



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101401

Course / Subject Name: Mechanical Measurement and Metrology

w. e. f. Academic Year:	2024-25
Semester:	4th/ 2ND Year
Category of the Course:	PC

Prerequisite:	Zeal to learn the subject
Rationale:	Measurement and Metrology deals with the application of science in Mechanical Engineering. It provides a means of assessing the suitability of measuring instruments, their calibration, and the quality control of manufactured products.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150



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Program Name: Engineering

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Course / Subject Code : BE101401

Course / Subject Name: Mechanical Measurement and Metrology

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<p>Introduction to Metrology, Linear and Angular Measurement: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars, standardization.</p> <p>Slip gauges: Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.</p>	12	14
2.	<p>System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.</p> <p>Comparators: Functional requirements, classification, mechanical-Johnson Mikrokator, sigma comparators, dial indicator, electrical-principles, , LVDT, Pneumatic- back pressure gauges, Solex comparators and optical comparators- Zeiss ultra-optimeter.</p>	12	22
3.	<p>Measurement of screw thread and gear: Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges, Tool maker's microscope. Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.</p>	10	20



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7.	Measurement systems and basic concepts of measurement methods: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system responsetime delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs. Advances in metrology: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines constructional features, applications.	12	10
8.	Force, Torque, Pressure, Strain and temperature Measurement: Direct methods and indirect method, force measuring instruments Torque measuring instruments, Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, pitot tube, pressure gauges, pressure transducers, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors. Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.	14	6
Total		60	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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Program Name: Engineering

Level: UG

Course / Subject Code : BE101401

Course / Subject Name: Mechanical Measurement and Metrology

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	summarize various methods and terms used in mechanical measurements and metrology.	Understand
2	measure mechanical quantities like Force, Temperature, Pressure, Velocity, Acceleration, Strain and Torque.	Apply
3	apply concepts of metrology for gears, threads and surface finish.	Apply
4	utilize various precision machines working based on Laser technology and coordinate measuring methods.	Understand

Program Outcomes (POs)

PO No.	PO Description (Abbreviated)
O1	Engineering Knowledge
PO2	Problem Analysis
PO3	Design/Development of Solutions
PO4	Conduct Investigations of Complex Problems
PO5	Modern Tool Usage
PO6	Engineer and Society
PO7	Environment and Sustainability
PO8	Ethics
PO9	Individual and Team Work
PO10	Communication
PO11	Project Management and Finance
PO12	Life-long Learning



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CO-PO Mapping Table:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6-PO12 (if applicable)
CO1	3	2	-	2	2	-
CO2	3	3	2	3	3	-
CO3	3	2	3	2	3	-
CO4	2	2	2	2	3	-

Program Specific Outcomes (PSOs):

PSO No.	PSO Description
PSO 1	Apply mechanical engineering principles to design and develop mechanical systems.
PSO 2	Use modern engineering tools and manufacturing technologies to solve real-world problems
PSO 3	Apply measurement techniques and quality standards to enhance manufacturing and product development.

CO-PSO Mapping Table

CO \ PSO	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	2	3	3
CO3	3	2	3
CO4	2	3	3

References/Suggested Learning Resources:

(a) Books:

1. Engineering Metrology and Measurements, Bentley, Pearson Education
2. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill
3. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON)
4. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.
5. Industrial Instrumentation & Control by S K Singh, McGrawHill
6. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press



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(b) Open source software and website:

1. <http://nptel.ac.in/courses/112106138>

Suggested Course Practical List:

1. Basic understanding of measurements and metrology: concepts, application, advantage and future aspects.
2. Performance on linear and angular measurements and check different characteristics of measurements.
3. Performance on temperature measurements and check different characteristics of measurements and also do calibration.
4. Performance on pressure measurements and check different characteristics of measurements and also do calibration.
5. Performance on stress, strain and force measurements and check different characteristics of measurements and also do calibration.
6. Performance on Speed/Velocity, acceleration measurements.
7. Performance on surface measurements.
8. Performance on measurements of gears and screw threads.

