



**K.K. Wagh Institute of Engineering
Education and Research, Nashik**

**Curriculum
S.Y. B. Tech
(2023 Pattern)**

**Department of
Mechanical Engineering**

w.e.f. AY 2024-2025



K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

2023 PAT.S.Y. B. Tech				Mechanical Engineering (wef AY 2024-25)										SEM-III			
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks								Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TU	TW	OR	PR	TOTAL	TH	TU	PR	TOTAL
2305201	PCC	Manufacturing Processes	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305202	PCC	Engineering Thermodynamics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305203	PCC	Mechanism and Machines	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305204	PCC	Mechanism and Machines Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2305205	PCC	Material Testing and Measurement Lab	-	-	4	-	-	-	-	50	50	-	100	-	-	2	2
2305206	MDM	Energy Systems for Mobility	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305207	MDM	Energy Systems for Mobility Lab	-	-	2	-	-	-	-	25	-	25	50	-	-	1	1
2305208	OE	Industrial Management	2	-	-	-	-	50	-	-	-	-	50	2	-	-	2
2305209	VEC	Professional Ethics	-	2	-	-	-	-	50	-	-	-	50	-	2	-	2
2305210	VSEC	Workshop Practice	-	1	2	-	-	-	25	25	-	-	50	-	1	1	2
Total			14	03	10	80	240	130	75	125	75	25	750	14	3	5	22

2023 PAT. S.Y. B. Tech Mechanical Engineering (wef AY 2024-25) SEM-IV																	
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks								Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TU	TW	OR	PR	TOTAL	TH	TU	PR	TOTAL
2300201D	BSC	Applied Mathematics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305212	PCC	Fluid Mechanics and Machines	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305213	PCC	Solid Mechanics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305214	PCC	Fluid Mechanics and Machines Laboratory	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2305215	PCC	Geometric Modeling and Production Drawing	-	-	4	-	-	-	-	50	-	50	100	-	-	2	2
2305216	MDM	Machine Intelligence	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2305217	MDM	Machine Intelligence Laboratory	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2305218	OE	Industrial Psychology and organizational Behaviour	2	-	-	-	-	50	-	-	-	-	50	2	-	-	2
2305219	VEC	Democracy, Election and Governance	-	2	-	-	-	-	50	-	-	-	50	-	2	-	2
2305220	AEC	Soft Skill	-	1	2	-	-	-	25	25	-	-	50	-	1	1	2
Total			14	3	10	80	240	130	75	125	50	50	750	14	3	5	22

2023 PAT. S.Y. B. Tech Mechanical Engineering (wef AY 2024-25)															
Department Specific Exit Courses (to award Certificate)															
Course Code	Course Type	Title of Course	TeachingScheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2305221	EXIT	Internship	-	-	--	-	-	-	100	-	100		-	2	2
2305222	EXIT	FaultDiagnosis and Maintenance of EV	2	-	2	-	-	50	50	-	100	2	-	1	3
2305223	EXIT	Battery build up Technology for EV	2	-	2	-	-	50	50	-	100	2	-	1	3
Total			4		4	-	-	100	200	-	300	4	-	4	8



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S. Y. B. Tech. Pattern 2023 Semester: III (Mechanical Engineering) 2305201: Manufacturing Processes			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks In Sem Exam: 20Marks End Sem Exam: 60Marks
Prerequisite Courses, if any: - Fundamentals of Mechanical Engineering - Knowledge of Materials and their properties, Stress-Strain Diagrams, Change in properties of metals on Heating and cooling, etc.			
Course Objectives:			
• Describe the casting processes, including permanent and collapsible molds, as well as the techniques of melting, molding, core and sand making, and finishing.			
• Explain the basics of metal forming processes and summarize the operations involved in sheet metal forming.			
• Discuss the properties and processing methods of polymers			
• Describe the principles and techniques of additive manufacturing processes.			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Identify appropriate manufacturing process for product under consideration and source of defect in manufacturing process.		2-Understand
CO2	Understand the mechanism of metal forming techniques and demonstrate basics operations.		2-Understand
CO3	Relate the principle of manufacturing polymers.		2-Understand
CO4	Understand and Demonstrate various rapid manufacturing techniques.		3-Apply
COURSE CONTENT			
Unit I	Casting Processes	(08hrs)	COs Mapped - CO1
Introduction to casting processes, Types of pattern and Allowances, Moulding sand, Core making, Melting practices and furnaces, Pouring and Gating system design, Riser design and placement (Numerical), Cleaning and Finishing of casting, Casting, Defects and remedies, Principle and equipments of Permanent mould casting, Investment casting, Centrifugal casting, Continuous casting.			
Unit II	Metal Forming Process	(07hrs)	COs Mapped - CO1, CO2
Forming Process, Classification, Rolling Process: Friction in rolling, Calculation of rolling load and power. Forging: Open and closed die forging, Forging stages, Extrusion: Types, Process parameter, Wire Drawing, Die profile Friction and lubrication in metal forming, Forming defects, causes and remedies for all forming processes.(Numerical on Rolling, Forging and Extrusion)			



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Unit III	Sheet Metal Working	(07hrs)	COs Mapped - CO1, CO2
Types of sheet metal operations, Press working equipment and its types, Types of dies, Clearance analysis, Estimation of cutting forces, Centre of pressure and blank size determination, Design of strip lay-out, Methods of reducing cutting forces, Formability and forming limit diagrams, Spring Back Effect.			
Unit IV	Introduction to Polymer Processing	(07hrs)	COs Mapped - CO1, CO3
Introduction to Polymer (Plastic and Rubber), Classification of Polymer, Thermoplastic and Thermosetting Plastic Manufacturing Process: Compression moulding, Transfer moulding, Blow moulding, Centrifugal moulding, Injection moulding Extrusion, Pressure Forming and Vacuum Forming.			
Unit V	Additive Manufacturing	(07hrs)	COs Mapped - CO1, CO4
Introduction, classification of Rapid Prototyping Processes, Working principle, features, models & specification of process, application, advantages and disadvantages, Rapid Tooling and STL format.			
Text Books			
1. P. N. Rao, "Manufacturing Technology Vol. I & II", Tata McGraw Hill Publishers 2. S. K. Hajra Choudhary, A. K. Hajra Choudhary, Nirjhar Roy, "Elements of Workshop Technology", Volume I, Media Promoters and Publisher Pvt, Ltd. 3. P. C. Sharma, "Production Engineering", Khanna Publishers			
Reference Books			
1. R. K. Jain, "Production Technology", Khanna Publishers 2. K. C. Chawala, "Composite Materials", Springer, ISBN 978-0387743646, ISBN 978-0387743653 3. Brent Strong, "Fundamentals of Composites Manufacturing: Materials, Methods", SME Book series. 4. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer			

Strength of CO-PO Mapping														
	PO												PSO1	PSO2
	1	2	3	4	5	6	7	8	9	10	11	12		
CO1	3	2	2	-	-	-	2	-	-	-	-	2	2	-
CO2	3	2	3	-	-	-	2	-	-	-	-	2	2	-
CO3	2	-	-	-	2	-	-	2	-	-	-	2	1	-
CO4	3	-	-	-	2	-	-	-	-	-	-	2	1	-
Average	3	2	3	-	2	-	2	2	-	-	-	2	2	-



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Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Assignments on each Unit	10
2	Online or Offline Test	10
	Total	20



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S. Y. B. Tech.			
Pattern 2023 Semester: III (Mechanical Engineering)			
2305202: Engineering Thermodynamics			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Courses, if any: -Engineering Mathematics I and II, Engineering Physics, Calculus			
Course Objectives:			
• To introduce laws of thermodynamics			
• To introduce the concept of entropy and availability			
• To cover fluid properties and vapour cycles.			
• To introduce first law analysis of refrigeration systems and Psychrometry			
• To introduce first law analysis of Air Compressor and Steam Generators			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Apply the concepts of First Law of Thermodynamics for Steady Flow Systems		3-Apply
CO2	Apply the concepts of Entropy and Availability for analysis of open and closed system		3-Apply
CO3	Estimation of steam properties and application of first law to power cycle		3-Apply
CO4	Estimate performance of refrigeration system and understand Psychrometry		3-Apply
CO5	Apply the concepts of First Law of Thermodynamics for Air Compressor and Steam Generators		3-Apply
COURSE CONTENTS			
Unit I	Laws of Thermodynamics	(08hrs)	COs Mapped - CO1
First Law of Thermodynamics: Concept of heat and work, Sign convention and its conversion. First law of thermodynamics, Equivalence of heat and work. Application of first law to Steady flow energy equation (SFEE)			
Second Law of Thermodynamics: Limitations of first law of thermodynamics, Statement of the Second law of Thermodynamics; PMM-II kind, Clausius Inequality, Carnot Theorem			
Unit II	Entropy and Availability	(07hrs)	COs Mapped - CO1, CO2



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Entropy: Entropy as a property, Clausius Inequality, Principle of increase of Entropy Principle, Entropy changes for an Open and Closed System, Change of Entropy for an ideal gas and Pure Substance, Concept of Entropy generation. Entropy - a measure of Disorder.

Availability: Available and Unavailable Energy, Concept of Availability, Availability of heat source at constant temperature and variable temperature, Availability of non-flow and steady-flow Systems.

Unit III	Properties of Working Fluid and Vapour Power Cycle	(07hrs)	COs Mapped - CO1, CO2, CO3
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Ideal Gas properties

Ideal Gas definition, Gas Laws: Boyle's law, Charles's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas Processes- on P-v and T-s diagrams, Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes (Open and Closed systems), Calculations of Heat transfer, Work done, Internal Energy, Entropy.

Properties of Pure substances: Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and h-s plots (Mollier Chart) for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined) Non-flow and Steady flow Vapour Processes, Change of Properties, Work and Heat transfer.

Vapour Power Cycle: Thermodynamic Cycle: Carnot Cycle, Rankine Cycle, Comparison of Carnot cycle and Rankine cycle.

Unit IV	First Law Analysis of Refrigeration System and Psychrometry	(07hrs)	COs Mapped - CO1, CO4
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Refrigeration System: Schematic of mechanical refrigeration system, SFEE of components of refrigeration system, Thermodynamic Refrigeration Cycle representation of vapour compression cycle (VCC) on T-s and P-h diagram, Performance Analysis of VCC

Psychrometry: Introduction, Psychrometry and Psychrometric Properties, Basic Terminologies & Psychrometric Relations, Psychrometric Processes, Psychrometric Chart.

Unit V	Air Compressor and Steam Generators	(07hrs)	COs Mapped - CO1, CO5
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Reciprocating Compressor: Applications of compressed air, single stage compressor (without clearance and with clearance volume), volumetric efficiency, isothermal efficiency, effect of clearance volume, free air delivery (FAD), actual indicator diagram for air compressor, Multi staging of compressor, optimum intermediate pressure, intercooler, after cooler, Capacity control of compressors.

Steam Generators: Classification, Constructional details of low pressure boilers, Boiler mountings and accessories, Instrumentations required for safe and efficient operation, Introduction to IBR Act

Text Books

P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publications
C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill.

