

GANPAT UNIVERSITY
GANPAT UNIVERSITY INSTITUTE OF TECHNOLOGY
 [Six years dual degree integrated Diploma & Degree Engineering Programme]
4th Semester (Mechanical Engineering)
(1ME401) THEORY OF MACHINES

COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Draw inversions and determine velocity and acceleration of different mechanisms.
- ii. Construct different types of cam profile and Turning moment diagram.
- iii. Solve problems on friction and power transmission
- iv. Calculate balancing mass and its position and identify different types of vibration, their causes and remedies.

Unit No.	Topics
1	Introduction: Introduction, need, scope and importance in design and analysis. Kinematics, kinetics and dynamics-concept and examples. Basic terminology related to machines and mechanisms. Development of different mechanisms and its inversions like four bar chain mechanism, slider crank mechanism, double slider crank mechanism, etc.
2	Velocity and acceleration diagram: Basic concept used in solving velocity and acceleration problems. Approach to solve velocity and acceleration related to mechanisms using Relative velocity method for single slider crank mechanism and Four bar chain mechanism. Klein's construction for single slider cranks mechanism.
3	Cam and cam profile: Introduction, functions and types of cams and cam followers. Types of motions and displacement for different types of cam and cam followers. Construct different types of cam profiles for radial/offset cam, knife edge and roller follower.
4	Friction: Concept and laws of friction. Appreciate the role of friction in thrust bearing, pivot bearing and collars considering - Uniform pressure and Uniform wear condition. Functions of Clutch and types of clutch with sketches and working. Functions and types of brakes with sketches and working. Dynamometers- types and operational working principles.
5	Power transmission: Introduction, need and modes of power transmission. Types of power transmission. Belt drive-types, terminology. Belt speed-co-efficient of friction, velocity ratios and slip. Power transmitted by flat belt - tensions, centrifugal tensions, maximum tension, condition for transmitting maximum power and initial tension.(with derivations), numerical examples. Merits and demerits of power transmission drives. Gear trains-types, numerical examples and applications.
6	Flywheel and governor: Turning moment diagram- Concept, its use for different machines, Fluctuations of energy. Co-efficient of fluctuation of speed and energy. Method to construct turning moment diagram, numerical examples. Flywheel-functions and types. Moment of inertia and mass calculation of flywheel-numerical examples. Governors: terminology, types & functions.
7	Balancing and vibrations: Concepts and types of balancing. Effects of unbalanced masses. Balancing of revolving masses in same plane- Analytical and graphical methods to find balancing mass with numeric examples. Vibration-Terminology, effects, causes, remedies.

SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (outcomes in psychomotor and affective domain) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

1. Prepare one sheet on velocity and acceleration diagram for given mechanisms by relative velocity method. This should include minimum two problems of four bar mechanism & two problems of single slider mechanism.
2. Prepare one sheet on velocity and acceleration diagram for single slider mechanisms by Klein's construction method. Teacher will assign problems from sheet drawn with relative velocity method
3. Prepare one sheet on construction of cam profile for given data (without offset). This should include one problem of knife edge follower and another of roller follower.
4. Prepare one sheet on construction of cam profile for given data (with offset). This should include one problem of knife edge follower and another of roller follower.
5. Prepare one sheet on balancing using graphical and analytical method for a given data. Include minimum two problems.
6. Tutorials:
 - a. Calculate power loss due to friction in bearings from given experimental data.
 - b. Solve two problems of power transmission systems (one of belt drive and another of gear train) from given experimental data.
 - c. Calculate and prepare turning moment diagram from given experimental data.
 - d. Calculate mass of flywheel from given experimental data

SUGGESTED LEARNING RESOURCES: REFERENCE BOOKS:-

1. Theory of Machines by Jagdishlal- Metropolitan Book New Delhi.
2. Theory of Machines by S.S. Ratan-Tata McGraw Hill, New Delhi.
3. Theory of Machines by Shah & Jadvani-Dhanpatray and sons, New Delhi.
4. Theory of Machines by R.S. Khurmi-S. Chand, New Delhi.
5. Theory of Machines by P.L. Bellaney-Khanna publication, New Delhi.

