial differential equations: elliptic, parabolic, hyperbolic. Taylor series expansion and truncation error. Introduction to numerical methods.

Finite Difference Method (FDM): forward, backward, central difference schemes.

Finite Volume Method (FVM): control volume approach and conservation principles.

Finite Element Method (FEM): basic concepts.

UNIT-III

Discretization Techniques: Spatial discretization methods. Convective and diffusive terms discretization. Upwind, central difference, and higher-order schemes.

Time discretization: explicit and implicit methods.

Stability analysis: CFL condition. Consistency, stability, and convergence (Lax equivalence theorem).

K. Sadeh

UNIT-IV

Solution Algorithms and Turbulence Modeling: Solution of algebraic equations: direct and iterative methods (Gauss-Seidel, TDMA).

Pressure-velocity coupling: SIMPLE, SIMPLER, SIMPLEC algorithms.

Grid generation: structured and unstructured meshes. Introduction to turbulence modeling: RANS equations, $k-\epsilon$ and $k-\omega$ models. Near-wall treatment and boundary layer modeling.

UNIT-V

CFD Applications and Software: Introduction to CFD software (e.g., ANSYS Fluent, Open FOAM), Pre-processing: geometry creation and mesh generation, Solver settings and boundary conditions. Post-processing: visualization of results (velocity, pressure, contours, streamlines). Validation and verification of CFD results. Applications: flow over flat plate, pipe flow, heat transfer, external aerodynamics.

Suggested Reading:

1. H. K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2nd ed. Harlow, U.K.: Pearson Education, 2007.
2. K. Muralidhar and T. Sundararajan, Eds., Computational Fluid Flow and Heat Transfer, 2nd ed. New Delhi, India: Narosa Publishing House, 2014.
3. J. H. Ferziger, M. Perić, and R. L. Street, Computational Methods for Fluid Dynamics, 4th ed. Cham, Switzerland: Springer Nature, 2020.
4. J. D. Anderson, Jr., Computational Fluid Dynamics: The Basics with Applications. New York, NY, USA: McGraw-Hill, 1995.
5. A. Sharma, Introduction to Computational Fluid Dynamics: Development, Application and Analysis. Cham, Switzerland: Springer Nature Switzerland, 2022.


CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500007


HEAD
 Department of Mech. Engg.
COLLEGE OF ENGINEERING
 Osmania University, Hyderabad-7


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

ENERGY SCIENCES AND ENGINEERING	
Course Code: PE622ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand conventional and renewable energy sources.
2. To explain the operation of conventional power plants.
3. To understand the principles of renewable energy systems.
4. To learn energy storage and waste heat recovery techniques.
5. To understand power plant economics, energy efficiency, and environmental aspects.

Course Outcomes:

After completing this course, the student will be able to:
CO1: Identify different conventional and renewable energy sources.
CO2: Explain the working of thermal, nuclear, and hydro power plants.
CO3: Analyze the operation of renewable energy systems.
CO4: Apply energy storage and waste heat recovery concepts..
CO5: Evaluate power plant economics, pollution control, and energy efficiency.

Unit-I

Introduction: Various sources of energy, relative merits and demerits, Statistics and prospects of conventional and Renewable energy sources.

Unit-II:

Conventional Energy Sources: Fossil Fuels: Power generation using steam turbine and gas turbine power plants, Nuclear Fuels: Parts of reactor core, Nuclear power plant outline, Methods to dispose radioactive waste. Hydro Energy: Spillways, Hydroelectric power plant Outline

Unit-III

Renewable Energy Systems: Solar Energy – Types of collectors and concentrators, Solar Photo Voltaic Cell. Wind Energy – Types of Wind Turbines and their working, geothermal power plant, Biomass conversion, Wave Energy power plant, Tidal Energy power plant, Ocean thermal energy power plant.

