MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

For batches admitted in Academic Session 2020-21

Production Lab

Category	Title	Code	Credit-2			Practical Slot
Departmental Lab Core-DLC	Production Lab	120415/190415/ 120405/190405	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	4	

Course Objective:

1. To demonstrate the fundamentals of machining processes and machine tools.
2. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
3. To apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, etc.

List of Experiments:

1. Step Turning and Taper Turning on Lathe.
2. Threads Cutting and Knurling on Lathe.
3. Machining Flat Surface using Shaper Machine.
4. Manufacturing of Spur Gear using Milling Machine.
5. Making Internal Splines using Slotting Machine.
6. Hole on work piece through Drilling.
7. Grinding of Single Point Cutting Tool
8. Slot / Groove cutting using shaping machine.
9. Performance on mold making of Simple component.
10. Performance on pattern making of Simple component.
11. Performance on Metal Casting of Simple component.
12. Performance on Welding of simple work piece (Example Arc Welding)
13. Performance on Sheet Metal work of Simple component.
14. Performance on hot forging of Simple component

Laboratory Course Outcomes: After the completion of the course Lab student will be able to:

CO1 Define the different conventional method of material removal and function of different parts.
CO2 Apply the theory of metal cutting in experiments.
CO3 Perform step, taper turning, knurling and threading.
CO4 Produce stepped surface using shaper and keyway using milling machine.
CO5 Demonstrate knowledge of different machine tools used in machine shop.
CO6 Evaluate the chip thickness ratio, shear angle and material removal rate.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

For batches admitted in Academic Session 2020-21

190511/120511: Industrial Engineering

Category	Title	Code	Credits: 2			Theory Paper
Departmental Core-DC	Industrial Engineering	190511/120511/ 190501/120501	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2hrs.
			2	-	-	

Course Objectives: Industrial engineering is concerned with the design, improvement, installation, and management of integrated systems of men, material, and machine. After completing this course, students will learn a set of skills that includes mathematical modeling, probability and statistics, computer science, human factors, interpersonal skills, project management, and an ability to manage and administer large technical engineering and research projects. Thus, industrial engineering may be thought of as applied problem-solving, from inception to implementation.

Syllabus

UNIT-I
Production Systems and Productivity: Production Management: design of production systems (product, job shop and batch). Definition and types of productivity, Measurement of productivity, factors affecting the productivity and productivity improvement programs.
Production Planning and Control: Aggregate production planning, Capacity planning: capacity measurement, long-term and short-term strategies, aggregate production planning, and graphical method to choose aggregate plan.

UNIT-II
Forecasting techniques: Need and type of forecasting, factors affecting forecasting, forecasting in decision making, time series analysis, demand patterns, qualitative methods- measures of forecast accuracy and error analysis in quantitative forecasting.

UNIT-III
Inventory Control – Objectives and functions, need and classifications- codification and standardization ABC analysis, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems. Probabilistic inventory management, economic ordering quantity procurement cost, carrying charges, lead-time, reorder point.

Unit-IV
Facility Locations and Plant Layout: Facility location factors and evaluation of alternate locations; qualitative aspects, quantitative models for layout decisions, types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing, materials handling systems.
Project management - Project Scheduling, Network diagram, critical path method (CPM), Project Evaluation and review techniques (PERT), Time cost trade off.

UNIT-V
Master Production Scheduling and MRP: Functions, planning horizon and planning periods for master production schedule, types of master production schedule, Bill of Material, Independent Demand versus dependent demand, Functions of material requirements planning and manufacturing resource planning (MRP I and MRP II), inputs for MRP system, performance characteristics of MRP system, materials requirement planning explosion.

Course outcomes: After learning the course the students should be able to:

CO1. **Define** and measure productivity.
CO2. **Understand** Production planning and control required for industry to analyze the engineering problems.
CO3. **Apply** engineering design to produce solutions that meet specified needs of manufacturing industry
CO4. **Analyze** practice through various Management and Operation Tools for Improving Quality and Quantity.
CO5. **Evaluate** various kinds of problems or issues faced by service and manufacturing industries like Inventory control, sales forcasting economic consideration, optimum utilization of resources, productivity.
CO6. **Create** new mathematical models for efficient production planning and control.

Text Books:

1. Industrial Engineering and Production Management, Martand Telsang, S. Chand
2. Production and Operation Management by R. Panneerselvam, PHI, Latest Edition
3. Manufacturing planning and control for SCM by Vollmann; TMH, Latest Edition.
4. Purchasing & Materials Management by Dobler & Lee, PHI, Latest Edition

Reference Books:

1. Operations Management by Krajewski, L. J., Ritzman, L. P. and Malhotra, M. K., Prentice Hall, New Delhi; Latest Edition.
2. Production/Operations Management by Ebert, J and Adams, D.J., Prentice Hall of India, New Delhi; Latest Edition.
3. Production and Operations Management: manufacturing and services by Chase, R. B., Aquilano, N. J. and Jacob, F. R., TMH, New Delhi; Latest Edition .
4. Modern Production/Operations Management by Buffa and Sarin, Wiley India; Latest Edition.

