Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization
Ph.D	Engineering and Technology	Mechanical Engineering

List of Subjects

S.No	Subject Code	Name of Subject
1	MEEN019902/01	Experimental stress analysis
2	MEEN019902/02	Maintenance of thermal power plant equipments
3	MEEN019902/03	Advanced machine design
4	MEEN019902/04	Product design & development
5	MEEN019902/05	Metal forming
6	MEEN019902/06	Advanced materials
7	MEEN019902/07	Composite materials
8	MEEN019902/08	Advanced machine dynamics
9	MEEN019902/09	Thermal power plant engg.
10	MEEN019902/10	Steam and gas turbines
11	MEEN019902/11	Finite element method
12	MEEN019902/12	Computer aided design
13	MEEN019902/13	Computers aided manufacturing
14	MEEN019902/14	Nanotechnology
15	MEEN019902/15	Artificial Intelligence in engineering
16	MEEN019902/16	Design of mechanical System

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Experimental stress analysis	MEEN019902/01

Unit-wise Content distribution

Unit	Contents
Unit-I	Overview of experimental stress analysis, Stress analysis – Analytical, Numerical and Experimental approaches, Specific domain of these approaches, Advantages and disadvantages.
Unit-II	Optical methods work as optical computers, Direct information provided by various experimental methods – brief description, Visual appreciation of field information – Listing of various problems of different complexity.
Unit-III	Stress, Strain and Displacement fields for various problems, Beam under pure bending, Analytical solution, Fringe contours from various experimental methods, Disc under diametral compression – Analytical solution, Fringe contours from various experimental techniques, Clamped circular plate under a central load – Analytical solution, Fringe contours from various experimental techniques
Unit-IV	Spanner tightening a nut – completeness of a numerical solution, comparison with photoelastic fringes. Physical principle behind various experimental techniques, Strain Gauges, Photoelasticity, Grids for determining plastic strains, Geometric moiré, grating details – u and v displacements, Demonstration of fringes due to translation and rotation of gratings of various types
Unit-V	Strain Gauge Rosette, Types of rosette, four element rectangular rosette, Tee-delta rosette, rosette analysis. Application, Design of turbo machinery components such as steam turbine rotor, L.P. and H.P. cylinder diaphragm value rotary compressors and its parts. Fatigue testing and vibration studies.

Text Books/Reference Books

1.Experimental Stress Design; Daly and Reilly
2.Experimental Stress Design; Sadhu Singh

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Maintenance of Thermal power plant equipments	MEEN019902/02

Unit-wise Content distribution

Unit	Contents
Unit-I	Maintenance Management, Maintenance strategies, maintenance schedule, emergency maintenance procedure spare part management, Diagnostic Maintenance.
Unit-II	Machine Health Monitoring, practical application of diagnostic maintenance to specific industrial machinery and plants.
Unit-III	Various techniques of condition monitoring wear analysis, vibration and noise signature, thermography etc. Mechanism of Lubrication & Lubricants, Lubrication Regimes: Lubrication regimes, analysis and modes of lubrication in different bearings, squeeze films, fluid film, elasto-hydrodynamic and boundary lubrication.
Unit-IV	Failure Mechanisms and Analysis, Material failure and failure due to environmental effects, Design faults, analysis of engineering failures, failure due to abuse of machinery, failure of seals & packing, failure of bearings, failure of gears, fatigue failure, failure due to time –temperature effects (creep) corrosion etc.
Unit-V	Maintenance of Power Plant Machinery, Predictive and preventive maintenance of steam turbine and its components. On load and off load cleaning of condenser tubes. Maintenance scheduling of cooling water plants, cooling towers.

Reference Books;

1. Maintenance & Spare Parts & Management P. Gopal Krishnan
2. Modern Power Station Practice10 Volumes in Reference British Electricity

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Advanced machine design	MEEN019902/03

Unit-wise Content distribution

Unit	Contents
Unit-I	General consideration for design of machine elements. Types of loadings.
Unit-II	Criteria for failure. Distinction between design approaches for static and fatigue loading and their influences on design criteria.
Unit-III	Designing against fatigue, creep and impact loading. Stress concentration and stress concentration factors. Residual stresses and their determination.
Unit-IV	Types of drives. And their relative merits. Belt drives – design and performance. Chain drive. Gear drives. Strength of gear tooth surface. Beam strength. Strength, deflection and design of shafts. Selection of bearings. Gear drive housing.
Unit-V	Fluid power systems, pumps and accessories, circuit design and applications. Step less drives, P.I.V. drives. Power transmission in machine tools. Stress intensification in presence of sharp notches and cracks. Design of machine elements in presence of cracks.