GANPAT UNIVERSITY
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 [Six years dual degree integrated Diploma & Degree Engineering Programme]
4th Semester (Mechanical Engineering)
(IME402) FLUID MECHANICS AND HYDRAULIC MACHINES

Learning outcomes:

After completion of this course, student will able to

- * Understand fluid properties, fluid flow patterns & flow through pipes in real flow situation.
- * Select and use flow measuring devices & pressure measuring devices based on given situation.
- * Explain and Apply Fluid equations in simple Industrial situations.
- * Select and use an appropriate pump & turbine with reference to given application.
- * Select and use proper hydro-pneumatic devices/equipment.

Unit No.	Topics
1	<u>FLUID AND FLUID PROPERTIES:</u> Concept and classification, Properties of fluid. Newton's law viscosity. Simple numerical examples.
2	<u>FLUID STATICS:</u> Pressure and pressure measurement of fluid, laws of fluid statics, Selection of pressure measuring devices.
3	<u>FLUID KINEMATICS AND FLUID DYNAMICS:</u> <u>Fluid kinematics-</u> Concept of control volume. Continuity and energy equation. Momentum equations (without derivation). Types of fluid flow.. Flow patterns for ideal, laminar, turbulent and compressible fluid flow. <u>Fluid dynamics-</u> Fluid energy-types. Euler's equation (Concept and definition without derivation) Bernoulli's equation (Concept, definition, limitations, assumptions, derivation and applications. Simple numerical examples on all of above.
4	<u>FLOW MEASUREMENT:</u> Parameters and units of measurements related to following devices. Devices- classifications, principle, working, applications without derivation. (Pitot tube, Venturi meter, Flow nozzle, Rota meter, Orifice, Notch). Selection criteria for flow measuring device. Simple numerical examples on all of above.
5	<u>FLOW THROUGH PIPES:</u> Introduction to pipe and pipe flow. Reynolds's experiment, Darcy's equation, Moody's chart. Water hammer effect. Selection criteria for pipes and pipe sizes. Simple numerical examples.
6	<u>HYDRAULIC PUMPS AND PRIME MOVERS:</u> <u>Pumps-</u> Concept and classification of pumps. Construction, working and applications of Centrifugal pump, Reciprocating pump, Submersible pump, Rotary positive displacement type pumps like Gear pump and Van pump. Performance of centrifugal pump and reciprocating pump with simple numerical example. Need for priming of centrifugal pump. Selection of pumps. <u>Hydraulic prime movers (Turbine)-</u> Classification, construction, working principle and applications of Pelton wheel, Francis turbine and Kaplan turbine. Selection criteria of prime movers

7	<p><u>HYDRAULIC AND PNEUMATIC DEVICES:</u> Types, sketch, working, specifications, symbols and applications of hydraulic and pneumatic elements like Cylinder, Valve and Manifolds. Explain working of each Hydraulic device with labelled schematic diagram, their specifications and Applications- i. Hydraulic press. ii. Hydraulic accumulator. iii. Hydraulic lift iv. Hydraulic ram. v. Hydraulic crane. vi. Hydraulic coupling. vii. Hydraulic intensifier.</p>
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SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

Sr. No.	Experiment /Practical Exercises
1	Measure fluid flow by Venturimeter
2	Measure fluid flow by Orifice meter
3	Measure fluid flow by V Notch
4	Measure fluid flow by Nozzles
5	Verify Bernoulli's theorem.
6	Determine friction head losses through pipes.
7	Perform testing of Centrifugal pump as per BIS.
8	Perform testing of Reciprocating pump as per BIS.
9	Perform testing of Pelton wheel.
10	Find faults and remedies for Centrifugal pump. Prepare trouble shooting chart of Centrifugal pump.
11	Study and write a report on working of different types of water turbines.
12	Demonstration of working of double acting cylinder.
13	Study and write a report on any one of hydraulic devices.
14	Industrial visit and report

Practical, assignments and tutorials are based on above syllabus.

