

Title of the Course: Mathematics for Mechanical Engineering	L	T	P	Credits
Course Code: UMEPC0301	3	1	---	4

Course Pre-Requisite:

Core terms related to vector algebra, probability, differential equations, and the fundamentals of integration and derivative.

Course Description:

Applications of partial differential equations, vector calculus, Laplace transform, probability distributions, and Fourier series are all covered in this course.

Course Objectives:

1. To cultivate the capacity for critical reflection on their work as well as abstract, logical, and critical thinking.
2. Students learn about numerous mathematical techniques such as vector calculus, integral transforms, differential equations, probability, and partial differential equations in order to develop engineering solutions for specific scenarios.
3. The student needs to be able to create a mathematical model of an engineering problem and then solve it and understand how to apply the result in the actual world.

Course Outcomes:

COs	After the completion of this course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Understand different terms used in differential equations, probability, and Laplace transform properties.	II	Understanding
CO2	Solve vector differentiation problems, Laplace transform problems, Laplace equation numerically using the Gauss-Siedel method, and LDEs with constant coefficients.	III	Applying
CO3	Apply the knowledge of probability distributions, Laplace transform method to solve differential equations and express the given function as Fourier series over the given interval.	III	Applying
CO4	Analyze and interpret the answers to problems involving the oscillation of a spring, waves, and heat equations. You should also assess vector differentiation.	IV	Analyzing

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three units)

ESE: Assessment is based on 100% course content with 65-70% weightage for course content (normally last three units) covered after MSE.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

Course Contents:	
Unit 1: Linear Differential Equations with Constant Coefficients and Its Applications 1.1 Definition, general form, complete solution 1.2 Rules for finding complementary function 1.3 Rules for finding particular integral 1.4 Application: Mass – spring Mechanical system 1.4.1 Free oscillations 1.4.2 Damped Oscillations 1.4.3 Forced oscillations without damping.	7 Hrs.
Unit 2: Vector Differentiation 2.1 Scalar and vector point functions 2.2 Gradient, Divergence and Curl 2.3 Directional Derivative, Angle between two surfaces 2.4 Solenoidal and Irrotational Vector Field.	6 Hrs.
Unit 3: Laplace Transform 3.1 Definition, transforms of elementary functions, properties of Laplace transform 3.2 Transforms of derivative and integral 3.3 Inverse Laplace transform 3.4 Inverse Laplace transforms by using partial fractions and convolution theorem. 3.5 Solution of linear differential equations with constant coefficients by Laplace transform method.	7 Hrs.
Unit 4: Probability Distributions 4.1 Introduction to Probability 4.2 Random variable 4.3 Probability mass function and probability density function 4.4 Binomial distribution 4.5 Poisson distribution 4.6 Normal distribution	6 Hrs.
Unit 5: Fourier Series 5.1 Definition, Euler's formulae, Dirichlet's conditions. 5.2 Functions having points of discontinuity 5.3 Change of interval 5.4 Expansion of odd and even periodic functions 5.5 Half range Fourier series	7 Hrs.
Unit 6: Application of Partial Differential Equations 6.1 Introduction to partial differential equations 6.2 The method of separation of variables. 6.3 The Wave Equation. 6.4 One dimensional heat flow equation 6.5 The Laplace equation in two-dimensional heat flow (Steady State). 6.6 Numerical solutions of Laplace equation using Gauss – Seidel iterative method	7 Hrs.

Textbooks:					
SN	Title	Edition	Author/s	Publisher	
1.	Higher Engineering Mathematics	42	Dr. B. S. Grewal	Khanna Publishers, Delhi	
2.	A Text Book of Applied Mathematics Vol. II & III	6	P. N. Wartikar & J. N. Wartikar	Pune Vidyarthi Griha Prakashan, Pune	
Reference Books:					
SN	Title	Edition	Author/s	Publisher	Year
1.	Advanced Engineering Mathematics	10	Erwin Kreyszig	John Wiley & Sons	2011
2.	Advanced Engineering Mathematics	21	H. K. Dass	S. Chand & Company Pvt. Ltd, New Delhi	2014
3.	A text book of Engineering Mathematics		N.P. Bali, Iyengar	Laxmi Publications (P) Ltd., New Delhi	
4.	Engineering Mathematics		Ravish R Singh and Mukul Bhatt	McGraw Hill Education (India) Private Limited, Chennai.	2017



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0302	L	T	P	Credit
Course Name:	APPLIED THERMODYNAMICS	3	-		3
Course Pre-Requisites:	Basic Physics, Chemistry, Basic Mechanical Engg				
Course Description:	Basic Concepts in Thermodynamics, Forms of energy, Properties of pure substances, Phase diagram and Phase transition,				

Course Objectives:					
1	Understand various types of energies and its applications in thermodynamic systems				
2	Apply thermodynamic concepts to thermodynamic systems				
3	Know various laws of thermodynamics and applications to thermodynamic system				
4	Application of ideal gas processes to thermodynamic systems				
5	Study steam properties, Use of steam tables and Mollier charts with numerical applications				
6	Understand and analyze (numerical analysis) various types of air standard cycles				

