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

Manufacturing Processes

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Manufacturing Processes	120311/190414/ 120403/190404	2	1	-	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Objectives: To make students:

1. Able to learn the various methods and types of castings, welding processes, sheet metal forming, powder metallurgy
2. Able to **e**xamine the principles associated with basic operations involving the forming, machining and welding of engineering materials;
3. Aware of the necessity to manage manufacturing processes and systems for the best use of material and human resources.

Course Pre-Requisites: Manufacturing Practice

Syllabus

Unit-I Casting: Brief History, Basic principle & survey of casting processes. Sand casting, pattern materials, and allowances. Green and dry moulding, moulding methods, moulding sand properties and testing. Elements of mould and design considerations. Cores use, core materials and core making practice. Die, investment and centrifugal casting processes. Melting practice and concepts in solidification. Inspection and defects analysis.

Unit-II Forming: Elastic and plastic deformation, Concept of strain hardening. Rolling, forging, extrusion, spinning, wire and tube drawing processes, machines and equipment's, parameters and force calculations.

Unit-III Sheet Metal Working: Role of sheet metal components.Cutting mechanism. Description of cutting processes like blanking. Piercing, lancing etc. Description of forming processes like bending cup drawing, coining, embossing etc. Basic elements of presses for sheet metal working. Punch and Die clearances and die elements.

Unit-IV Welding: Principle of welding, soldering, brazing and adhesive bonding.Survey of welding and allied processes. Arc welding: power sources and consumables. MMAW, TIG& MIG processes and their parameter selection. Resistance Welding: principle and equipment. Spot, projection and Seam welding processes, Gas welding and cutting: Processes and equipment.

Unit-V Powder Metallurgy: Powder manufacturing, compaction and sintering processes. Advantages and applications of P/M. Manufacturing of Powder metallurgy components.

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

CO1- Describe the different types of manufacturing processes and their applications.
CO2- Identify suitable manufacturing process to achieve the required product shape with the aim of avoid defects, material and time wastage.
CO3-Illustrate the advantage and limitations of various manufacturing processes with regard to shape formation and surface quality.
CO4-Analyse the manufacturing processes for given problem and able to select an appropriate process according to a specific requirement.

CO5-Evaluate the procedures and techniques involved for the manufacturing of components for its optimization.
CO6-Propose a simplified manufacturing processes with the aim of reduction of cost and manpower.

Text &Reference Books

1. Jain R.K., Production Technology, Khanna Publishers, 2001.
2. Hajra Choudhry, Elements of Workshop Technology, Vol – II Media Promoters & Publishers, 1994.
3. Production Technology by HMT, Tata McGraw-Hill.
4.Chapman, W.A.J., Workshop Technology, Vol - II, Oxford & IBH Publishing Co. Ltd.,
5. Manufacturing Processes by Amstead, B.H., P.F. Oswald and M.L. Begeman, John Wiley and Sons Inc., New York.
6. Manufacturing Technology Vol. 1 by P.N. Rao.
7. Modern Manufacturing Process Engineering by Neibel, B.W., Alan B. Draper and R.A. Wysk, McGraw-Hill Publishing Co., New York.
8. Manufacturing Engineering and Technology by Kalpakjian, S, Addison-Wesley Publishing Co., New York.
9. Materials and Processes in Manufacturing by E. Paul DeGarmo, J. Temple Black, and Ronald Kohser, Macmillan Publishing Co., New York.
10. Introduction to Manufacturing Processes John A. Schey, McGraw-Hill Book Co., New York.

NPTEL Link for Manufacturing Process

http://nptel.ac.in/courses/112107145/

List of Experiment

1. Performance on mold making of Simple component
2. Performance on pattern making of Simple component
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple workpiece (Example Arc Welding)
5. Performance on Sheet metal work of Simple component
6. Performance on hot forging of Simple component

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Mechanics of Materials

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Mechanics of Materials	120312/190312/ 120302/190302/ BMEL-302/ MEL-305/3225	2	-	2	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Pre-Requisites:

Basic Civil Engineering and Mechanics

Course Objectives: To make the students:

1. Learn the basic concepts and principles of strength of materials.
2. Calculate stresses and deformations of objects under external loadings.
3. Apply the knowledge of strength of materials on engineering applications and design problems.