Reference Books



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Y. Cengel & Boles: Thermodynamics – An Engineering Approach,
P. L Ballaney: Thermal Engineering, Khanna Publishers
S. Domkundwar, C. P. Kothandaraman, and Domkundwar, Thermal Engineering, Dhanpatrai Publishers.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	2	-	-	-	-	2	-	-	2
CO2	3	2	2	2	-	-	-	-	2	-	-	2
CO3	3	2	2	2	-	-	-	-	2	-	-	2
CO4	3	2	2	2	-	-	-	-	2	-	-	2
CO5	3	2	2	-	-	-	2	-	2	-	-	2
Average	3	2	2	2	-	-	2	-	2	-	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Assignment on each unit	10
2	Test (Online/Offline) on each unit	10
	Total	20



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S. Y. B. Tech.			
Pattern 2023 Semester: III (Mechanical Engineering)			
2305203: Mechanism and Machines			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks
Prerequisite Courses, if any: -Fundamentals of Mechanical Engineering, Engineering Mechanics, Engineering Mathematics I & II, Engineering physics			
Course Objectives:			
1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.			
2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.			
3. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.			
4. To develop the competency to understand & apply the principles of gear theory to design various applications.			
5. To develop the competency to design a cam profile for various follower motions.			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	IDENTIFY mechanisms in real life applications		2-Understand
CO2	CALCULATE velocity and acceleration in mechanisms by analytical and graphical method		3-Apply
CO3	CONSTRUCT a four bar mechanism with analytical and graphical methods		3-Apply
CO4	APPLY fundamentals of gear theory as a prerequisite for gear design		3-Apply
CO5	CONSTRUCT cam profile for given follower motion		3-Apply
COURSE CONTENTS			
Unit I	Fundamentals of Mechanisms	(08 hrs)	COs Mapped - CO1
Introduction, Mechanism and machine, Link, Kinematic pair, Types of motion, Degrees of freedom (mobility), Classification of kinematic pairs, Kinematic chain, Linkage, Mechanisms, Grashoff's law, Kinematic inversion, Inversions of slider crank chain, Double slider-crank chain			
Unit II	Kinematic Analysis of Planar Mechanisms	(07 hrs)	COs Mapped - CO1, CO2
Kinematic analysis of slider crank Mechanism by analytical method, Velocity and acceleration analysis of Four-Bar and Slider crank mechanisms using Complex Algebra Method. Graphical method for the velocity and acceleration analysis of four bar, slider crank and other single degree of			



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freedom mechanisms by relative velocity method and ICR method.			
Unit III	Synthesis of Mechanisms	(07 hrs)	COs Mapped - CO1, CO3
Steps in Synthesis: Type synthesis, Number Synthesis, Dimensional synthesis, Tasks of Kinematic synthesis - Path, function and motion generation (Body guidance), Precision Positions, Chebychev spacing, Mechanical and structural errors Graphical Synthesis: Inversion and relative pole method for three position synthesis of Four-Bar and Single Slider Crank Mechanisms Analytical Synthesis: Three position synthesis of Four-Bar mechanism using Freudenstein's equation			
Unit IV	Gears and Gear trains	(07 hrs)	COs Mapped - CO1, CO4
Classification, Terminology, Law of Gearing, Interference and methods to avoid interference in spur gears. Simple, compound, reverted and Epicyclic gear trains.			
Unit V	Cam and Follower	(07 hrs)	COs Mapped - CO1, CO5
Classification of Followers and Cams, Terminology of Cam, Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion (SHM), Uniform Acceleration and Retardation Motion (UARM), Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon			
Text Books			
1. S. S. Rattan, "Theory of Machines", Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi. 2. Bevan T, "Theory of Machines", Third Edition, Longman Publication 3. G. Ambekar, "Mechanism and Machine Theory", PHI 4. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Fifth Edition, International Student Edition, Oxford			
Reference Books			
1. Paul E. Sandin, "Robot Mechanisms and Mechanical Devices Illustrated", Tata McGraw Hill Publication 2. Stephen J. Derby, "Design of Automatic Machinery", 2005, Marcel Dekker, New York 3. Neil Sclater, "Mechanisms and Mechanical Devices Sourcebook", Fifth Edition, Tata McGraw Hill Publication 4. Ghosh Malik, "Theory of Mechanism and Machines", East-West Pvt. Ltd. 5. Hannah and Stephans, "Mechanics of Machines", Edward Arnold Publication 6. R. L. Norton, "Kinematics and Dynamics of Machinery", First Edition, McGraw Hill Education (India) P Ltd. New Delhi 7. Sadhu Singh, "Theory of Machines", Pearson 8. Dr. V. P. Singh, "Theory of Machine", Dhanpatrai and Sons 9. C. S. Sharma & Kamlesh Purohit, "Theory of Machine and Mechanism", PHI			



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Strength of CO-PO Mapping														
	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	2	-	-	1	2	-
CO2	3	3	2	2	-	-	-	-	2	-	-	1	2	-
CO3	3	2	-	2	1	-	-	-	1	-	-	1	2	-
CO4	3	3	2	2	-	-	-	-	1	-	-	2	2	-
CO5	3	2	2	2	1	-	-	-	2	-	-	2	2	-
Average	3	3	2	2	1	-	-	-	2	-	-	1	2	-

Components for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Assignments on each Unit	10
2	Online/ offline Test on Each Unit	10
	Total	20



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S. Y. B. Tech. Pattern 2023 Semester: III (Mechanical Engineering) 2305204: Mechanism and Machines Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02 hrs/week	01	Term work: 25Marks Oral: 25Marks
Prerequisite Courses, if any: - Fundamentals of Mechanical Engineering, Engineering Mechanics, Engineering Mathematics I & II, Engineering physics		
Course Objectives: <ol style="list-style-type: none"> 1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications. 2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach. 3. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique. 4. To develop the competency to understand & apply the principles of gear theory to design various applications. 5. To develop the competency to design a cam profile for various follower motions. 		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	IDENTIFY mechanisms in real life applications	2-Understand
CO2	CALCULATE velocity and acceleration in mechanisms by analytical and graphical method	3-Apply
CO3	CONSTRUCT a four bar mechanism with analytical and graphical methods	3-Apply
CO4	APPLY fundamentals of gear theory as a prerequisite for gear design	3-Apply
CO5	CONSTRUCT cam profile for given follower motion	3-Apply
List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	To make a model of any mechanism by the group of 4 students and to give a presentation using PPTs.	CO1
2	Identify mechanisms in real life and Analyze for types and number of links, pairs, obtain degrees of freedom.	CO1
3	Velocity and acceleration analysis using relative velocity and acceleration method.	CO1, CO2
4	Velocity analysis using the ICR method.	CO1, CO2
5	Kinematic Analysis of Slider Crank Mechanism using Analytical Method by using any suitable programming language.	CO1, CO2
6	To synthesize the four bar and slider crank mechanism using relative	CO1, CO3



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	pole and inversion method with three accuracy points.	
7	To study manufacturing of gear using gear generation with rack as a cutter and to generate an involute profile.	CO1, CO4
8	To determine holding torque for Epicyclic gear train	CO1, CO4
9	To draw cam profile for various follower motion with radial and off-set cam and manufacturing by using laser cutting machine	CO1, CO5
10	To study and verify cam jump phenomenon.	CO1, CO5

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students its procedure, observations calculation, and outcome of this experiment.
2. Apparatus and equipment's required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistant.
4. After performing the experiment students will check their readings, calculations from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, and diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Term work Assessment

1. Each experiment from lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

Text Books

1. S. S. Rattan, "Theory of Machines", Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Bevan T, "Theory of Machines", Third Edition, Longman Publication
3. G. Ambekar, "Mechanism and Machine Theory", PHI
4. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Fifth Edition, International Student Edition, Oxford

Reference Books

1. Paul E. Sandin, "Robot Mechanisms and Mechanical Devices Illustrated", Tata McGraw Hill Publication
2. Stephen J. Derby, "Design of Automatic Machinery", 2005, Marcel Dekker, New York
3. Neil Sclater, "Mechanisms and Mechanical Devices Sourcebook", Fifth Edition, Tata McGraw Hill Publication
4. Ghosh Malik, "Theory of Mechanism and Machines", East-West Pvt. Ltd.
5. Hannah and Stephans, "Mechanics of Machines", Edward Arnold Publication
6. R. L. Norton, "Kinematics and Dynamics of Machinery", First Edition, McGraw Hill Education (India) P Ltd. New Delhi
7. Sadhu Singh, "Theory of Machines", Pearson
8. Dr. V. P. Singh, "Theory of Machine", Dhanpatrai and Sons
9. C. S. Sharma & Kamlesh Purohit, "Theory of Machine and Mechanism", PHI



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Strength of CO-PO Mapping														
	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	2	-	-	1	2	-
CO2	3	3	2	2	-	-	-	-	2	-	-	1	2	-
CO3	3	2	-	2	1	-	-	-	1	-	-	1	2	-
CO4	3	3	2	2	-	-	-	-	1	-	-	2	2	-
CO5	3	2	2	2	1	-	-	-	2	-	-	2	2	-
Average	3	3	2	2	1	-	-	-	2	-	-	1	2	-



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S. Y. B. Tech. Pattern 2023 Semester: III (Mechanical Engineering) 2305205 : Material Testing and Measurement Laboratory		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 04 hrs / week	02	Term Work: 50 Marks Oral: 50 Marks
Prerequisite Courses: - Fundamentals of Mechanical Engineering, Basics of linear measurement, Physics, Applied Chemistry.		
Course Objectives: <ul style="list-style-type: none">• Develop hands-on proficiency in operating Brinell and Vickers hardness testing machines to accurately measure and assess material hardness.• Acquire the knowledge and skills to apply Magnetic Particle Inspection Test for flaw detection in materials, ensuring a thorough understanding of the non-destructive testing technique.• Comprehend the principles of the Iron-Iron Carbide Phase diagram and apply this knowledge to predict and analyze material behavior during different heat treatment processes.• To develop essential skills for calibrating and testing instruments.• To apply basics of measurement methods through the gathering of data, analysis, and interpretation and expertise in designing limiting gauges.		
	Course Outcomes	Bloom's Level
CO1	Selection of measurement methods and standards, carryout data collection and its analysis.	2-Understanding
CO2	Determine limits, fits, tolerances, geometric tolerances and Design of Gauges.	3- Apply
CO3	Demonstrate proficiency in performing hardness measurements using both Brinell and Vickers hardness testing machines.	3- Apply
CO4	Understand the principles of the Iron-Iron Carbide Phase diagram and its application in predicting material behavior during heat treatment processes.	3- Apply
CO5	Apply non-destructive testing techniques, specifically the Magnetic Particle Inspection Test, for flaw detection in materials.	3- Apply
CO6	Develop practical skills in optical metallurgical microscopy, specimen preparation, and microstructure examination for accurate material characterization.	4- Analyze
COURSE CONTENTS		
The student shall complete the following activity as a Term Work, <ol style="list-style-type: none">1. Hardness measurement on Brinell hardness testing machine and Vickers hardness testing machine.2. Non Destructive Testing (Magnetic Particle Inspection Test).3. Study of Iron-Iron Carbide Phase diagram.4. Specimen preparation for microscopic Examination.		



