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

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)

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													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
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	-

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**

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

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**

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 andVapour Power Cycle**	**(07hrs)**	**COs Mapped - CO1, CO2,CO3**

Ideal Gas properties

Ideal Gas definition, Gas Laws: Boyle's law, Charle'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**

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**

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

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	Assignments on Unit-1, Unit-2, Unit-3, Unit-4 & Unit-5	10
2	Online or Offline Test on Each Unit	10
	Total	**20**

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

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:

To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.

To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.

To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.

To develop the competency to understand & apply the principles of gear theory to design various applications.

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 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 Arnolde 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
CO1	3	3	2	2	1	-	-	-	2	-	-	1
CO2	3	3	2	2	-	-	-	-	2	-	-	1
CO3	3	2	-	2	1	-	-	-	1	-	-	1

CO4	3	3	2	2	-	-	-	-	1	-	-	2
CO5	3	2	2	2	1	-	-	-	2	-	-	2
Average	3	3	2	2	1	-	-	-	2	-	-	1

Components for Continuous Comprehensive Evaluationof Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments on Unit-1, Unit-2, Unit-3,Unit- 4, Unit-5	10
2	Online or Offline Test on Each Unit	10
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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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**	**Termwork: 25Marks** **Oral: 25Marks**

Prerequisite Courses, if any: - Fundamentals of Mechanical Engineering, Engineering Mechanics, Engineering Mathematics I & II, Engineering physics

Course Objectives:

To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.

To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.

To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.

To develop the competency to understand & apply the principles of gear theory to design various applications.

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 pole and inversion method with three accuracy points.	**CO1, CO3**
7	To study manufacturing of gear using gear generation with rack as a	**CO1, CO4**

	cutter and to generate an involute profile.	
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 Arnolde 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

Strength of CO-PO Mapping

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

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

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:

- 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,

1. Hardness measurement on Brinell hardness testing machineand 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.
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", TataMcGraw 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. ASTME, Handbook of Industrial Metrology, Prentice Hall of India Ltd.
10. Connie Dotson, Fundamentals of Dimensional Metrology, ThamsonPubln. 4th Edition.

Codes / Handbooks

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

E- resources

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)**		
Each laboratory assignment will be assessed for 30 Marks according to the following rubrics: R1- Timely completion of assignments (10 Marks) R2- Understanding of assignment (10 Marks) R3 – Presentation/Clarity of journal writing (10 Marks) For all 10 Experiments, total marks of 300 will be converted into 25 Marks.		
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.

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

To understand basics of IC Engines and analyze air standard cycles associated with it

. To evaluate various performance parameters of engines, compare combustion and identify appropriate emission control technologies in SI and CI engines

. To understand components and technologies used in electric and hybrid electric vehicles

. 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	2-Understand, 4- Analyze
CO2	**Compare** combustion and **identify** appropriate emission control technologies in SI and CI engines, **Calculate** various performance parameters of engines	2-Understand, 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, 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 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, Richard Stobart, 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**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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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
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 in the context of mechanical engineering.
2. To develop students' understanding of production planning, scheduling, and control techniques used in industrial settings.
3. To equip students with knowledge of quality management systems and techniques for enhancing productivity and efficiency in manufacturing.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	To apply industrial management principles to analyze and optimize manufacturing processes.	3
CO2	To analyze skills in production planning, scheduling, and control to ensure efficient utilization of resources.	4
CO3	Illustration of implementing quality management techniques to improve product quality and customer satisfaction.	4

COURSE CONTENTS

Unit I	**Introduction to Industrial Management**	**(04hrs)**	**COs Mapped –CO1**
Overview of Industrial Management (Objective, Role, Responsibility, Authority, Delegation of Power), Evolution and Importance of Industrial Management, Functions of Industrial Management			
Unit II	**Organization**	**(05hrs)**	**COs Mapped –CO2**
Organizational Structure and Hierarchical Levels (Objective, Types, Advantages, Limitations), Role of Industrial Managers and Leadership Styles			
Unit III	**Job Evaluation**	**(05hrs)**	**COs Mapped –CO3**
Job Evaluation and Wage Plan: Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, KRA			
Unit IV	**Wage Incentive**	**(05hrs)**	**COs Mapped –CO3**
Wage and wage incentive plans, Introduction, Types, Evolution			
Unit V	**Introduction to industrial legislation.**	**(05hrs)**	**COs Mapped –CO3**
Introduction , Objective , Employment Legislations			

Text Books

1. Introduction to Industrial and Systems Engineering" by Wayne C. Turner, CRC Press, 2020.

2. Production and Operations Management" by R. B. Khanna, Golden Swan Publications, 2019.
3. Total Quality Management: Text, Cases and Readings" by Joel E. Ross, Wiley, 2018.
4. Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl, Pearson, 2019.