Course Outcomes:		After the completion of the course the student will be able to		
COs	CO Statement		Blooms Level	Descriptor
CO1	Explain fundamental knowledge of Thermodynamics		II	Understand
CO2	Apply knowledge of thermodynamics cycles to understand the working of Thermodynamic systems.		III	Apply
CO3	Analyze performance parameters of Thermodynamic systems		IV	Analyze

CO-PO Mapping:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3										2	3		
CO2	3	2									2	3		
CO3	2	2									2	2		

Assessment Scheme:														
SN	Assessment					Weightage		Remark						
1	In Semester Evaluation 1 (ISE1)					10%		Assignment, Test, Quiz, Seminar, Presentation, etc.						
2	Mid Semester Examination (MSE)					30%		50% of course contents						
3	In Semester Evaluation 2 (ISE2)					10%		Assignment, Test, Quiz, Seminar, Presentation, etc.						
4	End Semester Examination (ESE)					50%		100% course contents						

Course Contents:														
Unit No.	Unit Content										No. of Lectures			
1	Unit 1: Review of Laws of Thermodynamics Second Law, Clausius theorem, Entropy, Clausius inequality, Entropy as a property of system, Entropy of pure substance. T-s and h-s planes, Entropy change in reversible and irreversible processes, Increase of entropy principle, Calculation of entropy changes of gases and vapors. Available Energy, Availability and Irreversibility										7 Hrs			
2	Unit 2: Steam Generators and Steam Condensers: Steam Generators: Study and classification of Boilers, Thermal efficiency of Boiler (Theoretical and Actual), Steam Condensers : Elements of condensing plant, Types of steam condensers, Vacuum efficiency, Condenser efficiency, Estimation of cooling water required.										7 Hrs			
3	Unit 3 : Vapour Power Cycles: Pure substance, Phase change processes, Properties of steam, Carnot cycle and Rankine cycle, Thermal efficiency, Specific steam consumption. Work ratio, Effect of condenser pressure on the performance. Reheat and regenerative steam power cycles, Use of steam table and Mollier chart.										6 Hrs			
4	Unit 4: Impulse and Reaction steam Turbine : Impulse Turbine: Functions, Shapes of steam nozzles, Operation and Classification of Impulse steam turbine, compounding of steam turbines. Velocity diagrams, Work done, Efficiencies. Reaction Turbine: Flow through impulse reaction blades, Velocity diagram, and degree of reaction, Parson's reaction turbine.										6 Hrs			

5	Unit 5: Gas Power Cycles: Air Standard cycles: Assumptions, the Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle and Brayton Cycle. Comparison of Otto, Diesel and Dual Cycles. Expression for air standard efficiency and mean effective pressure for Otto, Diesel and Dual Combustion cycle.	7 Hrs
6	Unit 6: Air Compressors: Application of compressed air, classification of compressor, Reciprocating Air Compressor: Work input, Necessity of cooling , Isothermal efficiency, Effect of clearance volume, Volumetric efficiency, Necessity of multistaging, Optimum intermediate pressure for minimum work required. Axial and Centrifugal air compressor: Construction and working, comparison of axial and centrifugal air compressor, Characteristics of axial and centrifugal compressor.	7 Hrs

Text Books:

Sr. No.	
1	Thermodynamics: An Engineering Approach, 3rd Edition, Yunus A Çengel and Michael, Boles, Tata McGraw Hill.
2	Basic and Applied Thermodynamics, 2nd Edition, Nag P. K., Tata McGraw-Hill.

Reference Books:

Sr. No.	
1	Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics:
2	Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of
3	Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
4	Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMEPC0303	L	T	P	Credit
Course Name:	Materials Engineering	3			3
Course Pre-Requisites:	Basic Mechanical Engineering-Processing, Physics, Chemistry, Fundamental knowledge of materials and their basic properties				
Course Description:	Basic concepts in material science are covered in this course, including how to create equilibrium diagrams from cooling curves and calculate mechanical properties from crystal structures, macrostructures, and microstructures. It covers the crucial aspects of material testing, such as destructive and non-destructive testing, which are crucial for identifying material flaws and evaluating mechanical properties. Students in this course are exposed to significant equilibrium diagrams of the ferrous and nonferrous families, as well as various alloys on the diagrams along with their properties and uses. The course also covers the principles of heat treating steel and how different heat treatments can improve its mechanical properties. The selection of materials for diverse engineering applications is the central idea of this course.				