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5. Microstructure examination of plain carbon steels and Cast Iron.
6. Heat Treatment of plain carbon steel and determination of hardness (Annealing, Normalizing, Hardening)
7. Demonstrate and compute linear and angular measurements employing tools such as Vernier Caliper, Screw Gauge, Dial Gauge, Height Gauge, Bevel Protector, etc.
8. Determine Parameters of screw thread using floating carriage micrometer.
9. Determine the geometry and dimensions of a given composite object or a single-point tool using an Optical Projector or Tool Maker's Microscope. Evaluate and distinguish its practical utility in real-life applications.
10. Measurement of the any one characteristics from the following using any suitable measurement system,
 - a. Surface roughness
 - b. Gear tooth Parameter
 - c. Verification of composite geometry.
11. Limit Gauges: Concepts, uses and applications of Go –No Go Gauges, Taylor's principle and Design of gauges (Numerical and student activity)
12. Industry visit for Heat Treatment Plant and advanced in measurement to provide exposure to students.

Text Books

1. Dr. V. D. Kodgire & S. V. Kodgire, "Material Science & Metallurgy For Engineers", Everest Publication.
2. William D. Callister, "Materials Science and Engineering an Introduction", Jr, John Wiley & Sons, Inc.
3. Jain R.K., Engineering Metrology, Khanna Publication.
4. I.C.Gupta, Engineering Metrology, Dhanpath Rai.
5. Bewoor A. K. and Kulkarni V. A., Metrology and Measurements, McGraw hill Publication.

Reference Books

1. Raghvan V., "Material Science & Engineering", Prentice Hall of India, New Delhi. 2003
2. Avner, S.H., "Introduction to Physical Metallurgy", Tata McGraw-Hill, 1997.
3. Higgins R. A., "Engineering Metallurgy", Viva books Pvt. Ltd.
4. George Ellwood Dieter, "Mechanical Metallurgy", McGraw-Hill 1988
5. Smith, W.F, Hashemi, J., and Prakash, R., "Materials Science and Engineering in SI Units", Tata McGraw Hill Education Pvt. Ltd.
6. Narayana K.L., Engineering Metrology.
7. Galyer J.F & Shotbolt C.R., Metrology for engineers
8. Judge A.W., Engineering Precision Measurements, Chapman and Hall
9. ASTM, Handbook of Industrial Metrology, Prentice Hall of India Ltd.
10. Connie Dotson, Fundamentals of Dimensional Metrology, ThomsonPubln. 4th Edition.

Codes / Handbooks

Francis T. Farago, Mark A. Curtis, Handbook of dimensional measurement

E- resources



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1. nptel.ac.in/courses/112106179
2. www.nptelvideos.in/2012/12/mechanical-measurements-and-metrology.html
3. <https://nptel.ac.in/courses/112/107/112107242/>
4. freevideolectures.com › Mechanical › IIT Madras
5. <https://nptel.ac.in/courses/112/106/112106139/>
6. <https://archive.nptel.ac.in/courses/112/106/112106175/#>
7. <https://archive.nptel.ac.in/courses/112/106/112106300/>

	Strength of CO-PO/PSO Mapping													
	PO												PSO	
Strength of CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	-	3	-	-	-	-	2	2	1	2	2	1
CO 2	3	2	-	3	3	-	-	-	2	2	1	2	2	1
CO 3	3	2	-	3	2	-	-	-	2	2	1	2	2	2
CO 4	3	2	-	3	2	-	-	2	2	2	1	2	2	2
CO 5	3	2	3	3	2	-	-	3	2	2	1	2	2	2
CO 6	3	2	-	-	2	-	-	2	2	2	1	2	2	2

Guidelines for Teamwork Assessment		
Continuous Assessment Policy		
(Term work marks of 25 will be awarded based on the following policy)		
<p>Each laboratory assignment will be assessed for 30 Marks according to the following rubrics:</p> <p>R1- Timely completion of assignments (10 Marks)</p> <p>R2- Understanding of assignment (10 Marks)</p> <p>R3 – Presentation/Clarity of journal writing (10 Marks)</p> <p>For all 10 Experiments, total marks of 300 will be converted into 25 Marks.</p>		
Description	Weightage	Evaluation criteria
R1-Timely completion of assignments	10 Marks	Each experiment/assignment will get 10 marks for timely submission. Late submission will be valued as 5 in totality. Failure to submit will be valued as 0 in totality
R2- Understanding of assignment.	10 Marks	Understanding of assignments is based on oral questions based on assignment.
R3 – Presentation/Clarity of Drawing Sheets	10 Marks	Completed sheet with proper dimensioning, line work carries 10 marks.



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S. Y. B. Tech.			
Pattern 2023 Semester: III (Mechanical Engineering)			
2305206: Energy Systems for Mobility			
Teaching Scheme		Credit Scheme	Examination Scheme
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Courses, if any: Engineering Thermodynamics, Basic Mathematics			
Course Objectives:			
1. To understand basics of IC Engines and analyze air standard cycles associated with it			
2. To evaluate various performance parameters of engines, compare combustion and identify appropriate emission control technologies in SI and CI engines			
3. To understand components and technologies used in electric and hybrid electric vehicles			
4. To understand the basics of Fuel cell technology and various configurations			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Explain basics of IC engines and Analyze air standard cycles		3- Apply
CO2	Compare combustion and identify appropriate emission control technologies in SI and CI engines, Calculate various performance parameters of engines		3- Apply
CO3	Understand and Compare EV, HEV and Internal combustion engine technologies based on net energy analysis		2-Understand
CO4	Understand the basics of Fuel cell thermodynamics and reaction kinetics and understand concept of Regenerative braking		2-Understand
COURSE CONTENTS			
Unit I	Introduction to Engines	(06 hrs)	COs Mapped – CO1
Basics of IC engines, Working of engines, Valve timing diagram, Analysis of Air standard cycles, Fuel air cycles, Actual cycle (Numericals)			
Unit II	Combustion and Emission control in Engines	(08 hrs)	COs Mapped - CO2
Combustion: Combustion in SI and CI engines, Knocking/ Detonation, Factors affecting Knocking in SI and CI engines , advanced technologies for improving combustion process (MPFI, GDI, HCCI, Stratified charge, CRI, Turbocharging)			
Emission Control: Pollutants, Phenomenon of formation, Emission norms (Bharat and Euro standards), Emission control technologies, Use of alternate fuels such as Ethanol, Methanol, CNG, Biodiesel, Hydrogen, Fuel additives			
Unit III	Engine Systems and Testing of engines	(08 hrs)	COs Mapped – CO2
Engine systems: Fuel supply, Ignition systems, Cooling systems, Lubrication systems			
Testing of engines: Performance parameters, Friction power measurement, Heat balance sheet for			



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I. C. Engines (Numericals)												
Unit IV	Electric and Hybrid Electric Vehicles							(08 hrs)	COs Mapped – CO3			
Electric Vehicles: Performance of Electric Vehicles, Motors, Traction Motor Characteristics and comparison with engines performance characteristics, Batteries, Battery sizing calculation, Battery management, Effect on carbon emissions Hybrid Vehicles: Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains, TorqueCoupling, Speed Coupling, Combined Torque and Speed Coupling in Parallel Hybrid Drive Trains												
Unit V	Fuel cell Technology and Regenerative Braking							(06 hrs)	COs Mapped –CO4			
Fuel cells: Operating Principle, Electrode Potential and current voltage curve, Fuel cell thermodynamics, Fuel cell reaction kinetics, Fuel cell technologies (Types of Fuel cell), Fuel cell Hybrid Vehicle Drive train technology, Hydrogen fuel cell, Hydrogen Production and Storage. Regenerative braking: Energy consumption in braking, Brake System of EVs and HEVs (Series Brake : Optimal Feel, Optimal Energy Recovery, Parallel Brake)												
Text Books												
1. IC Engines (Combustion and Emissions) by B. P. Pundir, Narosa Publications 2. Internal combustion engine by Mathur M. L. and Sharma R. P., DhanpatRai publications 3. Internal combustion engines by V. Ganesan, Tata McGraw Hill 4. Modern Electric, Hybrid electric and Fuel cell Vehicles, Ehsani M., Gao Y., Gay S., Emadi A., CRC Press 5. Fuel Cell Technology for Vehicles, 2nd Edition, <u>Richard Stobart</u> , SAE												
Reference Books												
1.Engine Emissions: Pollutant Formation and Advances in Control Technology by B. P. Pundir, Alpha science publication 2.Internal combustion engine Fundamentals by John B. Heywood, McGraw Hill 3.Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids by Y. Xu, J. Yan, H Qian, T lam, McGraw Hill												
Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	-	-	2	2	-	2	-	-	2
CO2	3	3	3	2	-	2	2	-	2	-	-	2
CO3	3	2	2	-	-	2	2	-	2	2	-	2
CO4	3	2	2	-	-	2	2	-	2	2	-	2
Average	3	3	2	2	-	2	2	-	2	2	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One assignment on each unit	10
2	Online/ Offline Test / Oral Presentation	10
	Total	20



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S. Y. B. Tech. Pattern 2023 Semester: III (Mechanical Engineering) 2305207: Energy Systems for Mobility Laboratory		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical :02 hrs/week	01	Term work: 25 marks Practical Exam: 25 marks
Prerequisite Courses, if any: - Basic Thermodynamics and I. C. Engines		
Course Objectives: To evaluate performance of engines and Compressor To diagnose engine combustion through emission measurement To evaluate the performance of refrigeration and Air conditioning system Use software in analysis of thermal system		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Apply first law of thermodynamics to energy systems	3-Apply
CO2	Evaluate various performance parameters of Energy systems through experimentation and using software	4- Analyze
CO3	Diagnose engine combustion through emission measurement	2-Understand
CO4	Analyze and Compare various systems from energy and environmental perspective	4- Analyze

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1.	Trial on IC engine to determine performance parameters and to draw heat balance sheet at different loads	CO1, CO2
2.	Trial on engine to study the effect of variable compression ratio	CO4
3.	Demonstration on Exhaust Gas Analyzer	CO3
4.	Analysis of Fuel cell system	CO1, CO2
5.	Analysis of Vapour compression refrigeration system	CO1, CO2
6.	Analysis of AC system	CO1, CO2
7.	Trial on Bomb calorimeter to determine calorific value of fuel	CO1, CO2
8.	Trial on Air compressor to determine performance parameters	CO1, CO2
9.	Analysis of any thermal system using programming software (Assignment)	CO1, CO2, CO4
10.	Visit to Automobile Service station	CO1, CO2, CO3, CO4



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11.	Case study on Fuel cell or electric vehicle (Assignment and Presentation)	CO1, CO4
Guidelines for Laboratory Conduction		
1. Teacher will brief the given experiment to students its procedure, observations calculation, and outcome of this experiment.		
2. Apparatus and equipment's required for the allotted experiment will be provided by the lab assistants using SOP.		
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistant.		
4. After performing the experiment students will check their readings, calculations from the teacher.		
5. After checking they have to write the conclusion of the final result.		
6. Experiment no. 10 and 11 are compulsory and any 06 experiments of experiment no. 1 to 9		
Guidelines for Student's Lab Journal		
Write-up should include title, aim, setup diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.		
Guidelines for Termwork Assessment		
1. Each experiment from lab journal is assessed for thirty marks based on three rubrics.		
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.		