List of Laboratory/Learning Resources Required:

1. Temperature and pressure Measurements Equipments/Devices/Sensors.
2. Stress/Strain/Force Measurements Equipments/Devices/Sensors.
3. Surface Measurements Equipments/Devices/Sensors
4. Linear/Angular Measurements Equipments/Devices/Sensors
5. Resistive Potentiometer, Tachometers, Piezoelectric Accelerometer
6. Gears/Screw Threads Measurements Equipments/Devices/Sensors
7. Miscellaneous measurements equipments

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Course / Subject Name: Mechanical Measurement and Metrology



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101402

Course / Subject Name : Fluid Mechanics and Hydraulics Machines

w. e. f. Academic Year:	2024-25
Semester:	4th/ 2ND Year
Category of the Course:	PC

Prerequisite:	Zeal to learn the subject
Rationale:	This course imparts fundamental knowledge regarding fluid, types, properties and basic governing equations in static and moving conditions. The course also provides the basic technical knowledge related to various fluid machines used in the practice.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101402

Course / Subject Name: Fluid Mechanics and Hydraulics Machines

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Fluids and Their Properties: Fluid classifications, hypothesis of continuum, shear stress in a moving fluid, molecular structure of material, density, viscosity, surface tension, capillary effect, vapor pressure, compressibility and the bulk modulus, pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, hydrostatic paradox	8	6
2	Static Forces on Surface and Buoyancy: Fluid static, action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure and surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body and floating bodies, determination of the metacentric height, determination of the position of the metacenter relative to the center of buoyancy	8	12
3	Motion of Fluid Particles and Streams: Fluid flow, different types of flow, frames of reference, analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system, rotational and irrotational flow, circulation and vorticity, streamlines and the stream functions, velocity potential and potential flow, relation between stream function and velocity potential, stream function and velocity potential for uniform flow, vortex flow	6	10
4	The Energy Equation and its Application: Momentum and fluid flow, Momentum equation for 2-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, mechanical energy of a flowing fluid, Bernoulli's theorem, kinetic energy correction factor, changes of pressure in tapering pipe, principle of venturimeter, orifice, rotameter, theory of notches and weirs	6	10
5	Dimensional Analysis and Similarities: Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π -theorem, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, kinematic similarity, model testing, model laws, undistorted and distorted models	4	8



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Level: UG

Course / Subject Code : BE101402

Course / Subject Name : Fluid Mechanics and Hydraulics Machines

6	Viscous and Turbulent Flow: Reynolds' experiment, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, turbulent flow expression for coefficient of friction -Darcy Weishbach equation, moody diagram, resistance of smooth and rough pipes, shear stress and velocity distribution in turbulent flow through pipes	4	8
7	Flow through pipes: Major and minor energy losses, hydraulic gradient and total energy lines, pipes in series and parallel, equivalent pipes, water hammer in pipes	6	10
8	Impact of Jet and Hydraulic Turbines: Force exerted on stationary flat and curved plates held normal, force exerted on moving plate held normal and on a plate when vane is moving in direction of jet, jet striking on curved vane tangentially at one tip and leaving at other end, classification of hydraulic turbines, impulse and reaction turbines, construction, working and analysis of Pelton, Francis and Kaplan turbines, draft tube, governing of the hydraulic turbines, cavitations, performance characteristics	4	8
9	Centrifugal Pumps: Pump classification and selection criterion, velocity vector diagrams, pump losses and efficiencies, net positive suction head, pressure rise in impeller, characteristic curves, priming	10	18
10	Hydraulic Machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter and air lift pump	6	10
Total		60	100

Note: Topic No. 4 and 7 of the above syllabus must be covered in Practical Hours.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	explain various fluid properties and behavior of fluid in static and dynamic mode.	Understand
2	make use of dimensional analysis and interpret types of fluid flow.	Apply

3	analyze theory of impact of jet and apply the same for hydraulic turbine.	Apply
4	evaluate performance of centrifugal pumps	Understand

Program Outcomes (POs)

PO No.	PO Description (Abbreviated)
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO12	Life-long learning

CO-PO Mapping Table:

CO \ PO	PO1	PO2	PO3	PO4	PO5
O1	3	2			
CO2	3	3		2	
CO3	2	3			
CO4	3	3	2	2	1

Program Specific Outcomes (PSOs):

PSO No.	PSO Statement
PSO1	Apply fundamental knowledge of mechanical engineering for solving real-world problems.
PSO2	Select and apply modern tools for analysis and design in thermal and fluid systems.