Unit-IV

Storage: Methods to store Mechanical Energy, Electrical Energy, Chemical Energy and Thermal Energy. Co-generation & Tri-generation: Definition, application, advantages, classification, saving Potential. Energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices

Unit-V

Power Plant Economics and Environmental Considerations: Costing, Estimation of power production - Pollutants and Pollution Standards -Methods of pollution control. Energy Efficiency rating and BEE standards, Future energy needs and challenges.

K. Gady 

Suggested Reading:

1. P. K. Nag, Power Plant Engineering, 4th ed. New Delhi, India: McGraw-Hill Education, 2014.
2. G. D. Rai, Non-Conventional Energy Sources, 6th ed. New Delhi, India: Khanna Publishers, 2017.
3. M. Majumdar, Energy Efficient Buildings in India. New Delhi, India: Ministry of New and Renewable Energy (MNRE), Government of India, 2001.
4. M. M. El-Wakil, Power Plant Technology. New York, NY, USA: McGraw-Hill, 1984.
5. P. K. Nag, Basic and Applied Thermodynamics, 2nd ed. New Delhi, India: McGraw-Hill Education, 2017.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

MACHINE LEARNING APPLICATION	
Course Code: PE623ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand data preparation techniques and regression models for predictive analysis.
2. To study supervised learning concepts including gradient descent and support vector machines.
3. To correlate unsupervised learning techniques such as clustering and dimensionality reduction.
4. To recognize neural networks and deep learning architectures along with training and optimization techniques.
5. To apply machine learning techniques to solve mechanical engineering problems and real-world applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Analyze datasets using pre-processing and regression techniques for predictive modelling.
CO2: Apply supervised learning algorithms for classification and regression problems.
CO3: Illustrate data using clustering and dimensionality reduction techniques.
CO4: Evaluate neural networks and deep learning models for complex problems.
CO5: Apply machine learning methods for condition monitoring and fault diagnosis in mechanical systems.

Unit-I

Data Preparation: Introduction, types of data, Data preparation -Data selection, Data Pre-Processing-Formatting, cleaning and sampling, Data Transformation-Scaling, Decomposition and Aggregation.

Regression: Linear regression, Multiple regression, Logistic regression, Stepwise, overfitting, Regularization.

Unit-II:

Supervised Learning: Gradient Descent, Bias and Variance, Support Vector Machine: Hyperplanes, Kernels, Regularization, Large margin classification.

Unit-III

Unsupervised learning: Clustering, k-means algorithm, Principal Component Analysis, Missing Data, choosing clusters.

Unit-IV

Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptron's: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, Overfitting, learning network structure. Importance of Deep Learning, key concepts in Deep Learning, Practical Considerations of Deep neural networks: hyper parameter tuning, initialization, regularization, gradient checking, optimization algorithms, Convolutional Neural Networks, step by step procedure, Recurrent Neural Networks- step by step procedure, ALEXNET, Auto encoders.

K. Sadeeq

Unit-V

Mechanical Applications of Machine Learning: ANOVA analysis of manufacturing processes (forming, welding, and abrasive machining) and **Optimization techniques:** Taguchi method, Response Surface Methodology, and Genetic Algorithm for industrial applications.

Suggested Reading:

1. T. M. Mitchell, Machine Learning. New York, NY, USA: McGraw-Hill Education, 2017.
2. S. Shalev-Shwartz and S. Ben-David, Understanding Machine Learning: From Theory to Algorithms, 2nd ed. Cambridge, U.K.: Cambridge University Press, 2014.
3. P. Włodarczak, Machine Learning and Its Applications, 1st ed. Boca Raton, FL, USA: CRC Press, 2021.
4. J. D. Kelleher, Deep Learning, 1st ed. Cambridge, MA, USA: The MIT Press, 2019.
5. S. Raschka and V. Mirjalili, Python Machine Learning, 3rd ed. Birmingham, U.K.: Packt Publishing, 2019.
6. D. J. Denis, Applied Univariate, Bivariate, and Multivariate Statistics Using Python: A Beginner's Guide to Advanced Data Analysis, 1st ed. Hoboken, NJ, USA: John Wiley & Sons, 2021.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