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	-	2	2	-	3	2	2	2
CO2	3	3	3	-	2	2	2	-	3	2	2	2
CO3	3	2	2	-	-	3	3	-	3	2	2	2
CO4	3	3	3	-	-	3	3	-	3	2	2	2
Average	3	2	2	-	2	3	2	-	3	2	2	2

Books to be referred
1. Basic and applied Thermodynamics - P. K. Nag, McGraw Hill Education
2. Refrigeration and Air conditioning - C P Arora, McGraw Hill Education
3. Internal Combustion Engines - V. Ganesan, Tata McGraw Hill Education



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S. Y. B. Tech. Pattern 2023 Semester: III (Mechanical Engineering) 2305208(Industrial Management)			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory:02hrs/week		02	Continuous Comprehensive Evaluation (CCE) : 50Marks
Prerequisite Courses, if any: -Introduction to Engineering Management			
Course Objectives			
1. To familiarize students with the principles and practices of industrial management 2. To explore organizational Structures, Business Ownership structures and Legal Frameworks. 3. To Implement Effective Job Evaluation and Quality Management.			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Describe the importance of management and explain key industrial management theories.		2
CO2	Describe various types of organizational structures		2
CO3	Apply job evaluation methods for effective job management system		3
CO4	Demonstrate types of business ownership, the associated legal frameworks and quality management principles and tools		3
COURSE CONTENTS			
Unit I	Introduction to Industrial Management	(05hrs)	COs Mapped –CO1
Nature and importance of Management, Evolution of Industrial Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Role of Industrial Manager and Leadership Styles.			
Unit II	Organizational Structures	(04hrs)	COs Mapped – CO2
Departmentation and Decentralization, Types of Organization Structure - Line organization, Line and Staff organization, Functional organization, Committee organization, Matrix organization, Virtual Organization, Cellular Organization, Lean and Flat organization Structure and their Merits and Demerits.			
Unit III	Job Evaluation	(05hrs)	COs Mapped – CO3
Objectives of Job Evaluation, Principles of job evaluation, Methods of Job Evaluation (Job Ranking Method, Job Classification Method, Point-Factor Method, Factor Comparison Method ,Competitive Market Analysis Method), Computer Assisted Job Evaluation. Process of Job Evaluation, Challenges in Job Evaluation.			
Unit IV	Overview of Business Ownership Structures and Legal Frameworks	(05hrs)	COs Mapped – CO4
Business Ownership and its Types: Types of Business Ownership, Sole Proprietorship, Partnership (Act 1934), Limited Liability Partnership, (LLP Act 2008). The One-Person Company, Joint Stock Company: Public Limited and Private Limited, Public-Sector Undertaking (PSU), Entrepreneurship and			



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Women Entrepreneurship Schemes			
Unit V	Quality Management	(05hrs)	COs Mapped – CO4
Concept - Quality control- Definition - Factors affecting quality- Advantages of quality control Total Quality Management-Meaning- Principles of Total Quality Management-PDCA Cycles Quality Circles-Definition-Function. Modern Approaches for Quality Management, Deming's 14 points of QM, TQM Principles, ISO 9000–2000, ISO 14000 (Environment) & ISO 50000 (Energy), Quality Standards			
Text Books			
<ol style="list-style-type: none">1. Management: A Practical Introduction" by Angelo Kinicki and Brian K. Williams, Edition: 10th (2022), Publisher: McGraw-Hill Education,ISBN: 978-12607862412. Industrial Management" by Bhattacharyya D.K. Edition: 3rd (2021) Publisher: PHI Learning Pvt. Ltd. ISBN: 978-93901564073. Principles of Management" by Ricky W. Griffin, Edition: 11th (2021), Publisher: Cengage Learning, ISBN: 978-03570985134. Operations Management: Processes and Supply Chains" by Lee J. Krajewski, Manoj K. Malhotra, and Larry P. Ritzman, Edition: 12th (2022) Publisher: Pearson, ISBN: 978-01344672415. Fundamentals of Management" by Stephen P. Robbins, Mary A. Coulter, and David A. DeCenzo, Edition: 11th (2023) Publisher: Pearson, ISBN: 978-0135581403.			
Reference Books			
<ol style="list-style-type: none">1. Quality Management for Organizational Excellence: Introduction to Total Quality" by David L. Goetsch and Stanley Davis, Edition: 9th (2020) Publisher: Pearson, ISBN: 978-01355773212. Contemporary Industrial Organization: A Quantitative Approach" by Lynne Pepall, Dan Richards, and George Norman, Edition: 2nd (2019) Publisher: Wiley, ISBN: 978-11194761023. Strategic Management: Concepts and Cases" by Fred R. David and Forest R. David, Edition: 17th (2020)Publisher: Pearson, ISBN: 978-01351830894. Total Quality Management: Key Concepts and Case Studies" edited by D.R. Kiran, Edition: 1st (2017)Publisher: Butterworth-Heinemann, ISBN: 978-01281103555. Industrial Organization: Markets and Strategies" by Paul Belleffamme and Martin Peitz, Edition: 2nd (2015) Publisher: Cambridge University Press, ISBN: 978-1107687899.			



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Strength of CO-PO/PSO Mapping														
Strength of COs	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	-	-	-	-	2	-	2	-	-		1	--	1
CO 2	3	-	-	-	-		-	-	2	-	2	-	-	2
CO3	3	-	2	-	-	-	-	-	3	-	2	-	--	1
CO 4	3	-	-	-	-	2	2	-	-	-	2	2	-	2
Avg.	3	-	2-	-	-	2	2	2	2	-	2	2	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One Assignments on Unit-1& Unit-2	10
2	One Assignments on Unit-3& Unit-4	10
3	MCQ Tests/Quiz (one test on each Unit)	15
4	Group Presentation	15
	Total	50



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S. Y. B. Tech. Pattern 2023 Semester: III Mechanical Engineering 2305209: Professional Ethics			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Tutorial: 02hrs/week		02	Tutorial: 50 marks
Prerequisite Courses: Communication skill			
Course Objectives: 1.To spread awareness amongst students about professionalism. 2.To promote ethics and values amongst students used in personal and professional career. 3.To provide openings to get involved in a group so as to develop team skills and learn professionalism.			
Course Outcomes: On completion of the course, students will be able to–			
COs	Course Outcomes		Bloom's Level
CO1	Understand basic purpose of profession, professional ethics and various moral and social issues		2-Understand
CO2	Describe professional rights and responsibilities of an Engineer, safety and risk benefit analysis of an Engineer		2-Understand
CO3	Acquire and apply knowledge of various roles of Engineer in applying ethical principles at various professional levels		3-Apply
TUTORIAL COURSE CONTENT			
Unit I	Introduction to Professional Ethics	(4 hrs)	COs Mapped- CO1, CO2, CO3
Introduction to Professional Ethics, Morals, Values and Ethics – Personal and Professional, Engineering Ethics, Code of Ethics by NSPE			
Unit II	Business Ethics	(5 hrs)	COs Mapped- CO1, CO2, CO3
Philosophical approaches to Business Ethics, ethical reasoning, ethical issues in business, Social Responsibility of Business, conflict of interest, cultural relativism, Ethical leadership			
Unit III	Psychological Approaches	(5 hrs)	COs Mapped- CO1, CO2, CO3
Ethical Theories - Psychological and Philosophical approaches, Myths about Morality, conflict of interest in psychological perspective, ethical dilemma, Emotional Intelligence			
Unit IV	Workplace Ethics	(5 hrs)	COs Mapped- CO1, CO2, CO3
Ethics in changing domains of Research , academic integrity, intellectual honesty , Role of Engineers and Managers, Ethical issues in Diverse workplace, Confidentiality, employee rights, Intellectual property rights, discrimination			
Unit V	Safety, Responsibilities and Rights	(5 hrs)	COs Mapped- CO1, CO2, CO3
Ecology, Engineering, Economy, Risk benefit analysis and reducing risk, Corporate social responsibility and Corporate Sustainability, CSR in India - Sustainability Case Studies			
Text Books			
1. Professional Ethics: R. Subramanian, Oxford University Press, 2017 2. Nagarasan. R.S. Professional Ethics and Human Values. New Age International Publications, 2006. 3. Ethics in Engineering Practice & Research, Caroline Whitbeck, Cambridge University Press 2015. 4. "Professional ethics & human values" by M. Govindarajan, S. Natarajan, V. S. Senthikumar, PHI			



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learning private ltd. Delhi, Third Printing

Reference Books

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

Strength of CO-PO Mapping

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	--	--	--	--	--	1	--	2	2	1	--	1
CO2	--	--	--	--	--	--	1	2	2	1	--	1
CO3	--	--	--	--	--	--	--	2	2	1	--	1
Average	--	--	--	--	--	1	1	2	2	1	--	1

List of Tutorial Assignments and guidelines for Continuous Comprehensive Evaluation

Tut. No.	Tutorial Assignments	Marks Allotted	CO Mapped
1	Assignment No. 1 on Introduction to Professional Ethics	30	CO1, CO2, CO3
2	Group presentations on Business Ethics	30	CO1, CO2, CO3
3	Assignment No. 2 Ethical Theories	30	CO1, CO2, CO3
4	Assignment No. 3 on Workplace Ethics and Safety, Responsibilities and Rights	30	CO1, CO2, CO3
5	Combined MCQ/Class Test on all Units	30	CO1, CO2, CO3

Guidelines for Tutorial Conduction

Faculty will explain details about the tutorial activity in short. Students will complete all 5 tutorial assignments as shown in the above section.

Guidelines for Continuous Comprehensive evaluation

Each tutorial assignments will be assessed for 30 Marks according to following rubrics:

- R1- Timely completion of assignments (10 Marks)
- R2- Understanding of concept/assignment/communication skills (10 Marks)
- R3- Presentation/Clarity of activity done (10 Marks)

All five tutorial assignments with total marks of 150 will be converted into 50 Marks



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S. Y. B. Tech.			
Pattern 2023Semester: III Mechanical Engineering			
2305210:Workshop Practice			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Tutorial : 01 hrs/week Practical : 02 hrs/week		01 01	Tutorial : 25Marks Term work : 25Marks
Prerequisite Courses, if any: - Workshop Practice (F.Y. B.Tech)			
Course Objectives:			
1) To apply the basic knowledge for Lathe operation 2) To acquire skill to produce a FRP job 3) To acquire skills to handle CNC/VMC, Slotting Machine, surface finishing machine and to produce a job.			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Apply the basic knowledge for various operation done on lathe machine		3-Apply
CO2	Apply the programming for CNC and VMC operation (Facing and Turning)		3-Apply
CO3	Development of fiber reinforcement job		3-Apply
CO4	Make a use of CNC program for appropriate machining processes like turning and milling		3-Apply
CO5	Demonstrate machining phenomenon like milling, gear and thread manufacturing, indexing, tapping, super finishing, slotting etc.		3-Apply
COURSE CONTENT			
Unit I	Lathe Machine Operation, turning, facing, knurling, threading, and parting, Gear train use for late	(03 hrs)	COs Mapped – CO1,CO5
Unit II	CNC& VMC programming (Computer Numerical Control Programming) Type of Codes, Simple Facing and Turning Programme, software’s for develop programme	(03 hrs)	COs Mapped – Co2,CO5
Unit III	Slotting machine and its working method, principle of reciprocating mechanism, Indexing mechanism for Gear manufacturing	(02h rs)	COs Mapped – CO5
Unit IV	FRP (Fibre-reinforced plastics) Materials, High Grade RESIN, Fibreglass Materials, Unsaturated Polyester RESIN, HDPE Material, Natural FRP. Die/mould manufacturing for FRP process, FRP Manufacturing processes.	(02h rs)	COs Mapped – CO3
Unit V	Facing operation, Programmable milling machine	(02h	COs Mapped –