Reference Books

1. Operations Management" by Nigel Slack and Alistair Brandon-Jones, Pearson, 2020.
2. Lean Thinking: Banish Waste and Create Wealth in Your Corporation" by James P. Womack and Daniel T. Jones, Free Press, 2019.
3. Six Sigma for Green Belts and Champions: Foundations, DMAIC, Tools, Cases, and Certification" by Howard S. Gitlow, Wiley, 2021.
4. Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse" by Gwynne Richards, Kogan Page, 2019.

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	2	-	-	2	-	-	-	-	2	2	2	2
CO 2	3	3	2	-	-	2	-	-	-	-	2	2	2	2
CO 3	3	3	2	-	-	2	-	-	-	-	2	2	2	2
Avg	3	3	2	-	-	2	-	-	-	-	2	2	2	2

Guidelines for Continuous Comprehensive Evaluationof Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	One Assignments on Unit-1, Unit-2, Unit-3	30
2	Offline Test	10
3	Online test	10
	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 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	(02hrs)	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.	(02hrs)	COs Mapped – CO3
Unit V	Facing operation, Programmable milling machine Drilling and Tapping process.	(02hrs)	COs Mapped – CO2,CO4

	Thread Pitch, Rotary motion with axial motion mechanism.		

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

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

A) Tutorial Assessment : 25 Marks

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 Marks
4. Final marks for student to be converted into 5 marks.
5. Two Assignments 10 Marks each.

Note: If student were absent for test conduct his/her test again through LMS or Offline mode and allot the marks.

B) Term work Assessment: 25 Marks

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.

Guideline for Term work assessment:

1. Each laboratory assignments will be assessed for 30 marks according to following rubrics:
    a. R1- Timely completion of assignments (10 Marks)
    b. R2-Understanding of assignments (10 Marks)
    c. R3- Presentation /Clarity of journal writing (10 Marks)

    Example of R1
    i) Decide the date for completion of Job/Assignment, if completion date is 14^{th} 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 (14^{th} date) and before or at the time of next practical (21^{st} Date of month) then allots 5 marks
    iii) 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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S.Y.B.Tech.
(R&A/Mechanical)
Pattern2023 Semester:IV
2300201D: Applied Mathematics

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,

Applicationof LTtosolve LDE.

Fourier Transform (FT): Fourier transform, Fourier Sine &Cosinetransform,InverseFourier Transforms.

UnitII	**Linear Differential Equations with Constant Coefficient**	**(07 hrs)**	**COs Mapped - CO1, CO2**

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)**	**COsMapped CO1,CO2, CO5**

Modeling of Mass-spring systems, Free & Forced Damped and undamped systems.Basic concepts,methodofseparationofvariables,modelingofVibratingString,Waveequation,one- and two-dimensionalHeat flow equations.

Unit IV	**Statistics and Probability**	**(07 hrs)**	**COsMapped - CO1,CO3 , CO5**

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,parabolaandrelatedcurves,CorrelationandRegression,ReliabilityofRegressionEstimates.Probability,Probabilitydistributions: Binomial, Poisson and Normal distributions

UnitV	**Vector Calculus**	**(07 hrs)**	**COs Mapped - CO1,CO3, CO5**

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. AdvancedEngineeringMathematics,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).

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.
Pattern2023 Semester: IV(Mechancial Engineering)
2305212 : Fluid Mechanics And Machines

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03 hrs/week	**03**	**Continuous ComprehensiveEvaluation: 20MarksInSem Exam: 20MarksEndSem Exam: 60Marks**

PrerequisiteCourses,ifany: -

CourseOutcomes: Oncompletion ofthecourse,studentswillbe ableto–

	CourseOutcomes	**Bloom'sLevel**
CO1	Gain fundamental knowledge of fluid,itspropertiesandbehaviorunder Variousconditionsofinternalandexternalflows.	1-Knowledge
CO2	Developunderstandingabouthydrostaticlaw,principleofbuoyancyandstabi lityof afloating body and application ofmass, momentumand Energyequation in fluid flow.	2-Understand
CO3	Imbibebasiclawsandequationsusedforanalysisofstaticanddynamic Fluids.	2-Understand
CO4	Determinethe lossesin a flow system,flow throughpipes,	3-Apply
CO5	Demonstrate hydraulic machines.	3-Apply