INDUSTRY 4.0	
Course Code: PE624ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To understand the evolution, concepts, and production systems of Industry 4.0.
2. To recognize key components, technologies, and trends driving Industry 4.0 transformation.
3. To apply Industry 4.0 frameworks for smart manufacturing, logistics, and predictive analytics.
4. To comprehend advanced technologies such as IoT, robotics, and sensor systems in industrial applications.
5. To realize the challenges, workforce skills, and strategies for adapting to Industry 4.0.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Examine Industry 4.0 concepts and compare modern smart factories with traditional systems.
CO2: Analyze emerging technologies and trends enabling digital transformation in industries.
CO3: Apply Industry 4.0 frameworks to design smart manufacturing and logistics solutions.
CO4: Explore applications of IoT, robotics, and advanced sensors in industrial automation.
CO5: Evaluate challenges and develop strategies for workforce adaptation in Industry 4.0 environments.

Unit-I
Introduction: Idea of Industry 4.0, Various Industrial Revolutions, Origin concept of Industry 4.0, Industry 4.0 Production system, How is India preparing for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory.
Unit-II:
Trends in Industry 4.0: Introduction, Main Concepts and Components of Industry 4.0, State of Art Technologies, Proposed Framework for Industry 4.0, Trends of Industrial Big Data and Smart Business Transformation.
Unit-III
Roadmap for Industry 4.0: Introduction, Proposed Framework for Technology Roadmap: Strategy Phase, Development Phase, Smart Manufacturing, Types of Smart Devices, Smart Logistics, Smart Cities, Predictive Analytics.
Unit-IV
Advances in the Era of Industry 4.0: Introduction, Recent Technological Components of Robots-Advanced Sensor Technologies, Internet of Things, Industrial Robotic Applications-Manufacturing, Maintenance and Assembly, Industrial Iota.
Unit-V
The Role of Industry 4.0 and Future Aspects: Introduction, Challenges & Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

K. Suresh

CHAIRPERSON

Board of Studies in Mechanical Engineering

Osmania University

Hyderabad-500 007

HEAD

Department of Mech. Engineering

COLLEGE OF ENGINEERING

Osmania University, Hyderabad

SENIOR PROFESSOR

Department of Mech. Engineering

University College of Engineering (A)

Osmania University, Hyderabad-07, T.S.

Suggested Reading:

1. Y. Uygun, Industry 4.0: Principles, Effects and Challenges. Hauppauge, NY, USA: Nova Science Publishers, 2020.
2. D. T. Matt, V. Modrák, and H. Zsifkovits, Industry 4.0 for SMEs: Challenges, Opportunities and Requirements, 1st ed. Cham, Switzerland: Palgrave Macmillan, 2020.
3. A. Ustundag and E. Cevikcan, Industry 4.0: Managing the Digital Transformation, 1st ed. Cham, Switzerland: Springer, 2018.
4. C. J. Bartodziej, The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics. Wiesbaden, Germany: Springer Gabler, 2017.
5. A. Gilchrist, Industry 4.0: The Industrial Internet of Things, 2nd ed. Berkeley, CA, USA: Apress, 2020.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

MODERN MACHINING AND FORMING METHODS	
Course Code: PE625ME	CIE: 30 marks
Instruction: 3 periods per week	SEE: 70 marks
Duration of SEE: 3 hours	Credits : 3

Course Objectives:

1. To Learn the principles, process parameters, and performance characteristics of abrasive jet machining, water jet machining, and ultrasonic machining processes.
2. To Study the concepts, material removal mechanisms, and process parameters of Electrical Discharge Machining (EDM) and Electrochemical Machining (ECM).
3. To Analyze the operating principles and performance aspects of advanced machining processes such as Laser Beam Machining (LBM), Plasma Arc Machining (PAM), and Electron Beam Machining (EBM).
4. To Evaluate high energy rate forming processes based on process parameters, advantages, limitations, and industrial applications.
5. To Apply the principles of stretch forming, spinning, and hydroforming processes to solve manufacturing problems.