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	Drilling and Tapping process. Thread Pitch, Rotary motion with axial motion mechanism.	rs)	CO2,CO4
Text Books			
1. A Text Book of Production Technology, P. C. Sharma, S.Chand Publications 2. A Text Book of Manufacturing Technology, R. K. Rajput, Laxmi Publications (p) LTD 3. A Text book of Manufacturing Technology, Metal Cutting and Machine Tools, P. N. Rao, Vol. 2, 2nd edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2002 4. Elements of Workshop Technology, Vol-II, S. K. Hajra Chaudhary, Media Promoters & Publications Pvt Ltd. 5. S. K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional			
Reference Books			
References Books: 1. Theory of Metal Cutting, M. C. Shaw, 1st Edition, Oxford and I.B.H. publishing, 1994 2. Jigs & Fixtures, P.H. Joshi, Third edition, McGraw Hill, 2017 3. Production Technology Manufacturing Systems VOL-I & II, R. K. Jain, Khanna Publishers 4. Production Technology –HMT, Tata McGraw Hill publication 5. An Expert Process Planning System, Chang, T. C., Addison Wesley Longman, 1990 6. Process Planning- Design/Manufacture Interface, Scallan P, Butterworth-Heinemann, 2003 7. CNC Machines, B. S. Pabla, M. Adithan, New Age International, 2018 8. Manufacturing Science, Amitabh Ghosh and AshokKumar Mallik, Affiliated East-West Press, 2010			

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	1	-	-	-	-	2	-	3	3	-	2
CO2	3	3	3	-	3	1	2	3	3	3	-	2
CO3	3	-	2	-	3	-	2	-	3	3	-	2
CO4	3	-	-	-	3	1	2	3	3	3	-	2
CO5	3	-	-	-	1	-	-	-	2	2	-	2
Average	3	2	3	-	3	1	2	3	3	3	-	2

Sr No	Tutorial Assignments	CO Mapped
1	Surface finishing , and Tapping operation by using simple programming	CO5
2	Manufacturing of Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques.	CO3



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List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments	CO Mapped
1	Various machining operation job on Lathe machine including, Facing, Liner-Taper turning, Threading, Grooving etc.	CO1,CO5
2	CNC programming for Lathe and VMC machine for Facing and Turning operation	CO2,CO4
3	Key way preparation by using slotting machine	CO5
Guidelines for Termwork Assessment		
<p>A) Tutorial Assessment : 25 Marks</p> <ol style="list-style-type: none">1. After completion of the unit in class room conduct 10 marks LMS Test.2. Maximum 10 questions in test and each question having 02 Marks weight age.3. Total 05 LMS test having 50 Marks4. Final marks for student to be converted into 5 marks.5. Two Assignments 10 Marks each. <p>Note: If student were absent for test conduct his/her test again through LMS or Offline mode and allot the marks.</p> <p>B) Term work Assessment: 25 Marks</p> <p>Term work assessment shall be based on the timely completion of jobs, quality of job, skill acquired, Completion of workshop diary and brief write-ups etc.</p> <p>Guideline for Term work assessment:</p> <ol style="list-style-type: none">1. Each laboratory assignments will be assessed for 30 marks according to following rubrics:<ol style="list-style-type: none">a. R1- Timely completion of assignments (10 Marks)b. R2-Understanding of assignments (10 Marks)c. R3- Presentation /Clarity of journal writing (10 Marks)<p>Example of R1</p><ol style="list-style-type: none">i) Decide the date for completion of Job/Assignment, if completion date is 14th date of month and student completed his/her job/assignment then allots the 10 Marks.ii) If student check/submit the job/assignment after the same date practical (14th date) and before or at the time of next practical (21st Date of month) then allots 5 marksiii) If students submitted or check the job/assignment after above mention date then allot 0 Marks.2. For machining operation/ job preparation allot the R2 based on quality of job and understanding about tool used and its process.3. For all 05 assignment/practical total marks of 150 will be converted into 50 Marks for student (Marks= 150/3)		



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<div>S.Y.B.Tech. (R&A/Mechanical) Pattern2023 Semester:IV 2300201D: Applied Mathematics</div>			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03hrs/week		03	Continuous ComprehensiveEvaluation: 20MarksInSem Exam: 20MarksEndSemExam:60 Marks
PrerequisiteCourses:-HigherSecondaryMathematics			
CourseObjectives: Find General solution of higher-order linear differential equation with constant & Variable coefficient using different Methods. Find Laplace transform and Fourier transform of functions using definition & properties & solve Ordinary D.E. using L.T. Recognize nature of vector fields, use different vector differential operators& able to evaluate Line, surface & Volume integrals & its application Solve boundary value problems for Laplace’s equation, heat equation, the wave equation by separation of variables. Find Laplace transform and Fourier transform of functions using definition & properties & solve Ordinary D.E. using L.T			
CourseOutcomes:On completion of the course, students will be able to–			
	CourseOutcomes		Bloom’sLevel
CO1	Understand basic concept of L.D.E, Fourier Transform, Laplace Transform, Statistics, Probability and Vector Calculus.		2-Understanding
CO2	Calculate Laplace transform, Fourier Transform, Directional Derivative, Line Integral and solution of L.D.E., P.D.E. using different Methods.		3-Apply
CO3	Apply Probability, Statistical methods and vector calculus to solve real life problems		
CO4	Calculate Laplace Transform and solution of LDE using MATLAB		3-Apply
CO5	Analyze real life problems by using concepts of LDE , statistics, probability and vector calculus		4-Analyze
COURSECONTENTS			
UnitI	Transforms	(08hr)	COs Mapped - CO1, CO2,CO3
LaplaceTransform(LT):LTofstandardfunctions,propertiesandtheorems,InverseLT,			



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Application of LT to solve LDE.

Fourier Transform (FT): Fourier transform, Fourier Sine & Cosine transform, Inverse Fourier Transforms.

Unit II	Linear Differential Equations with Constant Coefficient	(07 hrs)	COs Mapped - CO1, CO2
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LDE of nth order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous DE.

Unit III	Applications of Linear Differential Equations & Partial Differential Equations	(07 hrs)	COs Mapped CO1, CO2, CO5
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Modeling of Mass-spring systems, Free & Forced Damped and undamped systems. Basic concepts, method of separation of variables, modeling of Vibrating String, Wave equation, one- and two-dimensional Heat flow equations.

Unit IV	Statistics and Probability	(07 hrs)	COs Mapped - CO1, CO3, CO5
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Measures of central tendency, Measures of dispersion: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates. Probability, Probability distributions: Binomial, Poisson and Normal distributions

Unit V	Vector Calculus	(07 hrs)	COs Mapped - CO1, CO3, CO5
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Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoid and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stokes theorem.

Text Books

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Thomson Learning)

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.
2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), Pune Vidyarthi Griha Prakashan, Pune.
3. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).



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Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	2	-	-	-	-	-	-	3
CO3	3	2	-	2	2	-	-	-	-	-	-	3
CO4	3	2	2	3	2	-	-	-	-	-	-	3
CO5	3	-	-	-	2	-	-	-	-	-	-	3

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Tests on each unit using LMS (Each test for 15 M and total will be converted out of 05 M)	05
2	Problem solving through Computational Software	05
3	Tutorial (1 tutorial on each unit for 15 marks and total will be converted out of 05 M)	05
4	Group Presentation on real life problem	05

Topics for Tutorial		
Sr. No.	Title	CO Mapped
1	Examples on transforms	CO1, CO2, CO3
2	Examples on LDE of nth order with constant coefficients.	CO1, CO2
3	Examples on Applications of LDE & PDE	CO1, CO2, CO5
4	Examples on Statistics & Probability distributions.	CO1, CO3, CO5
5	Examples on Vector Calculus.	CO1, CO3, CO5



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S.Y. B.Tech			
Pattern-2023 Semester: IV (Mechanical Engineering)			
2305212 : Fluid Mechanics And Machines			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation:20MarksInSem Exam: 20MarksEndSem Exam: 60Marks
Pre requisite Courses ,if any: -Basics Mechanical Properties			
Course Out comes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Gain fundamental knowledge of fluid, its properties, and behavior Under various conditions of internal and external flows.		2-Understand
CO2	Develop an understanding of the hydrostatic law, principle of buoyancy, and stability of floating bodies, and apply mass, momentum, and energy equations in fluid flow		2-Understand
CO3	Imbibe basic laws and equations used for analysis of static and dynamic fluids		2-Understand
CO4	Determine the losses in a flow system and analyze flow through pipes.		3-Apply
CO5	Demonstrate hydraulic machines and understand their operation.		3-Apply
COURSE CONTENTS			
Unit I	Fluid Properties and Fluid statics	(08 hrs)	COs Mapped - CO1, CO2
Properties of fluids: Density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapors pressure, capillarity and surface tension. Fluid statics: Concept of fluid static pressure, absolute and gauge pressures. Pressure measurements by manometers, Hydro static forces on planes: center of pressure, buoyancy and floatation.			
Unit II	Fluid Kinematics	(07 hrs)	Cos Mapped - CO1,CO2,CO3
Fluid Kinematics: Classification and types of flow, velocity field and acceleration, continuity equation(one and three dimensional differential forms).Streamline ,streak line, path line, stream			



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Function, velocity potential function, flow net.			
Unit III	Fluid Dynamics	(07 hrs)	COs Mapped- CO1, CO2, CO3
Fluid dynamics: Equations of motion: Navier's stokes equation, Euler's equation along a stream line, Bernoulli's equation, flow measuring devices (venturi meter, orifice meter and Pitot tube).			
Unit IV	Analysis of Flow Through Pipes	(07 hrs)	COs Mapped - CO1, CO3, CO4
Reynold's experiment, laminar flow through circular pipe (Hagen poiseuille's), hydraulic and energy gradient, flow through pipes, Darcy – Weisbach's equation, friction factor, Moody's diagram, major and minor losses of flow in pipes, Boundary layer for external and internal flows, laminar and turbulent boundary layer displacement, energy and momentum thickness, Boundary layer separation and control, drag and lift forces.			
Unit V	Hydraulic Machines	(07 hrs)	COs Mapped- CO1, CO2, CO5
Basic equation of energy transfer, definition of impulse and reaction machines, Impact of jets, Classification of turbines and pumps, velocity triangles associated with turbine and pump, heads and efficiencies of turbines and pumps.			
Text Books			
1. Introduction to Fluid Mechanics- Fox, Pichard, McDonald, Wiley 2. Fluid Mechanics-F.M. White, TATA McGraw-Hill 3. Fluid Mechanics,-Dr.R.K. Bansal-Laxmi Publication(P) Ltd. New Delhi 4. Fluid Mechanics,-Cengel & Cimbala, TATA McGraw-Hill 5. Hydraulics and Fluid Mechanics- Modi P.N. and Seth S.M, Standard Book House 6. Fundamentals of Fluid Mechanics-Munson, Young and Okiishi, Wiley India 7. Fluid Mechanics-Potter Wiggert, Cengage Learning			
Reference Books			
1. Fluid Mechanics-Kundu, Cohen, Dowling, Elsevier India 2. Fluid Mechanics-Chaim Gutfinger David Pnueli, Cambridge University press. 3. Introduction to Fluid Mechanics- Edward Shaughnessy, Ira Katz James Schaffer, OXFORD University Press			