Syllabus

Unit- I Stress and strain: Stress-strain relationship and elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain, compound and combined stresses, thermal stresses.
Unit-II Stresses in beams: Shear Force & Bending Moment diagram, theory of simple bending, Section Modulus, bending Stresses and Shear stresses in beam.
Slope and deflection: Equation of Elastic Curve, Macaulay's Method, Area Moment Method, Strain Energy Methods etc.
Unit- III Shear stress distribution: Horizontal, Vertical, Transverse, Longitudinal Shear Stress, Graphical Methods for Different Sections.
Shafts: Torsion of circular shaft, stress concentration in shafts; series and parallel combination.
Unit -IV Column and Struts: Euler's theory of column, Rankine's formula, slenderness ratio; strut with eccentric load.
Thin cylinder: Stress and Strain in thin cylinder, wire wound thin cylinder; thin spherical shells.
Unit- V Materials testing: Tensile, compressive, hardness, impact and torsion testing. Strain Gauges - types of strain gauges, electrical strain gauges, Gauge factor, strain rosette.
Strain Energy: Strain energy due to direct stress, simple shear, torsion, bending, shear force in beams.
Course Outcomes: After successful completion of this course students will be able to:

CO-1 **Identify** various structural elements and its application.
CO-2 **Illustrate** different types of stress and strain on various types of structural elements like beam, shaft column etc.
CO-3 **Calculate** principal stresses, maximum shearing stress, and the different stresses acting on a structural member.
CO-4 **Analyze** stresses and deflection for beam, shaft, long columns, thin cylinder etc.
CO-5 **Select** appropriate materials in design considering engineering properties, sustainability, cost and weight.
CO-6 **Design** simple bars, beams, and circular shafts to meet desired needs in terms of strength and deformation.

Text & Reference Books

1. Strength of Materials (MoM) **by** R S Lehri and A S Lehri; S K Katariya and Sons Pub.
2. Strength of Materials **by** S S Rattan; McGraw Hill Pub.
3. Mechanics of Materials **by** F P Beer, E R Johnston, J T DeWolf; TATA McGraw Hill Pub.
4. Strength of Materials **by** S. Timoshenko; D Van NostrandCompnay,
5. Mechanics of Solids **by** Mubeen; Pearson Education Pub
6. Strength of Materials **by** S Ramamrurtham, R Narayan; DhanpatRai sons Pub.
7. Strength of Materials **by** Sadhu Singh; Khanna Publisher Pub.
8. Mechanics of Materials **by**AdarashSwaroop, New Age international Pub.

NPTEL Link for Mechanics of Material

https://onlinecourses.nptel.ac.in/noc18_ce04/preview

LIST OF EXPERIMENTS

1. To Study Universal Testing Machine
2. To perform the Tensile test on metal specimen
3. To perform the Compression test on metal specimen
4. To perform Bending test on metal specimen
5. To perform single shear and double shear on UTM
6. To perform Hardness testing with Brinell hardness
7. To perform Hardness testing with Rockwell hardness
8. To study the impact testing machine and perform the IZOD impact test
9. To Perform Charpy impact test
10. To study and Perform Fatigue test
11. To study Bending Moment Diagram
12. To Study stiffness of spring and Modulus of rigidity of spring wire
13. Study of weight measurement using strain gauge

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

CO1. **Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.
CO2. **Conduct** the torsion test to determine the modulus of rigidity of given specimen.
CO3. **Perform** compression tests on spring and wood.
CO4. **Justify** the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
CO5. **Determine** elastic constants using flexural and torsion tests.
CO6. **Examine** the stiffness of the open coil and closed coil spring and grade them.

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Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Theory of Machines-I	120313/ 120303/ 190411/190401	L	T	P	Max.Marks-50 Min.Marks-16 Duration-3hrs.
			2	1	2	

Course Pre-Requisite:
Engineering Graphics
Mechanics of Materials

Course objectives: To make the students:
1. Familiarize with different types of mechanisms.
2. Understand the basics of synthesis of simple mechanisms.
3. Apply fundamental of mechanics to machines which include engines, linkages etc.

Syllabus

Unit-I Mechanism: Machine, Mechanism, Kinematics Links, Pairs, Chains, Degree of freedom. Mechanisms and its Inversions; Slider, Double Slider and 4 bar mechanism. Lower pair mechanisms: pantograph, Straight line motions. Davis and Ackerman Steering Mechanisms.

Unit-II Kinematic Analysis: Displacement, velocity and acceleration analysis of plane mechanisms; relative velocity, instantaneous centre, Kennedy's Theorem, Klein's construction methods. Coriolis component.

Unit-III Dynamic Analysis: D'Alembert's principle. Equivalent dynamic system, Graphical and analytical methods of dynamic forces, analysis of mechanisms and machines including reciprocating engines.
Flywheel: Introduction, Turning-moment diagrams and Flywheel analysis.