Course Outcomes:

- Upon successful completion of this course, the student will be able to:
- CO1:** Describe the working principles, process parameters, and performance characteristics of abrasive jet machining, water jet machining, and ultrasonic machining processes.
 - CO2:** Explain the material removal mechanisms, process parameters, and industrial applications of Electrical Discharge Machining (EDM) and Electrochemical Machining (ECM).
 - CO3:** Analyze the operating principles, process capabilities, and applications of advanced machining processes such as Laser Beam Machining (LBM), Plasma Arc Machining (PAM), and Electron Beam Machining (EBM).
 - CO4:** Evaluate high energy rate forming processes in terms of process parameters, advantages, limitations, and suitability for industrial applications.
 - CO5:** Apply the principles of stretch forming, spinning, and hydroforming processes to manufacture complex engineering components.

UNIT-I

Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect on MRR and accuracy. Equation for MRR Advantages, disadvantages and applications

Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

Ultrasonic Machining (USM): Introduction, process description, abrasive slurry, Abrasive materials and their characteristics. Functions of liquid medium in slurry, Types of Transducers, effect of process parameters, applications and limitations.

UNIT-II:

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper' Flushing, Mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), characteristics of spark eroded surfaces, advantages, disadvantages and applications. Wire EDM: Process description and applications.

K. Sadeeq

Electro-Chemical Machining (ECM): Schematic of the process parameters, function and characteristics of electrolyte, chemistry of the process, Equation for specific MRR and electrode feed rate, advantages, limitations and applications., Rotary Machining, Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

UNIT-III

LASER Beam Machining (LBM): Principle of LASER Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications.

Plasma Arc Machining (PAM): Introduction equipment used, process description and parameters, types of plasma arc; Transferred arc and non-transferred arc and process applications.

Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production of Electron beam, equipment used, Advantages, disadvantages and applications. ION Etching: Process description and applications.

UNIT-IV

Rubber Pad Forming: Principle of the process, process details and its types; Guerin, wheel on, Marfoming and Hydro forming processes and applications.

Electro-Hydraulic forming (EHF): Schematic of the process description and its applications.

High Energy Rate Forming (HERF): HERF hammers, principle of explosive forming, Explosive materials, types of explosive forming, standoff operation and contact operation, the pressure pulse, Gas bubble and the process applications.

UNIT-V

Stretch Forming: Introduction, types of stretch forming: stretch draw forming, rotary stretch is forming or stretch wrapping, compression forming, radial draw forming Stretch forming equipment and accessories, accuracy and surface finish, process variables and limitations Tube spinning: Introduction, methods of tube spinning, backward spinning, Forward spinning, machines and tools used. Machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications. Hydrostatic Forming: Process principle, description and applications. **Water Hammer Forming (WHF):** Schematic diagram of the process, principle of operation, process variables, work materials, process limitations and applications.

Suggested Reading:

1. P. K. Mishra, Non-Traditional Machining Processes. New Delhi, India: Narosa Publishing House, 2010.
2. V. K. Jain, Advanced Machining Processes. New Delhi, India: Allied Publishers, 2018.
3. T. Davies and E. Austin, Developments in High Speed Metal Forming. Brighton, U.K.: The Machinery Publishing Co. Ltd., 1985.
4. HMT Ltd., Production Technology. New Delhi, India: Tata McGraw-Hill Education, 2001.
5. S. Kalpakjian and S. R. Schmid, Manufacturing Engineering and Technology, 7th ed. Noida, India: Pearson Education, 2018.