Reference Books ;

1. Advanced Machine Design, Mubeen
2. Mechanical Engineering Design, Shigley

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Product design & development	MEEN019902/04

Unit-wise Content distribution

Unit	Contents
Unit-I	Elements of successful product design in their specialist market place. Study of Engineering Marketing relationship. The buying motivation and perception of industrial buyers
Unit-II	Individual customers, industry and government departments. Presentation of designs to potential customers. Acclerated product development.
Unit-III	Variety proliferation. Differential product "fast to market". Forecasting and market research for a new product. Purchasing and sales procedure. Demand analysis for new product.
Unit-IV	Intellectual property right. Introduction to IPR laws, nature, types of intellectual property, IPPP as an economic entity.
Unit-V	Development of IPR copyright, patents, design, trademarks, forms, global IP structure and IPRS in India, Infringement and remedies available, patent search, contractual agreements involving patents. Case studies

Reference Books:

1. Product design and development ;Karl Ulrich and Steven D Eppinger

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Metal forming	MEEN019902/05

Unit-wise Content distribution

Unit	Contents
Unit-I	Classification of metal forming processes, effect of temperature, strain rate and microstructural variables; Elementary stress analysis, Principal stresses, Yield criteria
Unit-II	Residual stresses, experimental techniques, yielding theories, Hot, Cold and Warm working of materials
Unit-III	Classification of forging processes, forging equipment, forging defects, Overview of metal forming processes, classification, Formability limits, Non-uniformityand segregation in materials
Unit-IV	Classification of rolling processes, rolling mills, cold rolling, hot rolling, Types of extrusion, process variables, wire, rod, and tube drawing
Unit-V	lubrication processes, stretch forming, deep drawing. Flow curves

Reference Books:

1. Mechanical Metallurgy Dieter G. E,

2.Engineering Metallurgy, Volume II, Higgins R.A,

3.Mechanical Working of Metals-Theory and Practice Harris J.N

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Advanced materials	MEEN019902/06

Unit-wise Content distribution

Unit	Contents
Unit-I	Nanomaterials: Carbon nanotubes, structure and properties, chemistry of carbon nanotubes
Unit-II	Graphite whiskers, cones and polyhedral crystals, nanocrystaline diamond, carbide derived carbon nanotubes in multifunctional polymer nano composites
Unit-III	Composites processing, micromechanics, shape memory alloys (SMAs), metallic foam, Plastics, polymeric materials (molecular viewpoint)
Unit-IV	Microstructures in polymers, mechanical properties (macro view point) chemical and physical properties (macro view point), designing with plastics
Unit-V	Thermoplastic materials (commodity plastics), thermoplastic materials (engineering plastics), thermoset materials, elastomeric (rubber) materials, related processes, Environmental aspects of plastics.

Reference Books;

1.Materials, their Nature, Properties and Fabrication Sukh Dev Sehgal, Lindberg R.A.
2. Light alloys: Metallurgy of Light Metals Polmear I. J.

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Composite materials	MEEN019902/07

Unit-wise Content distribution

Unit	Contents
Unit-I	Types of Composites, Reinforcements, Whiskers, Laminar composites, Flake composites, Filled composites, Particulate reinforced composites, Cremates, Micro-spheres, Solidification of composites. , Economics of Composites and Reinforcements, Design of Composite Materials, Mechanics of composites
Unit-II	Applications of Composites, Laminated metal composites, Ceramic materials, Ceramic-metal systems, Ceramic glass system, Ceramic-ceramic systems, Metal Matrix Composites
Unit-III	Reinforcement, Reinforcement selection, Matrix selection, effects of reinforcements, Properties, Fabrication, Whisker reinforcement, Whisker composite properties.
Unit-IV	Al composite foam, functionally gradient composite materials. Composite material for automobile, aerospace and general Engineering applications.
Unit-V	Ceramic Matrix Composites: Particulate reinforced composites, Continuous fiber reinforced composites, Chopped fiber and whisker reinforced composites, Fabrication processes, Properties. Contents