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Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Any Three Assignments on unit-1, Unit-2, Unit-3, Unit-4, Unit-5	10
2	Online and offline test	10
	Total	20

Strength of CO-PO/PSO Mapping														
	PO												PSO	
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	1	-	-	-	-	1	1	1	-	2	2	-
CO 2	3	2	1	-	-	-	-	1	1	1	-	2	2	-
CO 3	3	2	1	-	-	-	-	1	1	1	-	2	-	-
CO 4	3	2	1	-	1	-	-	1	1	1	-	2	2	-
CO 5	3	2	1	-	1	-	-	1	1	1	-	2	2	-
Avg	3	2	1	-	1	-	-	1	1	1	-	2	2	-



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S. Y. B. Tech.			
Pattern 2023Semester: IV (Mechanical Engineering)			
2305213 :Solid Mechanics			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Courses, if any: - Engineering Mechanics, Mathematics I & II, Fundamentals of Mechanical Engineering			
Course Objectives: <ul style="list-style-type: none">Understand the various types of stresses in machine membersUnderstand the beam theory with various load and support conditionsUnderstand the concept of complex stressesUnderstand the torsion and Buckling phenomenon			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Use the concepts of simple stresses, strains for the analysis of machine members and structures.		3 - Apply
CO2	Draw Shear force and Bending Moment Diagram		3 - Apply
CO3	Apply the concepts of Bending and Shearing stresses for Beams		3 - Apply
CO4	Determine Slope and deflection of beams & Buckling of columns		3 - Apply
CO5	Apply the concept of Principal stresses and Torsion		3 - Apply
COURSE CONTENTS			
Unit I	Simple stresses and strains	(8 hrs)	COs Mapped - CO1
Overview of Material Properties, Bulk Modulus. Interrelation between elastic constants, factor of safety, Stresses and strains in determinate and indeterminate structures, homogeneous and composite bars under concentrated loads. Thermal stresses			
Unit II	Shear Force and Bending Moment Diagrams	(7hrs)	COs Mapped – CO2
Shear force and bending moment diagrams for Simply supported & Cantilever beams for Point load, UVL, UDL & Couple, Maximum bending moment and position of points of contra flexure.			
Unit III	Stresses in Machine Elements	(7hrs)	COs Mapped – CO2
Bending stresses : Theory of simple bending, flexural formula, Shear stresses: Shear stress distribution formula & distribution diagrams for common symmetrical sections			
Unit IV	Slope and deflection of beams & Buckling of columns	(7hrs)	COs Mapped – CO2, CO3
Slope and deflection of determinate beams, Macaulay's method, slope and deflection for standard cases.			



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Buckling of columns: Euler's formula, Rankine's formula, safe load on columns			
Unit V	Principal stresses and strains, Torsion	(7hrs)	COs Mapped – CO3
Expression for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear, Graphical solution using Mohr's circle of stresses. Torsion equation, Basic Numerical on Torsion Equation			
Text Books			
1. R. K. Bansal, "Strength of Materials", Laxmi Publication 2. S. Ramamrutham, "Strength of material", DhanpatRai Publication 3. S.S. Rattan, "Strength of Material", Tata McGraw Hill Publication Co. Ltd. 4. Punmia and Jain, "Mechanics of Materials", Laxmi publications 5. Singer and Pytel, "Strength of materials", Harper and row Publication 6. R. C. Hibbeler, "Mechanics of Materials", Prentice Hall Publication			
Reference Books			
1. Egor. P. Popov, "Introduction to Mechanics of Solids", Prentice Hall Publication 2. Gere and Timoshenko, "Mechanics of Materials", CBS Publishers 3. Beer and Johnston, "Strength of materials", CBS Publication 4. James M. Gere, "Mechanics of Materials", CL Engineering 5. Timoshenko and Young, "Strength of Materials", CBS Publication, Singapore			

Strength of CO-PO/PSO Mapping														
	PO												PSO	
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO 2	3	3	2	-	-	1	-	1	-	-	-	2	2	-
CO 3	3	3	2	-	-	1	-	1	-	-	-	2	2	-
CO 4	3	3	2	-	-	1	-	1	-	-	-	2	2	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	2	2	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One Assignment on each unit	10
2	Online or Offline Test on Each Unit	10
	Total	20



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S.Y. B. Tech. Pattern2023 Semester: IV (Mechanical Engineering) 2305214 : Fluid Mechanics and Machines Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02hrs/week	01	Term work: 25 Marks Oral : 25Marks
Prerequisite Courses ,if any: -		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Explain fundamentals of fluid properties, pressure measurement and fluid statics	3-Apply
CO2	Apply governing equation Bernoulli's Equation and applications of fluid momentum mechanics equation i.e. for Continuity equation, different fluid flow	3-Apply
CO3	Analyze the losses in fluid flow systems.	3-Apply
CO4	Demonstrate hydraulic machines.	3-Apply

List of Laboratory Experiments (Any Eight)		
Sr. No.	Laboratory Experiments	CO Mapped
1	Determination of pressure using manometers.	CO1
2	Determination of fluid viscosity and its variation with temperature	CO1
3	Determination of Metacentric height of floating object	CO1
4	Determination of Reynolds number and flow visualization of laminar and turbulent flow using Reynolds apparatus.	CO2
5	Verification of modified Bernoulli's equation	CO2
6	Calibration of Orifice meter / Venturimeter	CO2
7	Determination of minor/major losses through metal/non-metal pipes	CO3



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8	Study of Impact of Jet / Turbine / Pump.	CO4
9	Case study on CFD	CO3,CO4
Guidelines for Laboratory Conduction		
1. Teacher will brief the given experiment to students its procedure, observations calculation, and outcome of this experiment. 2. Apparatus and equipment's required for the allotted experiment will be provided by the lab assistants using SOP. 3. Students will perform the allotted experiment in a group (two students in each group) under the supervision off faculty and lab assistant. 4. After performing the experiment students will check their readings, calculations from the teacher. 5. After checking they have to write the conclusion of the final result.		
Guidelines for Student's Lab Journal		
Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.		
Guidelines for Term work Assessment		
1. Each experiment from lab journal is assessed for thirty marks based on three rubrics. 2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.		

Strength of CO-PO/PSO Mapping														
	PO												PSO	
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2	-	-	-	-	1	1	1	-	2	2	1
CO 2	3	2	2	-	-	-	-	1	1	1	-	2	2	1
CO 3	3	2	2	-	-	-	-	1	1	1	-	2	2	1
CO 4	3	2	2	-	1	-	-	1	1	1	-	2	2	1
AVG	3	2	2	-	1	-	-	1	1	1		2	2	1



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S. Y. B. Tech. Pattern 2023 Semester: IV (Mechanical Engineering) 2305215: Geometric Modeling and Production Drawing			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Practical: 04 hr / week		02	Term work: 50 Marks Practical: 50 Marks
Prerequisite Courses: - Systems in Mechanical Engineering, Engineering Graphics, Engg. Math I & II			
Course Objectives: To understand basic concepts of 3D modeling and to create geometric models and assemblies of simple engineering components. The student should be able to employ their knowledge to create more complicated models. To read, understand and explain basic Geometric Dimensioning & tolerancing concepts. To apply various geometric and dimension tolerances based on type of fit To create engineering drawings, design documentation and use in manufacturing activities. To ensure that the components of the assembly fit together properly, without excessive clearance or interference.			
Course Outcomes			Bloom's Level
CO1	READ the Industrial drawing to understand standard industrial practices.		2- Understanding
CO2	CONSTRUCT solid models, assemblies of real life components using various modeling techniques		3- Apply
CO3	APPLY geometric and dimensional tolerance, surface finish symbols in production drawing		3- Apply
CO4	Apply geometrical & dimensional tolerance using suitable software to mechanical component		3- Apply
COURSE CONTENTS			
Part A			
I	Assignment on parametric solid modeling of a machine component.	(04hrs)	COs Mapped – CO1, CO2
Introduction to parametric solid modeling, Introduction to the CAD software interface, basic drawing tools, sketching techniques, Introduction to 2D sketching techniques, apply/modify constraints and dimensions, and geometric relations in creating 2D profiles of the machine component, transform the parametric 2-D sketch into a 3D solid, feature operations.			
II	Assembly modeling of the parts modeled in Practical assignment-1 using proper assembly constraint conditions and generation of exploded view for assemblies	(04 hrs)	COs Mapped – CO1, CO2
Assembly modeling – defining relationship between various parts of machine, creation of			



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constraints, generation of exploded view			
III	Generation of production drawings of the parts and assembly with appropriate tolerance.	(04 hrs)	COs Mapped – CO2, CO3, CO4
Production drawing – generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning, tolerancing and symbols			
Part B			
I	Assignment I : Limits Fits and Tolerances Assignment II : Calculation of Tolerances based on Type of Fits in Assembly	(06hrs)	COs Mapped – CO1,CO3
Limits, Fits, Dimensional Tolerances, Geometric Tolerances, calculate tolerances based on the type of fit required for an assembly.			
II	Study and reading of Industrial Drawings to understand standard industrial procedure Assignment III : Study and use of geometrical tolerances in production drawing Assignment IV : Student has to draw a A2 size drawing sheet for a mechanical component, including dimensional and geometrical tolerances. Assignment V : Student has to show tolerances and fits in production drawing using suitable software for any mechanical system.	(06 hrs)	COs Mapped – CO4, CO5
Introduction to ASME Y14.5-2018, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, runout, profile, true position, parallelism, orientation, GD &T, Surface finish, Welding symbols			
Text Books			
1. Bhatt, N. D. and Panchal, V. M., (2014), “Machine Drawing”, Charotar Publishing House Pvt. Ltd, Anand, India, ISBN-13: 978-9385039232 2. Ajeet Siingh, “ Machine Drawing”, Mc Graw Hill Publications, New Delhi 2012 3. Narayana, K. L., Kannaiah, P., Venkata Reddy, K., (2016), “Machine Drawing”, 2nd edition, New Age International Publishers, New Delhi, India, ISBN-13: 978-8122440546 4. Chang, Kuang-Hua, (2015), "e-Design: Computer-Aided Engineering Design", Academic Press, ISBN-13: 978-0123820389			
Reference Books			
1. Cogorno, G. R., (2020), "Geometric Dimensioning and Tolerancing for Mechanical Design", 3rd edition, McGraw-Hill Education 2. Blokdyk, Gerardus, (2019), "Geometric Dimensioning and Tolerancing: A Complete Guide - 2020 Edition", 5STARCOoks			
Codes / Handbooks			
Standards: ASME Y14.5 – 2018			
Standards: ISO/TR 23605:2018, ISO 1101:2017, SP 46, IS 15054(2001)			
e resources			



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- 1 <https://geotol.com/resources/>
- 2 <https://www.sae.org/learn/professional-development/gdt>

Useful websites / Video

- 1 <https://nptel.ac.in/courses/112/102/112102102/>
- 2 <https://nptel.ac.in/courses/112/103/112103019/>
- 3 <https://nptel.ac.in/courses/112/106/112106179/>
- 4 <https://youtu.be/0IgOapAtauM>
- 5 <https://youtu.be/aS9OgYadjpY>