COURSECONTENTS

UnitI	**FluidPropertiesand Fluidstatics**	**(08 hrs)**	**COs Mapped - CO1, CO2**

Properties of fluids: Density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapourpressure, capillarityand surface tension.
Fluid statics: Concept of fluid static pressure, absolute and gauge pressures. Pressure measurements by manometers, Hydrostaticforces on planes: centre of pressure, buoyancy and floatation.

UnitII	**FluidKinematics**	**(07 hrs)**	**COsMapped - CO1,CO2,CO3**

FluidKinematics:Classificationandtypesofflow,velocityfieldandacceleration,continuityequation(onea ndthreedimensionaldifferentialforms).Streamline,streakline,pathline,stream function,velocitypotentialfunction,flownet.

Unit III	FluidDynamics	(07 hrs)	COsMapped-CO1,CO2,CO3

Fluiddynamics: Equationsofmotion:Navier'sstokesequation,Euler'sequationalongastreamline,Bernoulli's equation, flow measuring devices (venturi meter, orifice meter and Pitot tube).

Unit IV	Analysisof FlowThroughPipes	(07 hrs)	COs Mapped - CO1,CO3,CO4

Reynold's experiment, laminar flow through circular pipe (Hagen poiseulle'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 turbulentboundarylayerdisplacement,energyandmomentumthickness,Boundarylayerseparationandcontrol,dragandliftforces.

UnitV	Hydraulic Machines	(07 hrs)	COsMapped-CO1,CO2,CO5

Rotodynamic machines: 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.

TextBooks

1. IntroductiontoFluidMechanics- Fox,Pichard,McDonald,Wiley
2. FluidMechanics-F.M. White,TATAMcGraw-Hill
3. FluidMechanics,-Dr.R.K.Bansal-Laxmi Publication(P) Ltd.NewDelhi
4. FluidMechanics,-Cengel&Cimbla,TATAMcGraw-Hill
5. Hydraulicsand FluidMechanics-ModiP.N.andSethS.M,StandardBookHouse
6. FundamentalsofFluid Mechanics-Munson, YoungandOkiishi,WileyIndia
7. FluidMechanics-PotterWiggert,Cengage Learning

ReferenceBooks

1. FluidMechanics-Kundu,Cohen,Dowling,ElsevierIndia
2. FluidMechanics-ChaimGutfingerDavidPnueli,CambridgeUniversitypress.
3.Introduction to Fluid Mechanics- Edward Shaughnessy, Ira Katz James Schaffer, OXFORD UniversityPress

GuidelinesforContinuousComprehensiveEvaluationofTheoryCourse		
Sr.No.	**Components forContinuousComprehensiveEvaluation**	**MarksAllotted**
1	Any Three Assignments on unit-1, Unit-2,Unit-3 ,Unit-4, Unit-5	10
2	Online and offline test	10
	Total	**20**

ListofLaboratoryExperiments/Assignments		
Sr.No.	**LaboratoryExperiments/Assignments**	**COMapped**
1	Determinationofpressureusingmanometers (minimumtwo)	**CO1,CO2**
2	Determinationoffluidviscosityanditsvariationwith temperature	**CO1**
3	DeterminationofMetacentricheightoffloatingobject	**CO1,CO2**
4	DeterminationofReynoldsnumberandflowvisualizationoflaminarandturbulentflow usingReynolds apparatus.	**CO1,CO3**
5	Verificationofmodified Bernoulli'sequation	**CO2,CO3**
6	CalibrationofOrificemeter/Venturimeter	**CO3**
7	Determinationofminor/majorlossesthroughmetal/non-metalpipes	**CO4,CO5**
8	Study of Impact of Jet / Turbine /Pump .	**CO5**

GuidelinesforLaboratoryConduction

1. Teacher will brief the given experiment to students its procedure, observations calculation, andoutcomeofthis experiment.
2. Apparatusand equipmentsrequired fortheallotted experimentwillbe providedbythe labassistantsusingSOP.
3. Students will perform the allotted experiment in a group (two students in each group) under thesupervisionoffacultyand lab assistant.
4. Afterperformingtheexperimentstudentswillcheck theirreadings,calculationsfromtheteacher.
5. Aftercheckingtheyhaveto writethe conclusion of thefinalresult.