Unit-IV Brakes: Analysis of simple brake assuming uniform pressures and uniform wear, band brake, block brakes, internal and external shoe brakes, braking of vehicles.
Clutches: Single plate and multi plate clutches, cone clutches, centrifugal clutches.
Dynamometers: Different types and their applications.

Unit-V Governors: Introduction, Types of governors, Various gravity and spring-controlled governors, governor characteristics, Effort and power of a governor, Controlling force diagrams, Coefficient of insensitiveness.

Gyroscopes: Gyroscopic couple, Effect of Gyroscopic couple on the stability of four wheel and two-wheel vehicles, Aeroplanes and Naval ships, Gyrostabilisers.

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

CO 1.Identify basic mechanisms in real life applications.
CO 2.Discuss about mechanics of various machines.
CO 3.Apply fundamental principles of statics and dynamics to machinery.
CO 4.Analyze various types of motions and mechanisms of machinery.

CO 5. **Compare** various components suitable for different applications.e.g. different types of governor, clutch, brakes, flywheel etc.

CO 6. **Create** the mechanism or components to justify the demands of work.

Text &Reference Books:

1. Theory of Machines by Rattan, SS; TMH full detail of publicaiton
2. Theory of Machine by Norton, RL; TMH
3. Theory of Machine byBallaney, PL;Kanna Pub.
4. Mechanism and Machine Theory by Ambekar, AG; PHI.
5. Theory of Mechanism and Machines by Sharma, CS and Purohit K; PHI.
6. Theory of Machines by Bevan, Thomos; Pearson/ CBS PUB Delhi.
7. Mechanism and Machine Theory byRao, JS and Dukkipati; NewAge Delhi.
8. Theory of Machines byLal,Jagdish; Metropolitan Book Co; Delhi –
9. Theory of Mechanisms & Machines byGhosh,A.,Mallik,AK; Affiliated East West Press,Delhi.

NPTEL Link for Theory of Machines-I

http://nptel.ac.in/courses/112104121/1 and http://nptel.ac.in/courses/112104114/

List of experiments (expandable)

1. Study of Kinematics links pairs and chains.
2. To find degree of freedom of a given mechanism.
3. To study all inversions of four-bar mechanisms using models.
4. Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism.
5. Study of inertia forces in reciprocating parts and analysis of flywheel.
6. Study of various types of governors.
7. Study of various types of clutch.
8. Study of various types of brakes.
9. Study of various types of dynamometer.
10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

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

CO1. **Design** and **analyze** mechanism required for the specified type of motion.

CO2. **Draw** inversions and determine velocity and acceleration of different mechanisms.

CO3. **Construct** different types of cam profile for a given data.

CO4. **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive.

CO5. **Compare** the various components related to machines and mechanism.

CO6. **Determine** the degrees-of-freedom (mobility) of a mechanism.

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Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	120314/190314	2	1	2	Max.Marks-50 Min.Marks-16 Duration-3hrs.

Course Objectives: To make the students understand:

1. Fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
2. And give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. And develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

Course Pre-Requisite:
Basic Mechanical Engineering.

Syllabus

Unit-I Properties of fluid: Pressure, density, specific weight, viscosity, dynamic and kinematic viscosity Newton's law of viscosity and its applications.
Fluid Static: Pressure variation with depth, pressure measurement, pressure on immersed surface centre pressure, Buoyancy, flotation, stability of floating bodies.
Unit-II Fluid Kinetics: One dimensional flow approximation, control volumes concept, continuity equation in 3-D, its differential and integral form, velocity and acceleration of fluid particle, stream line, path line. Rotation, vorticity and circulation. Stream function and velocity potential function. Flow net, Free and forced vortex flow.
Unit-III Fluid Dynamics: Momentum theorem, Impulse momentum equation and its application, Euler's equation in 3-D, Bernoulli's equation for incompressible fluid flow, engineering applications of energy equation, Pitot -Tube, Venturi meter, Orifice meter.
Unit-IV Flow through Pipes: Critical Reynolds's number, velocity distribution in pipes, friction factor. Moody's chart, Laminar flow through pipe, Hagen-Poiseulli's equation, Turbulent flow through pipe, Hydraulic gradient line and total energy line. Minor head losses in pipes, Pipe Networking and Transmission of power through pipes.
Unit-V Water Turbine and Pump: Impulse and Reaction principles, Pelton, Francis and Kaplan turbines, velocity diagrams, Work done by turbines, Draft Tube theory. Application of dimensional analysis, similarity to turbines and pumps, Classification, advantage over reciprocation type, definition of manometric head gross head, static head, vector diagram and work done. Performance and Characteristics of turbines and pumps.