List of Open Source Software/learning website:

1. Operation Management, IIT Roorkee, Dr. Inderdeep singh, https://nptel.ac.in/courses/112107238
2. Operation and Supply chain Management, IIT Madras, Prof. G. Srinivasan
https://nptel.ac.in/courses/110106045

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

For batch admitted in Academic Session 2020-21

190513/120513: Heat and Mass Transfer

Category	Title	Code	Credits -4			Theory Paper
			L	T	P	
Departmental Core-DC	Heat and Mass Transfer	190513/120513/ 120503/190503	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

Course Objectives: To make the students understand:

1. the comprehensive of physical science and its fundamentals applicable to the engineering discipline of heat and mass transfer.
2. the fundamentals of heat transfer mechanisms in fluids and solids.

Syllabus

UNIT I - Fundamental of Heat Transfer: Modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, thermal conductivity and its variation with temperature, film coefficient of heat transfer, general heat conduction equations, Steady state heat transfer: Thermal resistances and conductance, overall Heat transfer Coefficient, Heat transfer through plane and composite wall, hollow and composite hollow cylinder and sphere, thermal diffusivity, one dimensional steady state conduction with heat generation , critical thickness of insulation. Unsteady State Heat Transfer: Transient and periodic conduction, Lumped System Analysis, heating and cooling of bodies with known temperature distribution, response of thermocouple.

UNIT II - Convection Heat Transfer: Introduction to Free and Forced Convection, laminar and turbulent flow, forced convection through hydrodynamic and thermal boundary layers, analysis of hydrodynamic and thermal boundary layer. Empirical equations of convection heat transfer. Heat Transfer in a circular pipe (forced convection). Applications of dimensional analysis to free and forced convection. Reynolds Number, Prandtl Number, Grashoff Number, Nusselt numbers, and Boit Number

UNIT III - Heat Exchangers: Basic types of heat exchanger. Logarithmic Mean Temperature Difference (LMTD), fouling factor, heat exchanger effectiveness, NTU Methods. Extended surfaces: Pin-Fin and rectangular fin of uniform cross section. Effectiveness and efficiency of Fin. Use of fin analysis for measuring, thermometric error, triangular and parabolic profile.

UNIT IV – Thermal radiation: Basic concept. Monochromatic and total emissive power, absorptivity, reflectivity and transmissivity, Kirchhoff's law, Concept of Black & Grey bodies. Plank's distribution law.Wien's displacement law. Steffen – Boltzmann law, Concept of Shape factor. Condensation heat transfer: Introduction, process, Theory of laminar film condensation. Nusselt's Theory. Drop wise condensation. Influence of the presence of non-condensable gases. Boiling heat transfer: Nature, Boiling regimes, Bubble size consideration, bubble growth and Collapse. Critical diameter, Rosen how Correlation.

Unit V - Diffusion Mass Transfer: Fick's law. Steady state diffusion of gases and liquids through solids, Equi-molal diffusion, isothermal diffusion, isothermal evaporation of water into air. Mass transfer coefficient. Convective Mass Transfer: Mass transfer through boundary layer. Analogy between momentum heat & mass transfer. Dimensional analysis, application to convective mass transfer. Forced convection mass transfer in laminar and turbulent flow through tubes. Simultaneous heat and mass transfer.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

Course Outcomes: After successful completion of this course students will be able to:

CO1. Formulate and solve one-dimensional conduction with and without heat generation
CO2. Apply the empirical equations to analyze various convection problems
CO3. Evaluate the performance of various types of heat exchangers
CO4. Develop the mathematical and physical concept of radiation heat transfer
CO5. Apply the physics of heat transfer in the processes like Condensation and Boiling
CO6. Analyze and solve the problems in diffusion and convective mass transfer

Text Books:

1. Kumar D. S, Heat & Mass Transfer, Latest Edition, Katson Publication.
2. Rajput R. K., Heat & Mass Transfer, Latest Edition, S. Chand Publication.