Reference Books;

1.Composite Materials Lawrence, J. Broutman;
2. Composite Materials, R.M. Jones

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Advanced machine dynamics	MEEN019902/08

Unit-wise Content distribution

Unit	Contents
Unit-I	Gear design: Spur, bevel, worm,
Unit-II	Balancing & vibration analysis, balancing of rotors, balancing of internal combustion engines
Unit-III	Gyroscope applications: Motor cycle
Unit-IV	Four wheel vehicle, aero plane
Unit-V	Naval ship rotor bearing system. Cam dynamics: analysis of an eccentric cam, jump speed analysis of cam, unbalance, spring surge & windup.

Reference Books;

1.Dynamics of Machinery, Farazdak Haideri
2. The theory of machines: a text-book for engineering students, Thomas Bevan
3. Mechanics of mechanism Ghosh and Mallick
4. Theory of Machines S S Rattan
5. Kinematics and dynamics of machines, George Henry Martin

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Thermal power plant engg.	MEEN019902/09

Unit-wise Content distribution

Unit	Contents
Unit-I	Conventional thermal power plants, super-critical power plants and its principles of working, performance curves and flow diagrams.Power plant components: Fuel and ash handling, pulverized fuel firing burners
Unit-II	Dust handling, fluidized bed combustion. Radiant super heaters and re-heaters, economizer and pre-heaters, combustion and furnace design, boiler water supply and treatment. Drat and arrangement of draft fans
Unit-III	different types of cooling systems, open closed, mixed and dry cooling tower systems, air cooled condensers.
Unit-IV	Ejector and vacuum pumps, feed heating systems, heaters, evaporators and de-airator, feed line protection, boiler feed pumps, different type of drives for it, steam turbine driven feed pumps. Plant instrumentation for thermal power plants, need and importance, distributed and centralized, pneumatic and electro-mechanical transducers and controllers, distributed computer control.
Unit-V	Piping and insulation: design and layout of ducting for air fuel, gases and pulverized fuels, selection of piping, pipe flexibility analysis, Various control valves and actuators. Insulation optimum thickness and costs. Installation, commissioning and operation: Preliminary performance checks and acceptance test for various components, heat balance of items and entire plant. Starting loading and normal operation checks, maintenance logging, parallel operations, droop setting, performance analysis, maintenance, safety and pollution controls. Plant Management: Preparing specifications and contract documents, guarantee. Training of power plant personnel, safety, and seismic analysis. Purchase and contract for fuel supplies.

Reference Books;

1.Power Plant Engineering, F T Morse

2. Power Plant Engineering, P K Nag

3. Power Plant Engineering, Arora and Domkundwar

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Steam and gas turbines	MEEN019902/10

Unit-wise Content distribution

Unit	Contents
Unit-I	Steam Turbines: Principle and working of steam turbines, type of turbines, impulse and reactions, compounding for pressure and velocity. Velocity triangles for various types, stage to blade, speed ratio for optimum efficiency, diagram efficiency, steam performance. Energy losses in steam turbine, turbine performance at various loads and governing of steam turbines.
Unit-II	Constructional details and description of steam turbine components in brief. Regenerative feed heating cycles: Introduction : Most Ideal Regenerative f eed heating cycle. Regenerative feed heating cycles and their represenation on T-s and h-s Diagram. Representation of actual process on T-s and h-s Diagram Regenerative cycles.
Unit-III	Other types of feed heating arrangements. Optimum feed water temperature and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters, Deaerators . Unit 3 Reheating – Regenerative and Regenerative water – Extraction Cycles.
Unit-IV	Reheating of steam, Practical reheating and Non- reheating cycles, advantage & disadvantages of reheating, regenerative water extraction cycles, practical feed heating arrangements. Feed heating system for 120MW, 200MW, 350MW, 500MW & 660 MW Units. Mixed Pressure Turbines: Low- pressure Turbines, Mixed pressure Turbines, Heat Accumulators.
Unit-V	Gas Turbines: Open and closed cycles, constant pressure and constant volume cycles, cycles with inter cooling, reheating and heat exchanger, compressor and turbine efficiencies, pressure losses, performance characteristics of various cycles, practical problems. Jet Propulsion: Calculation of thrust, Power, speed and efficiency, turbo – jet and turbo propulsion systems.