	Strength of CO-PO/PSO Mapping															
	PO												PSO			
Strength Of CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO 1	3	2	-	-	-	-	-	1	-	2	-	2	-	2		
CO 2	3	2	-	-	3	-	-	-	-	2	-	2	-	2		
CO 3	3	2	-	-	-	-	-	-	-	2	-	2	-	2		
CO 4	3	2	-	-	3	-	-	1	-	2	-	2	-	2		
Avg	3	3	-	-	3	-	-	1	-	2	-	2	-	2		

Guidelines for Tutorial / Termwork Assessment		
Sr. No.	Components for Termwork Assessment	Marks Allotted
1	Assignment on Geometric Modeling	20
2	Assignments on Production Drawing (Each assignment carries 30marks) R1- Timely completion of assignments (10 Marks) R2- Understanding of assignment (10 Marks) R3 – Presentation/Clarity of journal writing (10 Marks) For all 5 Assignment total marks will be converted into 30 Marks.	30
Practical Exam		
Sr. No.	Components for Practical Exam	Marks Allotted
1	Geometric Modeling	40
2	Production Drawing (One numerical on Tolerance Calculation)	10



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S.Y. B. Tech.			
Pattern 2023 Semester IV (Mechanical Engineering)			
2305216:Machine Intelligence			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory:03 Hrs/week		03	Continuous Comprehensive Evaluation:20Marks In Sem Exam: 20 Marks End SemExam:60 Marks
Prerequisite Courses:-Engineering Mathematics, Linear Algebra, Probability, Basic Statistics			
Course Objectives:			
1. UNDERSTAND the fundamentals of Artificial Intelligence and Machine Learning.			
2. APPLY Feature Extraction and Selection techniques to process datasets.			
3. APPLY fundamental of classification and regression algorithms.			
4. DEMONSTRATE the ability to develop machine learning models by outlining and executing essential steps, emphasizing practical application in mechanical engineering contexts.			
5. EXPLORE the concepts of reinforced and deep learning, digital twin and Transfer learning.			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	APPLY fundamental principles of Artificial Intelligence and Machine Learning.		2-Understanding
CO2	EXPLORE emerging technologies in solving engineering problems using Machine Learning.		2-Understanding
CO3	APPLY feature extraction and selection techniques to preprocess the given dataset		3-Apply
CO4	DEMONSTRATE classification and regression Algorithms in the context of mechanical engineering, enabling them to choose and implement suitable solutions		3-Apply
CO5	DEVELOP machine learning models, to address complex problems in mechanical engineering by following systematic and well-defined steps.		4-Analyze
COURSECONTENTS			
UnitI	Introduction to AI & ML	(08 hrs)	COs Mapped -CO1
Introduction to AI- Definition and history of AI, Comparison of AI with Data Science and Machine learning Basics of AI: Reasoning, Knowledge representation, Planning, Learning, Perception, Motion and manipulation. Approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Ethical considerations in AI, Societal Impact and Responsible AI			
Introduction to Machine Learning.			
Approaches to ML: Supervised learning, Unsupervised learning, Reinforcement learning.			
UnitII	Feature Engineering	(07 hrs)	Cos Mapped –CO3



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Feature selection: Filter Method, Wrapper Method, Embedded Methods, Greedy forward & backward methods, feature Ranking techniques, Decision tree Feature extraction: Statistical features, Principal Component Analysis. (Numerical based on Statistical features and PCA)			
Unit III	Machine Learning Algorithms	(07 hrs)	Cos Mapped –CO4
Classification: Decision tree- Entropy reduction and information gain, Random Forest, Naive Bayes, Support vector machine. (Numerical based on Decision tree using IG and Bays theorem only) Regression: Logistic Regression, K-Means, K-Nearest Neighbor (KNN), Time series forecasting Algorithms (ARIMA, SARIMA, LSTM)			
Unit IV	Development of Machine Learning Model	(07 hrs)	COs Mapped – CO4, CO5
Problem identification: classification, clustering, regression, ranking. Steps in ML modeling, Data Collection, Data pre-processing, Model Selection, Model training (Training, Testing, K-fold Cross Validation), parameters for Model evaluation of classification and regression algorithms (confusion matrix, Accuracy, Precision, Recall, True positive, false positive etc.), Hyper parameter Tuning. Introduction to Artificial Neural Network, Convolution Neural Network.			
Unit V	Introduction to Emerging Technologies	(07 hrs)	COs Mapped –CO2
Characteristics of reinforced learning Algorithms: Value Based, Policy Based, Model Based; Positive vs Negative Reinforced Learning Models, Markov Decision Process, Deep Learning, Introduction to digital twin (Definition, Components, Characteristics, Applications) and basics of Transfer Learning. Application of Artificial Intelligence and Machine Learning			

Text Books
1. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020. 2. Parag Kulkarni and Prachi Joshi, “Artificial Intelligence – Building Intelligent Systems”, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
ReferenceBooks
1. Stuart Russell and Peter Norvig (1995), “Artificial Intelligence: A Modern Approach,” Third edition, Pearson, 2003. 2. Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018. 3. Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018. 4. Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.



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Strength of CO-PO Mapping														
CO	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	-	-	2	-	1	-	-	-	2	-	-
CO2	3	-	1	2	-	2	-	-	2	2	-	2	-	-
CO3	3	3	1	2	-	-	-	-	2	2	-	2	2	-
CO4	3	3	2	2	-	-	-	-	2	2	-	2	2	-
CO5	3	3	2	2	-	-	-	-	2	2	-	2	2	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Assignment on each unit	10
2	Test (Online/Offline) on each unit	10



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S.Y. B. Tech. Pattern 2023 Semester: IV Mechanical Engineering 2305217:Machine Intelligence Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical:02hrs/week	01	Term work:25 Marks Oral:25 Marks
Prerequisite Courses:- Engineering Mathematics, Linear Algebra, Probability, Basic Statistics		
Course Objectives: <ol style="list-style-type: none">1. UNDERSTAND the fundamentals of Artificial Intelligence and Machine Learning.2. APPLY Feature Extraction and Selection techniques to process datasets.3. APPLY fundamental of classification and regression algorithms.4. DEMONSTRATE the ability to develop machine learning models by outlining and executing essential steps, emphasizing practical application in mechanical engineering contexts.5. EXPLORE the concepts of reinforced and deep learning, digital twin and Transfer learning.		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	APPLY fundamental principles of Artificial Intelligence and Machine Learning.	2-Understanding
CO2	EXPLORE emerging technologies in solving engineering problems using Machine Learning.	2-Understanding
CO3	APPLY feature extraction and selection techniques to preprocess the given dataset	3-Apply
CO4	DEMONSTRATE classification and regression Algorithms in the context of mechanical engineering, enabling them to choose and implement suitable solutions	3-Apply
CO5	DEVELOP machine learning models, to address complex problems in mechanical engineering by following systematic and well-defined steps.	4-Analyze

List of Experiments		
Sr. No.	Title	CO Mapped
1	To Visualize and analyze the Mechanical Engineering domain dataset	CO1
2	To Evaluate Statistical Features from given dataset	CO1, CO3
3	To apply feature selection and Extraction techniques to given dataset	CO1, CO3, CO4
4	To develop classification model and evaluate its performance	CO1, CO3, CO4,CO5



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5	To develop regression model and evaluate its performance	CO1, CO3, CO4, CO5
6	To Develop ANN Model and evaluate its performance	CO1, CO3, CO4, CO5
7	To Develop Deep learning model for Image-based dataset	CO1, CO2, CO4, CO5

Text Books

B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
Parag Kulkarni and Prachi Joshi, “Artificial Intelligence – Building Intelligent Systems”, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015

Reference Books

Stuart Russell and Peter Norvig (1995), “Artificial Intelligence: A Modern Approach,” Third edition, Pearson, 2003.
Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018.
Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.

Strength of CO-PO Mapping

CO	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	2	2	-	-	1	2	2	-	2	-	-
CO2	3	3	1	2	2	-	-	1	2	2	-	2	-	-
CO3	3	3	1	2	2	-	-	1	2	2	-	2	2	-
CO4	3	3	1	2	2	-	-	1	2	2	-	2	2	-
CO5	3	3	1	2	2	-	-	1	2	2	-	2	2	-

Guidelines for Term work Assessment

Sr. No.	Components for Term work Assessment	Marks Allotted
1	Presentation in group of 2-3 students on unit No. IV and V	5
2	Experiment(Each Experiment carries 30 marks) R1- Timely completion of assignments (10 Marks) R2- Understanding of assignment (10 Marks) R3 – Presentation/Clarity of journal writing (10 Marks) For all Experiments total marks will be converted into 20 Marks.	20



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Second Year B. Tech.			
Pattern: 2023		Semester: IV (Mechanical Engineering)	
2305218: Industrial Psychology and Organizational Behaviour			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Lecture: 02 hr / week		02	CCE: 50
Prerequisite Courses: - Industrial Management, Professional Ethics			
Course Objectives:			
1. To align the students to the application of principles of psychology in an industrial and organizational workplace.			
2. To demonstrate the understanding of job requirement and related fatigue, boredom and ways to handle it.			
3. To develop the insights into performance management and understanding related improvement strategies.			
4. To have an understanding of human behavior in groups and develop knowledge and skills in leadership, power, communication, negotiation and conflict management.			
5. To develop the expertise to understand the organizational culture, change management and organizational development.			
	Course Outcomes		Bloom's Level
CO1	Understand the importance of psychology in industry, various aspects of team, leadership and conflict management and organizational behavior.		2- Understand
CO2	Discuss the organizational culture, Theories and understands organizational development approaches		2- Understand
CO3	Demonstrate fundamental knowledge about need and scope of industrial -organizational psychology and behavior.		3- Apply
CO4	Illustrate the industrial fatigue, boredom and steps to improve the job satisfaction		3- Apply
COURSE CONTENTS			
I	Industrial Psychology	(05 hrs)	COs Mapped – CO1, CO3
Introduction to Industrial Psychology, Brief History of Industrial Psychology, Nature, Scope and Problems, psychology as a science and areas of applications, Individual differences and their evaluation, Role of heredity and environment, study of behavior and stimulus to response behavior, Types of individual differences, Scientific management and it's limitations. Hawthorne Studies			
II	Industrial Fatigue and Industrial Boredom	(05 hrs)	COs Mapped – CO1, CO3, CO4
Industrial Fatigue: Introduction, Concept and Meaning, Types of Industrial Fatigue, Causes of			



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Fatigue, Contents, Fatigue Symptoms, Industrial Studies on Fatigue, Causes and Remedies of Industrial Fatigue, Effects of Industrial Fatigue Industrial Boredom: Introduction, Concept and Meaning, Causes and Remedies of Boredom, Effects of Boredom, Reducing Boredom			
III	Organizational Behavior and Group Behavior	(05 hrs)	COs Mapped – CO1, CO2, CO3
Concept of organization & organizational behavior, Organizational structure, factors affecting behavior in organizations Group Behavior: Groups: Concept and Classification, Stages of Group Development, Group Structure, Roles and Norms, Premise and Issues. Group Decision-Making: Group vs Individual, Groupthink and Groups Shift, Group Decision Making Techniques and Process Team work: meaning, concept, types, creating, an effective team Leadership: Functions and approaches; trait, behavioral and contingency models; characteristics of successful leaders; role of power in leadership			
IV	Organizational Culture	(05 hrs)	COs Mapped – CO1, CO2, CO3
Organizational Culture: Concept, Dominant Culture, Strong vs Weak Cultures, Creating and Sustaining Culture, Employees Learning of the Culture, Creating a Customer-Responsive Culture. Organizational theory and development: Organizational Theory: Classical Organizational Theory, Humanistic Theory, Open-System Theory			
V	Organizational Development	(04 hrs)	COs Mapped – CO1, CO2
Organizational development: Need, models of Organizational change, Organizational development interventions Organizational Changes: Concept and Forces for Change, Managing Planned Changes, Resistance to Change, Approaches to Manage Organizational Change			
Text Books			
1. Vikram Bisen and Priya, Industrial Psychology, New Age Publication, 2010. 2. Michael Aamodt, Organizational/ Industrial Psychology, Wadsworth Cengage Learning, 2010 3. Robbins, S.P. Organizational Behaviour. Prentice-Hall, latest edition. 4. Spector, P.E. Industrial and Organizational Psychology: Research and Practice. International Student Version. Latest Edition. Wiley. 5. Davis K. & Newstrom J.W., Human Behaviour at work, McGraw Hill International, 1985 6. Stephen P. Robbin & Seema Sanghi, Organizational behavior, Pearson, 2011 7. L.M. Prasad, Organizational behavior, S Chand & sons			
Reference Books			
1. Blum M.L. Naylor J.C., Horper & Row, Industrial Psychology, CBS Publisher 2. Luthans Fred, Organizational Behaviour, McGraw Hill International. 3. Morgan C.t., King R.A., John Rweisz & John Schoples, Introduction to Psychology, McHraw			



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Hill, 1966.