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

CO1: **Define** the fundamental properties of fluids.
CO2: **Relate** the concepts of mechanics with various laws of fluid mechanics.
CO3: **Identify** the laws of fluid mechanics applicable for the body in various fluids under different conditions.
CO4: **Analyse** various forces and their effects, related to fluids mechanics.

CO5: **Measure** and compare losses in different fluid flow conditions.
CO6: **Compare** different turbo machines depending on their behaviour and their merits and demerits

Text &Reference Books:

1. Fluid Mechanics by Streeter &Wylis; McGraw-Hills Pub.
2. Fluid Mechanics by Modi& Seth; Standard publishing house.
3. Fluid Mechanics by D.S. Kumar ;Katson publisher.
4. Fluid Mechanics by R.K. Bansal; Laxmi Publishing House.
5. Fluid Mechanics byYunus A Cengel& John M. Cimbala; Tata McGraw Hill Edition.

NPTEL Link for Fluid Mechanics and Hydraulic Machines

http://nptel.ac.in/courses/112105171/1

List of Experiments:

1. To find out coefficient of discharge of a given Venturimeter.
2. To determine the hydraulic coefficient C_v , C_c , and C_d of an Orifice
3. To study the flow over a Rectangular notch to find the coefficient of discharge for it.
4. To determine the coefficient of friction for pipes of different sizes.
5. Experimental determination of Metacentric height of a ship model
6. Study of Redwood viscometer.
7. To study of different types of flow (Reynold's experiment).
8. To verify Bernoulli's Equation Experimentally.
9. To study the performance characteristics of a centrifugal pump and to determine the characteristic with maximum efficiency.
10. To conduct load test on Pelton Wheel Turbine and to study the characteristics of Pelton wheel turbine.
11. To conduct load test on Francis turbine and to study the characteristics of Francis turbine.
12. To study the characteristics of a Kaplan turbine.
13. To study the performance characteristics of a reciprocating pump and to determine the characteristic with maximum efficiency

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

CO1: **Conduct** experiment with flow measurement devices like Venturi meter and orifice meter.
CO2: **Estimate** the friction and measure the frictional losses in fluid flow.
CO3: **Predict** the coefficient of discharge for flow through pipes.
CO4: **Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.
CO5: **Calculate** the Critical Reynolds's Number through Pipe Set Apparatus.
CO6: **Apply** thermodynamic concepts to analyze Fluid machines.

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Software Lab

Category	Title	Code	Credit-1			Practical End Sem
Departmental Lab Core-DLC	Software Lab	120315/ 190315 120305	L	T	P	Max.Marks-60 Min.Marks-19 .
			-	-	2	

Course Pre-Requisites:
Engineering Graphics

Course Objectives: To make the students:
1. Develop an ability to make familiar with 2D, 3D modelling and simulation software
2. Develop an ability to create and modify complex 2D and 3D entities using CATIA software
3. Develop creative skills in developing new ideas.

SYLLABUS:

Auto CAD: Auto CAD interface, work space setting, Basic commands, viewports and printing.
Snaps: snap to grid, show to grid. Orthographic polar snap, object snap, dynamic UCS.
2D and 3D commands: Trim, extend, Offset, move, mirror, scale, rotate, extrude, union, subtract etc. commands. Units: properties, measure and dimension.

CATIA concepts: Display-Tree appearance, Three button move, view tool bar, Normal standard and shading view**,** 2D toolbar, sketch tools, constraint, profile, operation.
Toolbar: Sketch based features toolbar, commands-Pad, Pocket, shaft, groove, holerib etc. Dress up feature, Transformation features, Boolean operation.

Simulation: Assembly and simulation in CATIA, Linear and rotational motion, Nut-bolt mechanism simulation

Course Outcomes: After successful completion of this course students will be able to:
CO1 Describe AutoCAD and CATIA toolbars
CO2 Summarize 2D and 3D commands
CO3 Solve real time problems using AutoCAD and CATIA software
CO4 Analyse various mechanical engineering problems.
CO5 Evaluate technical drawings of machine assemblies as a design engineer
CO6 Generate 2D and 3D solid models with new features in machine elements

Text Books and Reference books:

1. Franke& Roger: Modelling and simulation for chemical engineering, Willey Interscience
2. Luyben-Process modelling simulation and control for chemical engineers, IInd, McGraw Hill,1989
3. Fundamentals of Engineering drawing Interactive graphics by Luzzader WJ, Duff JM;PHI
4. A general guide to computer aided design and drafting-CAD by Duggal, Vijay, cadd primer; CAD malimax publications.