CO-PSO Mapping Table

CO \ PSO	PSO1	PSO2
CO1	3	-
CO2	3	2
CO3	3	2
CO4	2	3

References/Suggested Learning Resources:**(a) Books:**

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw Education
5. Fluid Mechanics by Frank .M. White, McGraw Hill Education
6. Mechanics of Fluids by Shames, McGraw Hill Education

(b) Open Sources:

1. <https://nptel.ac.in>
2. www.vlab.co.in

Suggested Course Practical List:

1. Verification of Bernoulli's theorem
2. To determine metacentric height by metacentric height apparatus.
3. To measure the velocity of flow using orifice meter and venturi meter.
4. To determine the coefficient of discharge through open channel flow over a notch. 5
5. To determine the different types of flow patterns by Reynolds' experiment.
6. To determine the friction factor for the different pipes.
7. To determine the loss coefficients for different pipe fittings.
8. To verify Impulse-momentum principle for impact of jet on stationary vane.
9. Performance test on Pelton turbine.
10. Performance test on Kaplan turbine.
11. Performance test on Francis turbine.
12. Performance test on centrifugal pump



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Program Name: Engineering

Level: UG

Course / Subject Code : BE101402

Course / Subject Name : Fluid Mechanics and Hydraulics Machines

List of Laboratory/Learning Resources Required:

1. Reynolds' apparatus
2. metacentric height apparatus
3. impact of jet apparatus
4. test rigs of Pelton
5. Francis and Kaplan turbine
6. test rigs of centrifugal pump and hydraulic ram
- 7.

Suggested Project List:

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सर्व विद्या अधिपतये

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101403

Course / Subject Name : Fundamentals of Machine Design

w. e. f. Academic Year:	2024-25
Semester:	4 th / 2 ND Year
Category of the Course:	PC

Prerequisite:	Zeal to learn the subject
Rationale:	The course aims to impart basic skills of force and stress analysis for design of machine elements.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101403

Course / Subject Name : Fundamentals of Machine Design

Unit No.	Content	No. of Hours	% of Weightage
1.	Basics of stress and strain: <ul style="list-style-type: none"> 3 -D state of stress (Concept only) Normal/axial stresses: Tensile & compressive Stresses: Shear and complementary shear Strains: Linear, shear, lateral, thermal and volumetric. Hooke's law, Elastic Constants: Modulus of elasticity, Poisson's ratio, Modulus of rigidity and bulk modulus and relations between them with derivation. 	5	10
2.	Moment of inertia of planar cross -sections: <ul style="list-style-type: none"> Derivation of equation of moment of inertia of standard lamina using first principle, Parallel & perpendicular axes theorems, polar moment of inertia, 	5	10
3.	Flexural stresses: <ul style="list-style-type: none"> Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, Angle, channel sections. 	4	10
4.	Torsion: <ul style="list-style-type: none"> Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity. 	4	10
5.	Introduction to Machine Design: <ul style="list-style-type: none"> Design procedure, Selection of preferred sizes, Aesthetic and Ergonomic considerations in Design, Manufacturing considerations in Design, Mechanical Properties of Materials, Effect of Alloying elements and heat treatment on properties of steels, Materials Selection in Machine Design, Standardization. 	6	10
6.	Design Against Static Load: <ul style="list-style-type: none"> Concepts of stresses and Strain, Combinations of Axial, Shear, Torsional and Bending loads; Theories of Failures: Distortion energy (von Mises), Maximum-Shear stress, Maximum Principal stress, Selection and Use of theories of failures; Factor of safety, Contact stresses, Crushing and Bearing stress. Application Problems: Eccentric Loading; Cotter and Knuckle Joints; Design and analysis of levers: Cranked, Bell crank, Foot, Rocker arm. 	4	10



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101403

Course / Subject Name: Fundamentals of Machine Design

7.	Beams and Columns: <ul style="list-style-type: none"> Different types of supports / end conditions, Revision of Stresses in beams: Effect of Section, Orientation, and type of loading; Deflection of beams for different loading conditions. Compressive axial loading of columns and struts, Slenderness ratio, Compressive stress and Buckling of members, Effect of end conditions; Euler's Formula, Applications, validity and limitations; Rankine's Formula, stresses in curved beam. 	4	10
8.	Shafts and Keys: <ul style="list-style-type: none"> Design of solid and hollow circular shaft subjected to torque and combined loading for rigidity and stiffness; Design of Keys and splines. 	5	10
9	Power Screws and Threaded Joints: <ul style="list-style-type: none"> Forms of thread, Single and Multiple threaded screw, Terminology of power screw, Torque requirement of lifting/lowering, Self-locking, Efficiency of threads, coefficient of friction, design of screw and nut. Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Terminology of Screw thread, Bolted Joint: Simple and Eccentric loading, Torque requirement for bolt tightening. 	4	10
10	Design Against Fluctuating Loads: <ul style="list-style-type: none"> Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Design for reversed stresses and cumulative damage, Fluctuating stresses: Soderberg, Gerber, Goodman and Modified Goodman criteria, Combined stresses. 	4	10
Total		45	100