4. Schermerhorn J.R.Jr., Hunt J.G & Osborn R.N., Managing, Organizational Behaviour, John Willy.

5. Arnold J., Robinson, Iran, T. and Cooper, Cary L, Work Psychology, Macmillan India Ltd.

6. Muchinsky (2009). Psychology applied to work. New Delhi: Cengage.

7. Griffin, Ricky W: Organizational Behaviour, Houghton Mifflin co., Boston.

8. Ivancevich; John and Micheel T. Matheson, Organizational Behaviour and Management, Tata McGraw-Hill, New Delhi.

9. Newstrom, John W. and Keith Davis: Organizational Behavior: Human Behavior at Work, Tata McGraw-Hill, New Delhi.

Program Outcome (PO) and Program Specific Outcome (PSO)

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2
2305219.1	1	-	-	-	-	2	2	2	2	-	2	1	-	-
2305219.2	1	-	-	-	-	2	2	2	-	-	1	1	-	-
2305219.3	1	-	-	-	-	2	2	2	-	-	1	1	-	-
2305219.4	1	-	-	-	-	2	2	2	-	-	1	1	-	-
Avg.	1	-	-	-	-	2	2	2	2	-	1	1	-	-
Level	1	-	-	-	-	2	2	2	2	-	1	1	-	-



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S. Y. B. Tech.			
Pattern 2023 Semester: IV (Mechanical Engineering)			
2305219 : Democracy Election and Governance			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Tutorial :02 hrs/week		02	Tutorial : 50 Marks
Prerequisite Courses, if any: -Social Sciences			
Course Objectives			
1 To introduce the students meaning of democracy and the role of the governance			
2.To help them understand the various approaches to the study of democracy and governance			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Understand the concepts of social, economic and political democracy within the ideological framework relied upon by the framers of the Constitution of India		2-Understand
CO2	Analyse the rights and duties specified under the Constitution of India		3-Apply
CO3	Apply constitutional values to ensure just, equitable and secure environment for the protection of human rights, liberty and balancing the interests of the individuals and society at large		3-Apply
CO4	Develop an understanding of the role of institutions in their day to day life through introduction to the concepts of decentralization introduced via constitutional amendments		3-Apply
CO5	Analyze the effectiveness of governmental policies and programmes through exposure to governance theories		4-Analyze
COURSE CONTENTS			
Unit I	Democracy- Foundation and Dimensions, Elections	(08hrs)	COs Mapped - CO1
Constitution of India Evolution of Democracy- Different Models Dimensions of Democracy- Social, Economic, and Political			
Unit II	Decentralization	(08hrs)	COs Mapped - CO1, CO2
Indian tradition of decentralization History of panchayat Raj institution in the lost independence period 73 rd and 74 th amendments			



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Challenges of caste, gender, class, democracy and ethnicity			
Unit III	Governance	(08 hrs)	COs Mapped - CO1, CO2, CO3
Meaning and concepts Government and governance Inclusion and exclusion			
Text Books			
Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press. Basu, D. D. (1982). Introduction to the Constitution of India. Prentice Hall of India. Bhargava, R. (2008). Political theory: An introduction. Pearson Education India			
Reference Books			
1 Guha, R. (2007). India After Gandhi: The History of the World's Largest. Democracy, HarperCollins Publishers, New York. 2. Guha, R. (2013). Gandhi before India. Penguin UK. 3. Jayal. N.G. (2001). Democracy in India. New Delhi: Oxford University Press.			

Strength of CO-PO/PSO Mapping														
Strength of COs	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	-	-	-	-	-	3	-	3	3	2	-	-	-	-
CO 2	-	-	-	-	-	3	-	3	3	2	-	-	-	-
CO 3	-	-	-	-	-	3	-	3	3	2	-	-	-	-
CO 4	-	-	-	-	-	3	-	3	3	2	-	-	-	-
CO 5	-	-	-	-	-	3	-	3	3	2	-	-	-	-
Avg	-	-	-	-	-	3	-	3	3	2	-	-	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One Assignments on Unit-1, Unit-2, Unit-3	30
2	Oral Presentation	20
	Total	50



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S. Y. B. Tech. Pattern 2023 Semester: IV (Mechanical Engineering) 2305220 : Soft Skills		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial : 1hr/week Practical: 02hrs/week	01 01	Tutorial : 25 Marks Term work: 25 Marks
Prerequisite Courses, if any: ---- Communication Skills		
Course Objectives: 1. To highlight the need to improve soft skills among engineering students so as to become good professionals. 2. To facilitate a holistic development of students by enhancing soft skills. 3. To develop and nurture the soft skills of the students through individual and group activities. 4. To expose students to right attitudinal and behavioural aspects and assist in building the same through activities.		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Develop effective communication skills including Listening, Reading, Writing and Speaking	3-Apply
CO2	Practice professional etiquette and present oneself confidently.	3-Apply
CO3	Function effectively in heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.	3-Apply
CO4	Use Time management and Stress management skills.	3-Apply
CO5	Constructively participate in group discussion, meetings and prepare and deliver Presentations.	3-Apply

COURSE CONTENTS			
Unit I	Communication Skills	(4 hrs)	COs Mapped- CO1, CO2, CO5
Importance of communication, Barriers in communication and how to overcome these barriers, Significance of non-verbal messages as augmentation to verbal communication, Group Discussion, Listening Vs Hearing, Reading to comprehend, Learning to skim and scan to extract relevant information			
Unit II	Team building and Team work	(2 hrs)	COs Mapped- CO3, CO5
Team building, Team Work, Skills needed for Team Work, Aspects of Team building, Model of Team building, Role of a Team leader, Intergroup collaboration			
Unit III	Etiquettes and manners	(2 hrs)	COs Mapped- CO2
Corporate grooming and dressing, Email and Telephone etiquettes, Etiquettes in social and office setting			
Unit IV	Time management	(2 hrs)	COs Mapped- CO4
The 80-20 rule, Features of time, Time management matrix, Successful time management, Difficulties in time management, Time wasters, Time savers			



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Unit V	Stress management	(2 hrs)	COs Mapped- CO4
Stress, Eustress, Distress, Effects of stress, Kinds of stress, Sources of stress, Behaviour identified with stress, Signs of stress			

List of Laboratory Experiments			
Sr. No.	Laboratory Experiments / Assignments		COs Mapped
1	Literature Survey	Student should read research papers and write the Literature Survey	CO1
2	Story telling / Case Study	Every student will get 5 minutes, to share a fictional or real life story related to technology.	CO1,CO2
3	Group activity/Teamwork activity	The batch will be divided into groups of 4-5 students. For each group same activity (like preparation of drama, skit, play etc.) will be assigned. Maximum 30 minutes should be given to each group, simultaneously, to plan the activity. After 30 minutes, every group will get 10 minutes to present their work. At the end, there will be discussion between teacher and students, about things necessary for successful Teamwork, problems faced by students during teamwork etc.	CO1,CO3,CO5
4	Presentation Skills	Every student will have to choose a topic of his/her choice and make a 10-minute presentation using audio-video aids / PPT. Every student will make presentation on either technical or non-technical topic. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively.	CO1,CO2
5	Group Discussion	The batch will be divided into groups of 6-7 students for a discussion lasting 15 minutes. Topics should be provided by teachers. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only	CO1,CO3,CO5
6	Reviewing an Editorial article	Either by using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor's perspective is and what the student's perspective is. (10 minutes for each student to share author's perspective and their own perspective.)	CO1,CO2
7	Listening Skills	Listening Worksheets will be distributed among students. Each student will be given specifically designed	CO1,CO2



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		worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines)	
8	Time Management	Use Pomodoro Technique. Write your experience about it. (Self study)	CO1,CO4
9	Stress Management	Discuss stress management. Ask students about, What do they do to relieve stress?	CO1,CO4
10	Swayam/NPTEL course	Every student should complete at least one Swayam / NPTEL course on Soft Skills or Personality development.	CO1,CO2,CO3, CO4,CO5

Guidelines for Laboratory Conduction

The teacher may design specific assignments that can highlight the learning outcomes of each unit. Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students. Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment. Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor / facilitator at the end of the activity should learn towards encouraging students to work on improving their skills. Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills – e.g. Team Building Activity can highlight ‘open communication’, ‘group discussion’, ‘respecting perspectives’, ‘leadership skills’, ‘focus on goals’ which can help students improve their inherent interpersonal skills.

Guidelines for Student's Lab Journal

Each student should have a Lab Workbook (sample workbook attached) which outlines each lab activity conducted. The student must respond by writing out their learning outcomes and elaborating the activities performed in the lab., group discussion, group exercises and interpersonal skills and similar other activities/assignments.

Guidelines for Term work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities.

Text Books



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1. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills – An Integrated Approach to Maximize Personality”, Wiley India, ISBN:13:9788126556397
2. Simon Sweeney, “English for Business Communication”, Cambridge University Press, ISBN 13:978- 0521754507

Reference Books

1. Indrajit Bhattacharya, “An Approach to Communication Skills”, Delhi, Dhanpat Rai, 2008
2. Sanjay Kumar and Pushpa Lata, “Communication Skills”, Oxford University Press, ISBN 10:9780199457069
3. Business Communication & Soft Skills, McGraw Hill Education.
4. Atkinson and Hilgard, “Introduction to Psychology”, 14th Edition, Geoffrey Loftus, ISBN-10:0155050699, 2003.
5. Kenneth G. McGee, “Heads Up: How to Anticipate Business Surprises & Seize Opportunities First”, Harvard Business School Press, Boston, Massachusetts, 2004, ISBN 10:1591392993
6. Krishnaswami, N. and Sriraman T., “Creative English for Communication,” Macmillan

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-