References Books:

1. Arora & Domkundwar, A course in Heat & Mass Transfer, Latest edition, Dhanpat Rai& Co. Publication.
2. Nag P K, Heat Transfer, Latest Edition, McGraw-Hill
3. Holman J. P., Heat Transfer, Latest Edition, TMH.
4. Kreith & Bohn, Principles of Heat Transfer, Latest Edition, CL Engineering Publication.
5. Cengel Yunus A., Heat and Mass Transfer, Latest Edition, TMH.
6. Thirumaleshwer M., Heat and Mass Transfer by, Latest Edition, Pearson

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Powder.
3. Measurement of Emissivity.
4. Determination of Stefan-Boltzmann constant.
5. Determination of Heat Transfer coefficient by Pin-Fin Apparatus.
6. Determination of Effectiveness of Shell and Tube heat exchanger.
7. Determination of Effectiveness of Parallel and Counter Flow Heat Exchanger.
8. Determination of Heat transfer coefficient by Forced Convection.
9. Determination of Heat Transfer coefficient during drop and film wise condensation.
10. To study the drying characteristics of different wet granular materials using natural and forced circulation in a tray dryer.
11. To determine the diffusion coefficient of liquid vapor in air by Stefan's tube.

Lab Course Outcomes: After successful completion of this course students will be able to:

CO1: Determine the thermal conductivity of metal rod and insulating powder.
CO2: Estimate the Stefan-Boltzmann constant and measurement of emissivity.
CO3: Determine the effectiveness of various types of heat exchangers.
CO4: Evaluate the Heat Transfer coefficient in various heat transfer phenomena.
CO5: Evaluate the diffusion coefficient of liquid vapor in air by Stefan's tube.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

For batch admitted in Academic Session 2020-21

120514: Thermal Engineering

Category	Title	Code	Credits -4			Theory Paper
Departmental Core-DC	Thermal Engineering	120514	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2 hrs.
			2	1	2	

Course Objectives: To make the students understand:

1. the fundamental principles of IC engines and combustion phenomena
2. the basic principles of nozzles and diffusers
3. the application of basic thermodynamics and fluid mechanics in steam and gas turbine power plants

Syllabus

UNIT I - Vapor Power Cycles: Vapor Carnot cycle and its limitations, Rankine cycle and modified Rankine cycle, actual vapor power cycle, Reheat cycle, ideal regenerative cycle, actual regenerative cycle, Reheat – regenerative cycle, feedwater heaters, cogeneration of power and process heat, working fluids in vapor power cycle, binary vapor cycles, the efficiency of coupled cycles. Basics of condensers.

UNIT II – IC Engine Basics and Combustion in IC Engines
Basics of CI and SI Engines, Basics of two-stroke and four-stroke IC engines, Valve timing diagram, Performance parameters, Heat balance, Testing of the engine.
Stages of combustion in SI engine, Flame propagation, Rate of pressure rise, Abnormal combustion, Theory of detonation, Effect of engine operating variables on knock, Stages of combustion in CI engines, Delay period - Factors affecting delay period, Knock in CI engines - methods of controlling diesel knock, Combustion chambers for SI and CI engines.

UNIT III – Gas Turbine
Open cycle and closed cycle arrangements, applications, assumptions in ideal cycle analysis, simple gas turbine cycle, heat exchange cycle, intercooled cycle, various combinations of reheat, heat exchange and intercooling, comparison of various cycles, Combined Brayton and Rankine Cycle and GT-ST plants; Advantages of Combined Cycle

UNIT IV – Steam Turbines
Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Utilization factor, Blading, Velocity diagram & work calculations, Impulse Reaction Turbines, Losses in steam turbines, Governing of turbines.

Unit V Nozzles and Diffusers
Introduction, SFEE and continuity equation for nozzles & diffusers, momentum equation for the steam nozzle, entropy change due to friction in the nozzle, nozzle efficiency, critical pressure, stagnation enthalpy & pressure, Relation between area, velocity & pressure in nozzle, the effect of friction on critical pressure ratio, supersaturated flow in nozzles, the effect of variation of back pressure

Course Outcomes: After successful completion of this course students will be able to:

CO1: analyze the performance of steam power plant

CO2: describe the working principles of internal combustion engines and combustion phenomena
CO3: analyze the performance of gas turbine power plant
CO4: describe the working of various types of steam turbine
CO5: solve analytical problems of nozzles and diffusers

Text Books:

1. P K Nag, "Power Plant Engineering", Latest Edition, Tata McGraw Hill Publishing Company Limited,
2. Ganesan V, "Internal combustion engines", Latest Edition, Tata McGraw Hill Education Private Limited,
3. Ganesan V, "Gas Turbines", Latest edition, Latest Edition, Tata McGraw Hill Education Private Limited,
4. P. L. Ballaney, "Thermal Engineering", Latest Edition, Khanna Publishers

References Books:

1. John. B, Heywood, "Internal Combustion Engine Fundamentals", Latest edition, McGraw Hill Publishing Co., New York,
2. Sharma S. P, Chandramohan, "Fuels and Combustion", Latest edition, Tata McGraw Hill Publishing Co.
3. Mathur and Sharma, "A course on Internal combustion Engines", Latest edition, Dhanpat Rai& Co.
4. Rajput R. K, "A textbook of Thermal Engineering", Latest edition, Laxmi Publications
5. B.K. Venkanna, "Fundamentals of Turbomachinery", PHI Learning Private Limited

List of Experiments:

1. Introduction to Computational Fluid Dynamics and its methodology.
2. Perform CFD analysis on flow through pipe with varying Reynolds Number.
3. Performance test of two stoke diesel engine and four stroke diesel engines.
4. Study of compounding of Steam turbine.
5. Study of combined steam and gas turbine plant.

Lab Course Outcomes: After successful completion of this course students will be able to:

CO1: Describe the process involved and advantages in solving a fluid problem using computational fluid dynamics
CO2: Solve the Fluid flow problem using CFD technique.
CO3: Estimate energy distribution by conducting heat balance test on IC engines.
CO4: Determine performance parameters of impulse steam turbine
CO5: Evaluate the performance of steam turbine with compounding.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

For batch admitted in Academic Session 2020-21

120515: Machine Design

Category	Title	Code	Credit -4			Theory Paper
Departmental Core-DC	Machine Design	120515/120505	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2hrs.
			2	1	2	

Note: Use of PSG Design Data book is permitted in exam.

Course Pre-Requisites:
1. Mechanics of Materials
2. Design of Machine Elements

Course Objectives: To make students:
1. Develop an ability to identify, formulate and solve design engineering problems.
2. Develop an ability to use the techniques, skills and modern design engineering tools necessary for engineering practice.
3. Demonstrate the ability to make proper assumptions, perform correct analysis while design upon various mechanical machine elements.

Syllabus

UNIT-I
Stress concentration & fatigue: Stress Concentration-causes, effect in tension, bending and torsion, mitigation, **Fatigue**- cyclic loading, endurance limit, S-N curve, concentration factor, notch sensitivity, design consideration, Goodman and modified Goodman's diagram, Soderberg's equation, Gerber's parabola, design for finite life, cumulative fatigue damage factor.

UNIT-II
Spring: Function, classification, Rate, curvature of coil, scale, resilience, material, Stresses and deflection equations of helical springs, design of compression and tension springs, torsion springs, fatigue loading on springs, surge in spring, critical load, spiral springs, design of leaf spring.

UNIT-III
Gears: Design of Spur, Helical, worm and Bevel Gears: Force analysis, Selection of material, Beam and wear strength, Form or Lewis factor, Dynamic load-Barth equation and Buckingham equation, consideration for maximum power transmitting capacity, Gear lubrication.

UNIT-IV
Sliding contact bearings:
Classification, Selection, Viscosity of Lubricants, Materials, Types, Petroff's relation, loads on bearing, Design, Advantages, Disadvantages, Limitations, Heat Dissipation.

UNIT-V
Rolling contact bearings:
Designation, Types, Friction effect, loads, Fatigue, Deflection & deformation, Selection, bearing life.

Course Outcomes: After successful completion of this course students will be able to:

CO1:Describe the design procedure used in automotive industry to design the engine parts
CO2:Classify the different types of spring, bearing and Gears
CO3:Choose the right strategy for designing the machine components based on material and methods
CO4:Apply the design procedure for solving and drafting the different design of machine elements
CO5:Compare the various curves and design procedure used
CO6:Selection of machine elements under various loading and environmental conditions.

Text Books

1. Shigley, J.E., and CharlesMechanical Engineering Design; TMH
2. Bhandari VB, Design of Machine elements; Tata McGraw Hill Book Co.

Reference Books

1. John KC,Text Book of Machine Drawing; PHI Learning.
2. Machine Design by Mubeen, Pearson.
3. Engineering design by George Dieter; McGraw Hill.
4. Bhatt, ND,Machine Drawing; Charotar.
5. Kulkarni, S.G., Machine Design, McGraw Hill.
6. Narayana and Reddy,Machine Drawing; New age publication.
7. Design data book, PSG College of Technology, Coimbatore
8. Luzzader, WJ, Duff, JM,Fundamental of Engineering Drawing Interactive Graphics; PHI.
9. Mahadevan, Reddy's,Mechanical design data book;CBS Publisher.

NPTEL Link for Design of Machine Elements

https://nptel.ac.in/syllabus/112106137/

https://nptel.ac.in/downloads/112105125/

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

Laboratory Course Outcomes: After the completion of the course Lab students will be able **to**

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. **Compare** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.