K. Sreenivasulu Reddy
CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007

Dr. S. R. Schmid
HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING
Osmania University, Hyderabad

Dr. S. R. Schmid
SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

METROLOGY AND MACHINE TOOLS LAB	
Course Code: PC651ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives:

1. To develop skills in precision measurement using common metrology instruments.
2. To learn dimensional and angular measurement techniques using precision instruments.
3. To understand calibration methods and force measurement using sensors and gauges.
4. To perform basic machining operations on conventional machine tools.
5. To analyze metal cutting characteristics and conduct machining performance tests

Course Outcomes:

- Upon successful completion of this course, the student will be able to:
- CO1:** Measure engineering dimensions accurately using standard metrology instruments.
- CO2:** Perform precision dimensional and angular measurements using advanced measuring devices.
- CO3:** Calibrate measuring instruments and determine force using appropriate sensors.
- CO4:** Execute basic machining operations, including turning, threading, milling, grinding, and shaping.
- CO5:** Evaluate metal cutting parameters and conduct basic machine tool performance tests.

List of Experiments:**A) Metrology & Instrumentation:**

1. Measurement with inside, outside and depth micrometers, Vernier calipers and Height gauges.
2. Measurement of roundness errors with Bench Centres, V-block and dial Gauge.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope: Flat specimens. Plain cylindrical specimens with centers and threaded components.
4. Measurement of angles with Sine bar, Bevel protractor and Precision level.
5. Measurement with Dial Indicator / Electrical Comparator / Mechanical Comparator / Dial Bore Gauge / Snap Gauge/Plug gauges.
6. Calibration and Force measurement with Strain gauge type load cell/Proving Ring/spring type sensor

B) Machining Operations:

1. Thread cutting exercise on lathe machine as single start and multi start threads.
2. Typical exercises on lathe machine (Turning, Step turning, Facing, Parting off & Taper turning).
3. Typical exercises on shaper, cylindrical grinding machine.
4. Exercise of simple gear manufacturing on milling machine.
5. Production of threads with taps and threading dies and milling cutters.

K. Suresh

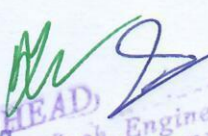
[Signature]

[Signature]

C) Metal Cutting:
1. Estimation of shear angle by measuring thickness and length of chips.
2. Measurement of Cutting forces with Lathe tool dynamometer and determination of friction angle and stresses on shear plane and rake plane.
3. Study of geometrical tests on lathe machine.

Note: Minimum ten experiments should be conducted in the semester.


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering (A)
Osmania University, Hyderabad-07, T.S.

COMPUTER AIDED ENGINEERING LAB	
Course Code: PC652ME	CIE: 25 marks
Instruction: 2 periods per week	SEE: 50 marks
Duration of SEE: 3 hours	Credits : 1

Course Objectives:

1. To understand the fundamentals of Finite Element Method for analyzing structural components under various loading conditions.
2. To develop skills in meshing, modeling, and simulation of engineering problems using CAE tools for structural analysis.
3. To apply concepts of stress, strain, and failure theories in plane stress, plane strain, and axisymmetric conditions.
4. To gain knowledge of thermal and fluid analysis using heat transfer and Computational Fluid Dynamics techniques.
5. To build competency in computational methods using MATLAB/Python for formulation and integration of element matrices in engineering analysis.

Course Outcomes

Upon successful completion of this course, the student will be able to:
CO1: Apply finite element methods to analyze truss, beam, plate, and shell structures for stresses, strains, and deflections under various loading conditions.
CO2: Analyze and evaluate structural behavior using meshing techniques, static, buckling, and modal analysis for different engineering components.
CO3: Apply plane stress, plane strain, and axisymmetric concepts to interpret failure behavior and stress concentration in engineering designs.
CO4: Evaluate thermal and fluid flow problems using heat transfer and CFD analysis for engineering applications.
CO5: Create and implement computational models using MATLAB/Python to develop element matrices and integrate with CAE tools for advanced simulations.