GuidelinesforStudent'sLabJournal

Write-upshouldincludetitle,aim,diagram,workingprinciple,procedure, observations, graphs,calculations,conclusionand questions, if any.

GuidelinesforTermworkAssessment

1. Eachexperimentfromlabjournal isassessedforthirtymarksbasedonthreerubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journalwritingwhere eachrubriccarries ten marks.

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

- Understand the various types of stresses in machine members
- Understand the beam theory with various load and support conditions
- Understand the concept of complex stresses
- Understand 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	**Slope and deflection of beams & Buckling**	**(7hrs)**	**COs Mapped –**

IV	**of columns**		**CO2, CO3**
Slope and deflection of determinate beams, Macaulay's method, slope and deflection for standard cases. 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**	**2**	**-**
CO 2	**3**	**3**	**2**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**-**	**2**	**2**	**-**
CO 3	**3**	**3**	**2**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**-**	**2**	**2**	**-**
CO 4	**3**	**3**	**2**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**-**	**2**	**2**	**-**
CO 5	**3**	**3**	**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 or Offline Test on Each Unit	10
	Total	**20**

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S.Y. B. Tech. **Pattern2023Semester:IV(Mechanical Engineering)** **2305214 : Fluid Mechanics and Machines Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical:02hrs/week	**01**	**Termwork:25 Marks** **Oral :25Marks**
Prerequisite Courses ,if any: -		
CourseOutcomes: On completion of th 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.	1-Knowledge
CO2	Develop understanding about hydrostatic law, principle of buoyancy and Stability of a floating body and application of mass, momentum and energy equation in fluid flow.	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, flow through pipes, boundary Layer flow and flow past immersed bodies	3-Apply
CO5	Demonstrate hydraulic machines.	3-Apply

List of Laboratory Experiments/Assignments

Sr. No.	**Laboratory Experiments/Assignments**	**CO Mapped**
1	Determination of pressure using manometers.	**CO1,CO2**
2	Determination of fluid viscosity and its variation with temperature	**CO1**
3	Determination of Metacentric height of floating object	**CO1,CO2**

4	DeterminationofReynoldsnumberandflowvisualizationoflaminarandturbulentflow using Reynolds apparatus.	**CO1,CO3**
5	Verification of modified Bernoulli's equation	**CO2,CO3**
6	Calibration of Orifice meter / Venturimeter	**CO3**
7	Determination of minor/major losses through metal/non-metal pipes	**CO4,CO5**
8	Study of Impact of Jet / Turbine /Pump .	**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 equipments 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.

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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	EVALUATE dimensional tolerance based on type of fit	5 - Evaluate
CO5	READ & ANALYSE industrial drawings with Manual drafting	4 -Analyze

COURSE CONTENTS

Part A

I	Assignment on parametric solid modeling and Surface 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, Surface modeling of a machine component.			
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 constraints, generation of exploded view			
III	Generation of production drawings of the parts and assembly with appropriate tolerance.	(04 hrs)	COs Mapped – CO2, CO3
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 – CO4, CO5
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.	(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

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	2	1	2	2	1		
CO 2	3	-	-	-	3	-	-	-	2	2	1	2	2	1		
CO 3	3	-	-	-	3	-	-	-	2	2	1	2	2	1		
CO 4	3	-	-	-	-	-	-	2	2	2	1	2	2	1		
CO 5	3				-	-	-	3	2	2	1	2	2	1		

Guidelines for Tutorial / Termwork Assessment

Sr. No.	Components for Termwork Assessment	Marks Allotted
1	Assignment on Geometric Modeling	10
2	Assignment on Production Drawing	15

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.
Pattern2023 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

PrerequisiteCourses:-Engineering Mathematics, Linear Algebra, Probability, Basic Statistics

CourseObjectives:

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**
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)			
UnitIII	**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.