Note: Topic No. 4 and 7 of the above syllabus must be covered in Practical Hours.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	15	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	understand fundamentals of material selection, strength of materials and loading patterns of machine elements.	Understand
2	distinguish basic failure modes of machine elements.	Apply
3	analyse beams and columns for stresses and deflection	Apply
4	design and analyse machine components under static loading.	Understand

Program Outcomes (POs)

PO No.	PO Description (Abbreviated)
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations
PO5	Modern tool usage
PO6	Engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and teamwork
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

CO-PO Mapping Table:

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	-	-	-
CO2	3	3	-	2	2
CO3	3	2	2	2	-
CO4	3	2	-	3	2

Program Specific Outcomes (PSOs):

PSO No.	PSO Description
PSO1	Apply mechanical engineering principles in the areas of thermal, design, and fluid systems.
PSO2	Use modern tools and techniques for analysis and modeling of mechanical systems.

CO-PSO Mapping Table

CO \ PSO	PSO1	PSO2
CO1	3	-
CO2	3	2
CO3	3	2
CO4	2	3

References/Suggested Learning Resources:

(a) Books:

1. Design of Machine Elements, V B Bhandari, 3/e, McGraw Hill.
2. A Textbook of Machine Design, P C Sharma and D K Aggarwal, S K Kataria & sons.
3. Shigley's Mechanical Engineering Design, R G Budnyas, J K Nisbett, McGraw Hill.
4. Fundamentals of Machine Component Design, R C Juvinall, 4/e, Wiley.
5. Machine Design: An Integrated Approach, R L Norton, Pearson
6. Strength of Materials, Part I & II, S Timoshenko, CBS publishers and distributors Pvt. Ltd.
7. Strength of Materials, Bansal R K, Laxmi publication.
8. Strength of Materials, Patnaik S, Hopkins D, Elsevier.
9. Engineering Mechanics, Bansal R K, Laxmi Publication.

(b) Open source software and website:

1. <http://nptel.ac.in>
2. <http://help.autodesk.com/view/fusion360/ENU/>

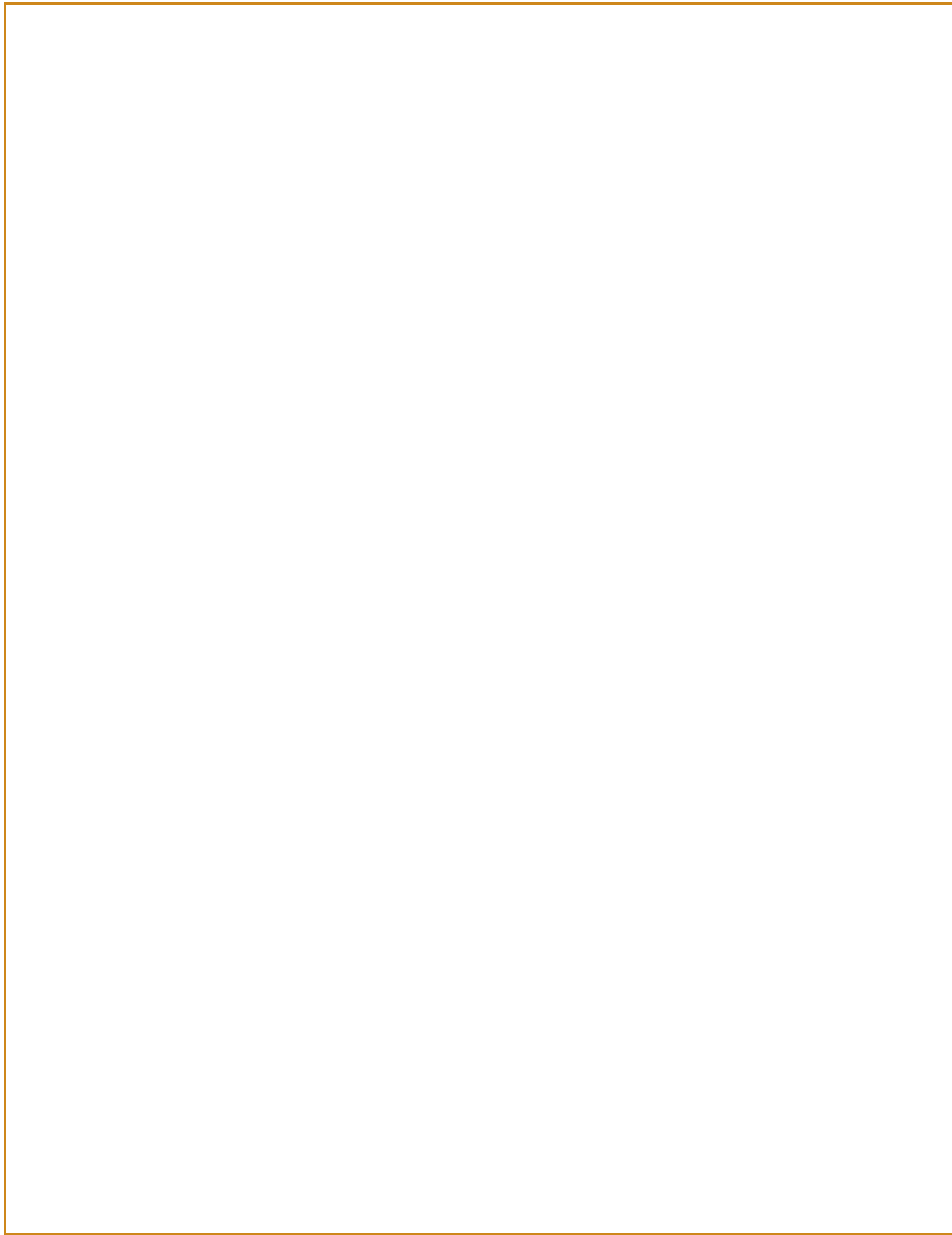
Suggested Course Practical List:

1. Detail and assembly of mechanism/machine.
2. Problems related to fundamentals of design (chapter no. 1 to 4)
3. Design and drawing of Joints and levers.
4. Design and drawing of screw jacks (Bottle neck and Toggle).
5. Design of machine components under fluctuates loading.
6. Case study for design of mechanical components.
7. 2D drawing of machine components using computer software.

List of Laboratory/Learning Resources Required:

Computational facility
CAD Software like Fusion 360

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101404

Course / Subject Name : Manufacturing Process-1

w. e. f. Academic Year:	2024-25
Semester:	4 th / 2 ND Year
Category of the Course:	PC

Prerequisite:	Zeal to learn the subject
Rationale:	Manufacturing processes related to machining are included in this subject. All conventional manufacturing machines are included in this course to understand the basic concepts in machining science.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	5	60	40	20	30	150



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101404

Course / Subject Name : Manufacturing Process-1

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Basic Machine Tools and Metal Cutting Principles: Machine tools classification, working and auxiliary motions in machine tools, Primary cutting motions in machines tools, Cutting tool geometry and tool signature, cutting forces and power requirement in machining	4	20
2	Metal Cutting Lathes: Engine Lathes, construction all arrangement and principal units of engine lathes, type and size range of engine lathes, Operations carried on engine lathe , attachment extending the processing capacities of engine lathes, Types of lathe machines, Capstan and Turret lathes, Taper turning on lathe, Thread cutting on lathe using gear train and chasing dial, Alignment tests of lathes	10	25
3	Drilling Machines: Purpose and field of application of drilling machines, Types of drilling machines, Drilling and allied operation: drilling, boring, reaming, tapping, counter sinking, counter boring, spot facing; deep hole drilling, alignment tests of drilling machine.	6	15
4	Boring Machine: Purpose and filed of application, Horizontal boring machines, Precision boring machines	3	
5	Milling Machines: Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, Indexing, Helical milling operation and its set up, Alignment tests of milling machine.	8	20
6	Planers, Shapers and Slotters: Classification of planers, Shapers and Slotters, Attachments extending the processing capacities of planers, Shapers and Slotters, machine and tooling requirements	5	5