Reference Books:

Sr. No.	Title of Books	Auth	Publication
1	Fundamentals of Fluid Mechanics (in S.I. Units)	Dr. D.S. Kumar	Katson Pub. House
2	Fluid Mechanics & Hydraulic Machines (In S.I. Units)	R.S. Khurmi	S.Chand & Co. Ltd.
3	Hydraulic Machines & Fluidics	Dr. Jagdish Lal	Metropolitan
4	Hydraulics & Hydraulic Machines	Prof. R.C. Patel & A.D. Pandya	Acharya Book Depot,
5	Fluid mechanics and Hydraulic Machines	S.C. Gupta	PEARSON Education
6	Industrial Pneumatic Control	Z.J. Lansky	Marcel Dekker, Inc

GANPAT UNIVERSITY
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 [Six years dual degree integrated Diploma & Degree Engineering Programme]
4th Semester (Mechanical Engineering)
(IME403) MANUFACTURING PROCESSES-II

Learning outcomes:

After completion of this course, student will able to

- Explain mechanics of cutting.
- Classify and explain working of basic machine tools with kinematics.
- Observe and conclude the effect of varying tool materials, cutting parameters and work piece materials.
- Interpret and select tool and tool holder designation system.
- Identify the machine tool and select cutting parameters for given job.
- Make the job as per given manufacturing drawing.

Unit No.	Topics
1	<p><u>INTRODUCTION AND FUNDAMENTALS OF METAL REMOVAL PROCESSES.</u></p> <p>Need, Scope & importance of Manufacturing processes in industries. Need of attitude, Knowledge & skill required for shop floor supervisor in manufacturing processes industries, Differentiate between forming and generating processes. Movements of tool, job, slides and chuck during cutting operation, concepts of cutting speed, feed and depth of cut. Mechanism of cutting action, Chip formation, types of chips, Orthogonal and oblique cutting. Forces acting on tool and chip, methods to compute cutting force using dynamometer. Functions and types of chip Breakers. Cutting fluid- Basic need, types, properties and its applications. Influence of cutting variables on surface finish, tool life, economy, and mass production. Metal removal rate (MRR).</p>
2	<p><u>BASIC MACHINE TOOLS:</u></p> <p>Define and classify basic machine tools. Types, constructional features, transmissions, working principle, (using block diagram also), detailed specification, various mechanisms used, materials for important elements, and selection criteria of following basic machine tools. * Lathe Machine * Drilling Machine * Milling Machine * Shaping Machine * Slotting Machine * Planing Machine * Boring Machine. Safety precautions.</p>
3	<p><u>CAPSTAN AND TURRET LATHE:</u></p> <p>Constructional features and working principle, functions and applications. Difference between Capstan and Turret lathe. Preparation of tool layout. Merits and Demerits of Capstan and Turret lathe in comparison with basic Centre lathe. Safety precautions.</p>

4	<p><u>CUTTING TOOLS:</u> Various cutting tools materials, their compositions and properties. Alloying elements in tool materials and their effects. Carbide inserts, its designations, its need, applications and benefits (As per ISO). General cutting parameters for various cutting tools materials and work piece materials. Various Cutting Tools (With tool geometry, nomenclature, tool materials, sketch/drawing of each, ISO/BIS standards,) used for various operations on Lathe Machine, Milling Machine, Drilling Machine, Shaping Machine, Slotting Machine, Boring Machine ,Planning Machine and Capstan/Turret machines. Also specify cutting parameters for each cutting tool for commonly used work piece materials for commonly used operations. Tool life, tool wear and machinability, factors affecting them. Relation between cutting speed and tool life.</p>
5	<p><u>AUTOMATES:</u> Single spindle Automats: Need, Constructional features, Working principle and applications, Collets-constructional features and applications. Introduction to multi spindle automates and special purpose automates.</p>

Practical, assignments and tutorials are based on above syllabus.

Reference Books:

Sr. No.	Title of Books	Author	Publication
1	Workshop Technology I & II	Raghuwanshi	Dhanpat Rai and Co(P) Ltd
2	Manufacturing Processes	M. L. Begman	John Wiley and Son
3	Production Technology	R. K. Jain and S. C. Gupta	Khanna Publishers
4	Elements of Workshop Technology Volume No. II Machine Tools	Hajra Choudhary, Bose S. K., Roy Nirjhar	Media promoters and publishers pvt. Limited

GANPAT UNIVERSITY

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[Six years dual degree integrated Diploma & Degree Engineering Programme]

4th Semester (Mechanical Engineering)

(1ME404) Metrology & Instrumentation

COURSE OUTCOMES

Mechanical engineers today need to produce more precise parts to meet complex requirement of machines. This requires precise measurement of produce parts. This subject provide knowledge on various precise measurement instruments that industry uses daily basis to maintain quality in products and develop confidence on workshop floor for precise measurement.