Reference Books;

1.Fluid dynamics and heat transfer of turbo-machinery, Budugur akshminarayana,

2. Cohen H Rogers, Sarvanmutto, Gas Turbine Theory, Longman Pub.
3. Mathur, Sharma, Gas turbine, Standard Pub And Distributors Delhi.

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Finite element method	MEEN019902/11

Unit-wise Content distribution

Unit	Contents
Unit-I	Approaches of FEM- Discrete, Variational and Weighted Residual; Direct Problems- Spring,
Unit-II	Hydraulic Network; Resistance Network and Truss Systems; 1-D Field and Beam Bending Problems-Formulation using Galerkin and Raleigh-Ritz approaches
Unit-III	Derivation of elemental equations and their assembly, Solution and its post processing; 2-D and Axisymetric Field and Stress Problems-Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly
Unit-IV	Solution and its post processing; 3-D Field and Stress Problems Formulation using Galerkin and Raleigh-Ritz approaches, Derivation of elemental equations and their assembly, Solution and its
Unit-V	Post processing; Eigen value and time dependent problems; Discussion about preprocessors, postprocessors and finite element packages.

Reference Books;

1. Introduction to Finite Elements in Engineering" by T R Chandrupatla and A D Belegundu
2. "Introduction to the Finite Element Method" by J N Reddy
3. Finite Element Analysis: Theory and Programming" by C S Krishnamoorthy

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Computer aided design	MEEN019902/12

Unit-wise Content distribution

Unit	Contents
Unit-I	Historical Development, Explicit and Implicit Equations, Intrinsic Equations, Parametric Equations, Coordinate Systems,
Unit-II	Curves: Fundamental of Curve Design, Parametric Space of a Curve, Reparametrization, Space Curves: Spline Curves, Bezier Curves, B-Spline Curve, Rational Polynomials, Rational curves, NURBS.
Unit-III	Surfaces: Fundamental of Surface Design, Parametric Space of a Surface, Reparametrization of a Surface patch, Sixteen point form, Four Curve Form, Plane, Cylindrical and Ruled Surfaces, Surfaces of Revolutions, Bezier Surface, BSpline Surface.
Unit-IV	Solids: Fundamental of Solid Design, Parametric Space of a Solids; Continuity and composite Solids, Surface and Curves in a Solid.
Unit-V	Solid Modeling: Topology and Geometry, Set theory, Euler Operators, Regularized Boolean Operators, Construction Criteria, Graph Based Models, Instances and Parameterized Shapes, Cell-decomposition and Spatial Occupancy Enumeration, Sweep representation, CGS, BRep, Wireframe Analytical properties, Relational properties and Intersection. Applications in Mechanical Engineering Design

Reference Books;

1. "Fundamentals Of Cad/Cam/Cim" by Sharma
2. Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelry (Springer Series in Materials Science)" by John O Milewski
3. AutoCAD 2014 For Dummies (Autocad for Dummies)" by Bill Fane and David Byrnes

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Computers aided manufacturing	MEEN019902/13

Unit-wise Content distribution

Unit	Contents
Unit-I	Fundamentals of Numerical Control: Need and future of NC Systems, Principles and Types of NC, Design Features of NC M/c Tools; Machining Centre; NC Part Programming:
Unit-II	Manual, computer Assisted-APT, EXAPT, ADAPT and CAD based Part Programming; Feedback DevicesResolvers, Encoders, and nductosyns;
Unit-III	Actuation Systems- Hydraulic, Pneumatic and Electromechanical; Computer Control and Adaptive Control System-CNC, DNC and AC; Flexible Manufacturing Systems-Concept and Classification,
Unit-IV	Types of Flexibility, pallets, fixtures, work handling systems, simulation and analysis in the design of FMS;
Unit-V	Concurrent Engineering-Objectives, tools and applications; Automated Quality Control Systems-Working, Programming and Applications of CMM