List of Experiments

1. Analysis of Plane Truss & Spatial Truss with various cross sections and materials to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading.
2. 1D, 2D and 3D meshing with different element sizes for different CAD geometry (Proposed Experiment).
3. Static analysis of plates with a hole to determine the deformations, the Stresses to study the failure behavior and SCF.
4. Plane stress and plane strain analysis of in-plane members under in-plane loading to study stresses and strains.
5. Axisymmetric loading on members to study stresses and strains.
6. Static analysis of connecting rod with tetrahedron and brick elements.
7. Buckling analysis of plates, shells and beams to estimate BF and modes.
8. Modal analysis of beams, plates and shells for natural frequencies and mode shapes
9. Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plate subjected to stepped and ramped loading with varying time.

K. محمد

10. Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.
11. Flow analysis of pipe with different fluids/gasses/air for velocity and pressure gradients.
12. CFD analysis of aero foil design.
13. CFD analysis of ducts/impeller/fan.
14. Couple field Analysis.
15. Use of MATLAB / Python for finding B matrix, stiffness matrix and loading matrices of beam/in plane/solid elements and interfacing with CAE software's

Note: Minimum ten experiments should be conducted in the semester


CHAIRPERSON
Board of Studies in Mechanical Engineering
Osmania University
Hyderabad-500 007


HEAD
Department of Mech. Engineering
COLLEGE OF ENGINEERING (A)
Osmania University, Hyderabad-7


SENIOR PROFESSOR
Department of Mech. Engineering
University College of Engineering
Osmania University, Hyderabad-7

MINI PROJECT	
Course Code: PW653ME	CIE: 25 marks
Instruction: 4 periods per week	SEE: 50 Marks
Duration of SEE: --	Credits : 2

Course Objectives:

1. To Identify and formulate engineering problems through literature survey and need analysis.
2. To apply engineering principles to design and develop a mechanical system or process.
3. To Use CAD tools for design, modeling, and documentation.
4. To develop skills in project planning, teamwork, and implementation.
5. To Test, evaluate, and document the developed project effectively.

Course Outcomes

Upon successful completion of this course, the student will be able to:
CO1: Identify and define a real-world engineering problem and propose a suitable solution.
CO2: Design and develop a mechanical product or manufacturing process to meet specified requirements.
CO3: Apply CAD tools for modeling, analysis, and project documentation.
CO4: Demonstrate teamwork, project management, and communication skills during project execution.
CO5: Test, evaluate, and present the project with proper technical documentation.

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is mechanical product design work/ manufacturing process with a focus on mechanical system design/manufacturing process.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based software.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.


CHAIRPERSON
 Board of Studies in Mechanical Engineering
 Osmania University
 Hyderabad-500 007


HEAD
 Department of Mech. Engineering
 COLLEGE OF ENGINEERING (A)
 Osmania University, Hyderabad-7


SENIOR PROFESSOR
 Department of Mech. Engineering
 University College of Engineering (A)
 Osmania University, Hyderabad-07, T.S.

SUMMER INTERNSHIP	
Course Code: PW753ME	SEE: ---
CIE: - 25 marks	Credits : 1

Course Objectives:

1. To produce an accurate record of work performed during the Internship/Co-op.
2. To apply engineering knowledge to a problem in industry
3. To Produce a technical report.
4. To discuss work in a team environment, if relevant to the project
5. To conduct herself/himself responsibly, safely, and ethically in a professional environment

Course Outcomes:

Upon successful completion of this course, the student will be able to:
CO1: Describe the organizational structure, workflow, and operational practices of the host industry.
CO2: Apply engineering/technical knowledge to solve or support real-time industrial problems during internship work.
CO3: Analyze project requirements, processes, and constraints to plan and execute assigned tasks effectively.
CO4: Evaluate different approaches, tools, and methods used in the industry to identify optimal solutions and improvements.
CO5: Develop a technical report and present internship outcomes through a structured seminar presentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will visit Government or Private Organizations/Computer Industries/Software Companies/R&D Organizations for a period of 2-4 weeks. This will be during the summer vacation following the completion of the III-year Course (VI-SEMESTER). One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents.
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessional are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of Minimum 4 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

K. Suddu

[Signature]