COURSE DETAILS:

Unit No.	Topics
1	<p>Linear and angular measurement Inspection, quality and quality control- definitions and differences. Define accuracy, precision and error. Principle of vernier scale and least count. Surface plates- types, important features, standards/ important sizes, applications and precautions in use. Types, constructional sketch, major parts and their functions, least count, measuring methods and measurement illustration of: Vernier caliper, Micrometer, Telescopic gauge, Height gauge, Depth gauge. Slip gauge- types, applications, and wringing method. Sketch, major parts and their functions, least count, measuring methods and measurement illustration of: Bevel Protector, Sine bar, Angle gauges, Angle Dekkar, Spirit level, Clinometers, Autocollimator, Calibration- concept and need.</p>
2	<p>Measurement of geometrical tolerances Dial indicators/gauge- types, constructional sketch and applications. Definition, symbol and measuring methods of: Straightness, Flatness, Squareness, Parallelism, Perpendicularity, Roundness, Concentricity.</p>
3	<p>Measurement of surface roughness Terminology used in connection with surface finish. Comparison methods to inspect surface finish- concept and applications. Direct instrument measurement methods- types and concepts. Construction, working and applications of Talysurf surface roughness tester and Tomlinson tester. Centre line average and Root Mean Square systems of surface texture evaluation- terminology used, concept, equations and numerical examples. Indication of various surface roughness characteristics with surface roughness symbols- interpretation.</p>
4	<p>Gear and thread measurement Types of gears. Forms of gear teeth- types and concept. Gear tooth Terminology. Sketch, major parts and their functions, least count, measuring methods and measurement illustration of gear tooth vernier. Derivation and numerical example to measure gear tooth thickness using: Gear tooth vernier. Constant chord method, Base tangent method. Gear tooth profile measurement. Threads- classification, elements, specifications and forms. Measurement of major and minor diameters. Three and two wire method of measuring effective diameter of external thread- concept, terminology used, best wire size, derivation of equation and numerical example. Thread micrometer- sketch, method to use and determination of dimension. Pitch measurement methods.</p>
5	<p>Limit gauges, Transducers and Sensors Limit gauges- classification, sketch and applications. Comparators- concept, types and applications.</p>

	Instrumentation-introduction, performance characteristics. Static characteristics of instruments. Transducers-concept, classifications, physical quantities which can be measured, advantages and disadvantages. Electrical transducers-types, working principles and applications. Linear Variable Differential Transformer (LVDT) type pressure gauge. Resistance type, Capacitance type, Inductance type (LVDT), Piezo-electric crystal Sensors- classification and applications.
6	Temperature, pressure and flow measurement Introduction. Classification, working principle, construction, working, advantages, limitations and applications of temperature measuring devices: Types and applications of manometers (only list and applications). Working principle, construction, working, advantages, limitations and applications of pressure measuring devices: Concept of transducer based pressure measuring devices- Classification of flow measuring devices. Working principle, construction, working, advantages, limitations and applications of volumetric flow measuring devices: Working principle, construction, working, advantages, limitations and applications of velocity measuring devices.

SUGGESTED LIST OF EXERCISES/PRACTICALS.

Sr. No.	Unit No.	Practical Exercises	Hrs.
1	I	Linear And Angular Measurement: Sketch each component. Sketch and label main parts of instruments to be used. Calculate least count of the instrument/s to be used. Measure and record applicable dimensions of each component using: 1- Vernier calliper. 2- Inside micrometer. 3- Outside micrometer. 4- Telescopic gauge. 5- Height gauge. 6- Depth gauge. 7- Bevel protector. 8- Clinometers.	14
2	I	Sine Bar: Measure angle between two planes with the help of sine bar and slip gauges.	02
3	II	Straightness: a. Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking straightness.	02
4	II	Flatness: Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking flatness.	02
5	II	Squareness, Perpendicularity And Parallelity: Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking following. Squareness. Perpendicularity and Parallelity.	02
6	II	Roundness, Cylindricity, Concentricity, Run Out And Ovality: Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking roundness, cylindricity, concentricity, run out and ovality.	02
7	III	Surface Roughness: a. Tabulate machining processes, and roughness values (R_a , mm), roughness grade number and roughness symbol. b. Demonstrate various surfaces having different roughness values.	04
8	IV	Gear Measurement: a. Sketch gear tooth nomenclature. b. Sketch gear tooth vernier and label each part. c. Calculate chordal thickness and height of given gear.	02