Reference Books;

1. "Computer Integrated Design and Manufacturing" by David Bedworth and Philip Wolfe
2. Computer Aided Manufacturing" by P N Rao
3. CAD/CAM : Computer-Aided Design and Manufacturing" by M Groover and E Zimmers

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Nanotechnology	MEEN019902/14

Unit-wise Content distribution

Unit	Contents
Unit-I	Introduction: Background and Fundamentals of Nanotechnology Methods of Measuring Properties: Structure, Microscopy, Spectroscopy
Unit-II	Properties of Individual Nanoparticles: Metal Nanoclusters, Semiconducting Nanoparticles, Rare Gas and Molecular Clusters, Methods of Synthesis
Unit-III	Carbon Nanotubes: Fabrication, Structure, Electrical Properties, Vibration Properties, Mechanical Properties, Applications of Carbon Nanotubes Bulk Nanostructured Materials: Solid Disordered Nanostructures, Nanostructured Crystals
Unit-IV	Nanomachines and Nanodevices: Microelectromechanical Systems (MEMs) and anoelectromechanical Systems (NEMs) Technology, Fabricating MEMS and NEMs, Advantages of MEMs and NEMs. Thin Film Deposition Processes: Chemical Vapor Deposition (CVD), Electrodeposition, Epitaxy, Thermal oxidation, Physical Vapor Deposition (PVD), Evaporation, Sputtering, Casting. Lithography
Unit-V	Etching Processes: Wet etching and Dry etching Mirco/ Nanoibology: Measurement Technique, Friction and Adhesion: Atomic scale friction, Micro scale friction; Scratching, Wear, Local Deformation and Fabrication/ Machining, Indentation, Lubrication, Challenges and advances in Nanomaterials processing techniques

Reference Books;

1. “Nano: The Essentials Understanding Nanoscience and Nano” by T Pradeep
2. “Nanomaterials” by B Viswanathan
3. “Introduction to Nanotechnology” by Charles P. Poole; Frank J. Owens

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Artificial intelligence in engineering	MEEN019902/15

Unit-wise Content distribution

Unit	Contents
Unit-I	Introduction to expert system, Introduction to Artificial intelligence, Expert System
Unit-II	Overview, Development of expert systems, Problem presentation, Expert system structure, knowledge basis and representation, inference mechanism
Unit-III	Introduction to PROLOG, data structure, Backtracking and cut, input-output, predates. Equipment selection, Layout design, Material handling, CAPP.
Unit-IV	Feature extraction and Recognition, Bar code and coding of components.
Unit-V	Automatic storage and Retrieval Qualitative reasoning, Fuzzy logics, neural nets, application from manufacturing.

Reference Books;

1. Computational Intelligence, Control and Computer Vision in Robotics and Automation" by Bidyadhar Subudhi
2. "Artificial Intelligence: A Beginner's Guide (Beginner's Guides)" by Blay Whitby
3. McGraw-Hill Illustrated Encyclopedia of Robotics and Artificial Intelligence" by Stan Gibilisco

]

Madhyanchal Professional University, Bhopal

Program	Faculty	Branch/Specialization	Name of Subject	Subject Code
PhD	Engineering and Technology	Mechanical Engineering	Design of mechanical systems	MEEN019902/16

Unit-wise Content distribution

Unit	Contents
Unit-I	Computer Aided Design of one of the following mechanical system with its components. Only one of the sub systems is to be designed.
Unit-II	Refrigeration System: Design of any of the sub-system of compressor condenser or evaporator. Optimum design for minimum cost & maximum performance
Unit-III	Automobile System: Design of clutch gearbox and brakes for given power and speed requirements.
Unit-IV	I.C.Engines: Design of piston, cylinder, connecting rod, Crankshaft, Cam, Camshaft and Valves.
Unit-V	Machine Tools: Power requirement calculations, frame, bed and guide ways, spindle & bearing design.

Reference Books;

1. "Mechanical System Design" by S P Patil
2. "Mechanical System Design" by Anurag D
3. "Mechanical System Design" by K U Siddiqui
4. "Basic Machines and How They Work" by United States Bureau of Naval Personnel