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101404

Course / Subject Name : Manufacturing Process-1

7.	Sawing and Broaching Machines: Metal sawing classification: reciprocating sawing machines, circular sawing machines, band sawing machines, Types of broaching machines, advantage and limitations of broaching.	3	5
8.	Grinding Machines and Abrasives: Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, center less grinders, Types of grinding wheels, wheel characteristics and wheel selection.	6	10
Total		45	100

Note: Topic No. 4 and 7 of the above syllabus must be covered in Practical Hours.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	15	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand the basic concept of machining operations.	Understand
2	Analyze conventional machining processes.	Apply
3	Study, understand and generate the sequence of machining operation to produce the end product.	Apply
4	Judge the limitations and scope of machines to perform variety of operations.	Understand



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code : BE101404

Course / Subject Name : Manufacturing Process-1

Program Outcomes (POs)

PO No.	PO Description (Abbreviated)
PO1	Engineering Knowledge
PO2	Problem Analysis
PO3	Design/Development of Solutions
PO4	Investigation of Complex Problems
PO5	Modern Tool Usage
PO6	Engineer and Society
PO7	Environment and Sustainability
PO8	Ethics
PO9	Individual and Team Work
PO10	Communication
PO11	Project Management and Finance
PO12	Lifelong Learning

CO-PO Mapping Table:

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2			
CO2	3	3	2	2	
CO3	2	2	3	2	2
CO4	2	3	2	2	3

Program Specific Outcomes (PSOs):

PSO No.	PSO Description
PSO1	Apply mechanical engineering principles for designing and analyzing mechanical systems and processes.
PSO2	Utilize modern tools and techniques to solve real-world mechanical engineering problems



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Program Name: Engineering

Level: UG

Course / Subject Code : BE101404

Course / Subject Name : Manufacturing Process-1

CO-PSO Mapping Table

CO \ PSO	PSO1	PSO2
CO1	3	
CO2	3	2
CO3	3	3
CO4	2	3

References/Suggested Learning Resources:

(a) Books:

1. Workshop Technology Vol. I, II & III, WAJ Chapman.
2. Workshop Technology Vol. II, Hajra & Choudhari.
3. Manufacturing Processes, O.P. Khanna.
4. Production Technology, R. K. Jain.
5. Processes and Materials of Manufacture; Lindberg Roy A.; Prentice-Hall India.
6. Principles of Manufacturing Materials and Process, J S Campbell

(b) Open source software and website:

1. <http://nptel.ac.in>
2. <https://nptel.ac.in/courses/112107145/14>

Suggested Course Practical List:

1. Study of Machine Tools (Lathe, Shaper, Slotter, Planner) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool. Also derive capacity and capability of respective machine tools from machine specifications and number of available attachments to perform variety of operations.
2. Study of Machine Tools (Grinding, Milling, Drilling) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool. Also derive capacity and capability of respective machine tools from machine specifications and number of available attachments to perform variety of operations.
3. Job making on lathe machine
4. Job making on shaper / slotter machine
5. Job making on milling machine
6. Job making on Drilling machine
7. Job making on Grinding machine
8. Alignment test on lathe machine / any other machine

List of Laboratory/Learning Resources Required:

1. ~~conventional machine tools such lathe~~



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2. milling
3. shaper
4. slotter
5. drilling machine
6. grinder, etc.

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Program Name: Engineering

Level: UG

Course / Subject Code: BE101405

Course / Subject Name: Mechanical Drafting

w. e. f. Academic Year:	2024-25
Semester:	4th/ 2ND Year
Category of the Course:	PC

Prerequisite:	Fundamentals of engineering drawing and basic computer operating skills
Rationale:	NiL

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
0	0	2	1	00	00	20	30	50



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Course / Subject Code: BE101405