9	IV	Thread Measurement: For given external threaded part: Draw nomenclature for ISO screw threads (Internal and external both).	04
10	V	Limit Gauges: a. Demonstrate use of various limit gauges. b. Select appropriate limit gauge for given dimension/part and check the dimension with gauge.	02
11	V	Demonstration of Transducers and Sensors: Demonstrate electrical (LVDT type, resistance type, capacitance type, inductance type and piezo-electric.) transducers and various sensors.	04

SUGGESTED LEARNING RESOURCES

Sr no.	Title of Books	Author	Publication
1	Mechanical measurements and instrumentation	R.K. Rajput	KATSON
2	Text book on Metrology	Mahajan	Dhanpat Rai
3	Engineering Metrology	R.K. Jain	Khanna Publications.
4	Mechanical Measurement and Control	D.S. Kumar	Metropolitan Book Pub.

GANPAT UNIVERSITY
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 [Six years dual degree integrated Diploma & Degree Engineering Programme]
4th Semester (Mechanical Engineering)
(1ME405) AutoCAD

Learning outcomes:

After completion of this course, student will able to

- Use basic and advanced commands of AutoCAD.
- Prepare and modify orthographic and isometric view.
- Prepare 3D solid models.

Unit No.	Topics
1	<u>Introduction to AutoCAD, workspace and drawing fundamentals :</u> Introduction to AutoCAD and its interface, How to start, save and open existing drawing in AutoCAD, Pan & zoom command practice with keyboard shortcuts. Customize workspace setting, Different drawing methods in AutoCAD using line command (Absolute co-ordinate, Relative Rectangle method, and Relative polar method & direct distance entry method), Importance of object snapping and tracking and polar settings.
2	<u>Drawing & Modifying commands :</u> Basic drawing commands i.e. line, circle, rectangle, ellipse, arc, polyline, Spline, x-ray, construction line, hatch Modifying commands-move, copy, rotate, mirror, fillet, chamfer, trim, extend, offset, explode, scale, stretch, erase, array, Advance modifying commands- break, polyline edit.
3	<u>Orthographic drawing:</u> Concept of orthographic views, Drawing ortho views in AutoCAD using advanced Draw & Modify commands like x-ray and construction line.
4	<u>Isometric drawing:</u> Use of Iso-Grid, Iso-Circle Changing cursor shape for TV, FV. Draw isometric views from given orthographic views. Dimensioning of an Isometric view
5	<u>Annotation:</u> Creating text (single line, multiline), Dimensioning the drawing, Creating table & linking from excel
6	<u>Layer management, blocks & attributes:</u> Concept and use of layer, Create, modify and deleting a layer, Concept of Block, Creating block with attributes
7	<u>Plotting:</u> Plotting drawing from model space and layout, Create page setup, Creating viewport, Plotting drawing with, annotative style, Need of title block with template.
8	<u>Palettes & Miscellaneous commands:</u> Importance of property palette & design center, Learn various miscellaneous commands like Inquiry, purge, multiline, area, Mass prop.
9	<u>Introduction to 3D Solid Modeling:</u> Basics of 3D solid modeling, Switching from 2d to 3d workspace, Solid primitive commands like box, cylinder, sphere, wedge, pyramid, torus, Creating solid from sketch using extrude, revolve, loft and sweep command. Modifying solid model using various solid editing commands.

10	<u>Rendering 3D solid model :</u> Concept of rendering, material assigning to solid model & rendering it.
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Practical, assignments and tutorials are based on above syllabus.

Reference Books:

Sr.	Title of Books	Author	Publication
	AutoCAD2012: A problem solving approach	Prof. Sham Tickoo	CADCIM technologies
2	AutoCAD2011 Tutorials	Randy H. Shih	SDC Publication
3	AutoCAD no experience required	David Frey	AutoDesk
4	AutoCAD2013 Tutor for EngineeringGraphics	Kelvin Chang	Cengage