StrengthofCO-POMapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	1	2	2	2	-	1	2	2	-	2
CO2	3	3	1	2	2	2	-	1	2	2	-	2
CO3	3	3	1	2	2	2	-	1	2	2	-	2
CO4	3	3	1	2	2	2	-	1	2	2	-	2
CO5	3	3	1	2	2	2	-	1	2	2	-	2

GuidelinesforContinuousComprehensiveEvaluationofTheoryCourse		
Sr.No.	**ComponentsforContinuousComprehensiveEvaluation**	**Marks Allotted**
1	Assignments- Total5Assignment Assignment on each unit for 10 Marks (These 50 markswill beconvertedto 10 Marks)	10
2	Testsoneachunitusing LMS \ Learni-Co (Each test for10 Mandtotal 50 marks will beconverted to10M)	10

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S.Y.B.Tech. **Pattern2023 Semester: IV Mechanical Engineering** **2305217:Machine Intelligence Lab**		
TeachingScheme:	**CreditScheme:**	**ExaminationScheme:**
Practical:02hrs/week	**01**	**Term work:**25 Marks **Oral:**25 Marks

PrerequisiteCourses:-Engineering Mathematics, Linear Algebra, Probability, Basic Statistics

CourseObjectives:

6. UNDERSTAND the fundamentals of Artificial Intelligence and Machine Learning.
7. APPLY Feature Extraction and Selection techniques to process datasets.
8. APPLY fundamental of classification and regression algorithms.
9. DEMONSTRATE the ability to develop machine learning models by outlining and executing essential steps, emphasizing practical application in mechanical engineering contexts.
10. EXPLORE the concepts of reinforced and deep learning, digital twin and Transfer learning.

Course Outcomes: On completion of thecourse, students will be able to–

	Course Outcomes	**Bloom'sLevel**
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**	**COMapped**
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
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.

StrengthofCO-POMapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	2	2	2	-	1	2	2	-	2
CO2	3	2	1	2	2	2	-	1	2	2	-	2
CO3	3	2	1	2	2	2	-	1	2	2	-	2
CO4	3	2	1	2	2	2	-	1	2	2	-	2
CO5	3	2	1	2	2	2	-	1	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(EachExperimentcarries30marks) 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: 2023Semester: IV (Mechanical Engineering)
2305218 :Industrial Psychology and Organizational Behaviour

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hr / week	02	**Continuous Comprehensive Evaluation : 50**

Prerequisite Courses: - Industrial Management, Professional Ethics

Course Objectives:

To align the students to the application of principles of psychology in an industrial and organizational workplace.

To demonstrate the understanding of job requirement and related fatigue, boredom and ways to handle it.

To develop the insights into performance management and understanding related improvement strategies.

To have an understanding of human behavior in groups and develop knowledge and skills in leadership, power, communication, negotiation and conflict management.

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, Theoriesand 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 job analysis, have understanding of fatigue, boredom and improve the job satisfaction	3- **Apply**

COURSE CONTENTS

I	**Industrial Psychology**	(06hrs)	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	**Job Analysis , Industrial Fatigue and Industrial Boredom**	(06 hrs)	COs Mapped – CO1, CO3, CO4

Job Analysis and Evaluation.

Industrial Fatigue: Introduction, Concept and Meaning, Types of Industrial Fatigue, Causes of

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**	(06 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 Cultureand Organizational Development**	(06 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
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, Indistrial Psychology, New Age Publication, 2010.
2. Michael Aamodt, Organizational/ Industrial Psychology, Wadsworth Cengage Learning, 2010
3. Robbins, S.P. Organizational Behaviour. Prenctice-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 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 IndiaLtd.
6. Muchincky (2009). Psychology applied to work. New Delhi: Cengage.
7. Griffin, Ricky W: Organizational Behaviour, Houghton Mifflin co., Boston.
8. Ivancevich; John and Micheeol 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**	-	-

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

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

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, NewYork.

2. Guha, R. (2013). Gandhi before India. PenguinUK.

3. Jayal. N.G. (2001). Democracy in India.New Delhi: Oxford UniversityPress.

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 Evaluationof 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**

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

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** **Termwork: 25 Marks**

Prerequisite Courses, if any: ----

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.	**4-Evaluate**
CO5	Constructively participate in group discussion, meetings and prepare and deliver Presentations.	**4-Evaluate**

Text Books

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	-	-

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			
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	Phonetics & Vocabulary building activity	To have discussion on phonetic chart by International Phonetic Alphabet (IPA). Vocabulary development methods should be discussed. Every student should maintain a daily record of minimum 2 (or maximum 5) unknown words , across which they have come. Students should use these words in their communication.This	CO1

		activity should be continued during the entire semester.	
2	Story telling	Every student will get 5 minutes, to share a fictional or real life story.	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 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)	CO1,CO2
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.