Course / Subject Name: Mechanical Drafting

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to modeling software: System requirements, important terms and definitions, file menu options, managing file, Function of mouse, various toolbars.	2	8
2.	Sketcher: Configuring for sketcher, Setting sketching environment, Creating sketcher geometry, Modifying sketcher geometry, Dimensioning sketcher geometry, Constraining geometry, To study of Different entities : line, circle, rectangle, arc, ellipse, text, plane, point, fillet, polygon, straight slot, trim entity, convert entity, offset entity, mirror entity, linear sketch pattern, move entity, rapid sketch, quick sketch, repair sketch, Display delete relation.	4	10
3.	Part modeling: Basic (Parent child relationship), Base feature, Create datum's features, Edit features, Engineering features, Advanced features, Creating drawing, Working model views, Dimensioning and detailing your models, Controlling drawing details with layers, Importing and exporting data, Features: extrude boss/base, revolved boss/base, swept boss, lofted boss, boundary boss, extrude cut, hole wizard, revolve cut, swept cut, lofted cut, boundary cut, fillet, pattern, rib, draft, dome, mirror, reference geometry, curves, instant 3D	18	40
4.	Assembly: Reading top-down assemblies, creating bottom-up assemblies, Placement constraints, Assembly datum planes, assembling the components, redefining the components of the assembly, reordering the components, modifying the components of the assembly, the bill of material, Mechanism & animations: Motor, Spring, Contact, Gravity, Animation wizard, Motion study properties, Save animation, Play back mode. Edit component, insert component, mate, smart fasteners, move component, show hidden component, assembly features, reference geometry, Linear component pattern, bill of materials, exploded view, Interference detection, clearance verification, hole alignment, mass property, Section property, sensor, assembly visualization, symmetry check	08	12



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5.	Drawing: View lay out, model view, projected view, auxiliary view, and section view, detail view, broken out section, break, and crop view. Annotation : smart dimension, model items, spell checker, format painter, note, balloon, surface finish, weld symbol, hole callout, geometric tolerances, datum features, datum target, area hatch/fill, blocks, centre mark, centre line, revision symbol, tables.	10	30
Total		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Get acquainted with modelling software like Solid Works, Creo, etc.,	Understand
2	Generate details engineering drawing, General arrangement drawing, Bill of Material etc. in minimum time	Apply
3	Model components and assembly	Apply
4	Components and assembly analysis can be done	Understand



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Program Outcomes (POs)

PO No.	PO Description (Abbreviated)
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6– PO12	[Generally not directly mapped for CAD modeling unless interdisciplinary or ethical/societal design is considered]

CO-PO Mapping Table:

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	-	3
CO2	2	-	2	-	3
CO3	2	-	3	2	3
CO4	2	2	2	3	3

Program Specific Outcomes (PSOs):

PSO No.	PSO Description
PSO1	Apply mechanical engineering knowledge and software tools for design and manufacturing of mechanical systems
PSO2	Use advanced CAD/CAM/CAE tools for modeling, analysis, and optimization of mechanical components

CO-PSO Mapping Table

CO \ PSO	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	2	3



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Course / Subject Name: Mechanical Drafting

References/Suggested Learning Resources:

(a) Books:

1. Bible, Matt Lombard, “Solid works 2010”, Wiley Publishing, Inc. Manual from the solid works web site.
2. Sham Tikoo, “Solid works for engineers & designers”, Release – 2011
3. Sham Tikoo, “Pro/Engineer PTC Creo Parametric 3.0 for Engineers and Designers” Release – 2015

(b) Open source software and website:

1. <https://nptel.ac.in/courses/112102101/37>
2. <https://www.youtube.com/watch?v=6c852zSMrSs&list=PLBHP-24ac73ScwMuQfgToQobHtsBZILe>
(INTRODUCTION TO MODELING SOFTWARE)
3. https://www.youtube.com/watch?v=DsqCEPlxVek&list=PL8MELgWj0RxPDAUJ25h9Nwp_gKAQE
K2w (SKETCHER)



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Level: UG

Course / Subject Code: BE101405

Course / Subject Name: Mechanical Drafting



Swaminarayan University

Teaching & Examination Scheme

Course – Faculty of Engineering (Degree)

Branch – Mechanical Engineering

Semester – 4th

Subject Code	Subject Name	Category	L	T	P	Total Credit	E	M	I	V	Total Marks
BE100401	Organisational Behaviour & Management	Humanities and Social Science	3	0	0	3	60	40	0	0	100
BE101401	Mechanical Measurement and Metrology	Basic Science	4	0	2	5	60	40	20	30	150
BE101402	Fluid Mechanics and Hydraulics Machines	Professional Core	4	0	2	5	60	40	20	30	150
BE101403	Fundamentals of Machine Design	Professional Core	4	0	2	5	60	40	20	30	150
BE101404	Manufacturing Processes	Professional Core	3	0	2	4	60	40	20	30	150
BE101405	Mechanical Drafting	Professional Core	0	0	2	1	0	0	20	30	50
	Total		18	0	10	23					

L=Lecture, T=tutorial, P=Practical, E=Theory External, M=Theory Internal, I=Practical Internal, V=Practical External