Course Objectives:

1	To gain knowledge of types of different ferrous and nonferrous metals and non metal materials.
2	To study principle of Heat treatment, variables and different types of heat treatment processes, powder metallurgy process.
3	To understand process of plotting various types of equilibrium diagrams of Ferrous and Non Ferrous materials, TTT and CCT diagram.
4	To gain knowledge of Composite, different steels, cast irons and non ferrous alloys by studying their equilibrium diagrams.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
C01	Explain the concept of phase and basic terminologies associated with material engineering	II	Understand
C02	Relate mechanical properties of composite and sintered materials and their importance in materials selection.	II	Understand
C03	Analyze structure and properties of Ferrous, nonferrous metals and alloys and identification of phases by analyzing the phase diagrams	IV	Analyze
C04	Relate the role of heat treatment on the development of microstructure and properties of metallic materials.	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2									1	3		
C02	3	2									1	3		
C03	3	2	2		1						1	3	1	
C04	3	2									1	3	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1: Introduction to Metals and alloy systems Introduction to Metallic, Non-metallic, advanced materials and classification Alloy System: Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic-cored Structure, Basic Terminology: Phases, Solid solutions, Hume Rothery Rule, Intermediate phases, Gibbs phase rule, cooling curves, Long and short-range freezing, Construction of equilibrium diagrams Alloy systems : Isomorphous, Monotectic, Eutectic, Partial solubility, Peritectic, Intermetallic Compounds, Lever arm principle (Numerical Treatment expected based on Lever arm principle or wt percentage calculation).	6
2	Unit 2: Study of Ferrous alloys Fe- Fe ₃ C equilibrium diagram: Invariant Reactions, Ferrous Alloys (Steel, Cast Iron, Types), Alloy Steels, Effect of Alloying Elements, Free Cutting Steels, High Strength Low Alloy steels, Maraging Steels, Creep Resisting Steels, Stainless Steels, Tool Steels, Selection of Materials and Designation of Carbon Steel, Cast Iron and Alloy Steels as per IS, AISI, SAE Standards, Criteria for Selection of Materials for Auto-Industry, Aerospace, Marine Applications.	9
3	Unit 3: Study of Non Ferrous Alloys Copper based alloys: Brass-Types, Bronze-Types [Cu-Sn, Cu-Be, Cu-Ni], Aluminum based alloys: Al-Cu (Duralumin), Al-Si (Modification treatment), Lead Tin Based (Solders and fusible alloys), Sn-Sb alloys- Babbitts (With Reference to Composition, Properties and Application)	5
4	Unit 4: Principles of Heat treatment of Steel Principles of Heat treatment process: Objectives, Heat Treatment Processes Variables, Concept of phase Transformation, Transformation of Pearlite to Austenite upon heating, austenite to Pearlite, Bainite and Martensite on Cooling, TTT Diagram and CCT diagram, Effect of alloying elements on TTT diagram, Retained Austenite, Sub Zero Treatment	8

5	Unit 5: Heat treatment Processes Heat Treatment Furnaces and Equipment, Processes: Annealing-Types, Normalising, Hardening, Tempering, Austempering, Martempering, Phase Transformation During tempering, Quenching Media, Quenching Mechanism, Hardenability- Concept and Hardenability Measurement and Jominy End Quench Test, Tempering - Types and Purposes , Heat treatment Defects and Remedies, Hardness Measurement (Brinell, Rockwell, Vickers), Precipitation Hardening (Non Ferrous), Surface hardening: Flame and Induction, Chemical Heat Treatments-Case hardening- Carburizing, Nitriding, Carbonitriding	9
6	Unit 6: Powder Metallurgy and Composite Powder Metallurgy: Principle, Importance, Process, Applications, Advantages and Disadvantages of Powder Metallurgy, Blending, Compaction, Sintering and Metal Injection Molding; Processes of Powder Making and Mechanisms of Sintering Composite Introduction , Properties, Applications of Composites, Classification and properties of Composites, Type of Reinforcements, Carbon Fiber, Glass Fiber and Particulates, Metal and Ceramic Matrix Composite.	8

Text Books:

Sr. No.	
1	S.H. Avner, "Introduction to physical metallurgy", McGraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendra singh, "Physical metallurgy", Standard Publishers Delhi
3	W. D Callister, "Material science and engineering", Wiley India Pvt. Ltd., 5th Edition.
4	V. D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune
5	T.V. Rajan / C.P. Sharma, "Heat Treatments Principles and Practices", Prentice Hall of India Pvt Ltd, New Delhi
6	V Raghwan, "Material Science and Engineering", Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.
7	Principles of Materials Science and Engineering, William F. Smith, Third Edition, 2002, McGraw-Hill
8	Composite Materials: Engineering and Science, Matthews F.L., and Rawlings
9	Kenneth G. Budinski, "Surface Engineering for wear resistance", Prentice Hall of India.

Reference Books:

Sr. No.	
1	The Science and Engineering of materials, Donald Askeland, Pradeep Fuley, Wendelin J. Wright, 6th Edition, Publisher Global Engineering:
2	W. Callister, "Materials Science & Engineering", John Wiley & sons
3	R.A. Higgins, "Engineering Metallurgy", Viva Books Pvt. Ltd., New Delhi, 1 st Edition
4	ASM Handbook Volume no.5 Surface Engineering
5	Composites Manufacturing Fundamentals of Materials, Methods, and Applications Second Edition, A. Brent Strong, ISBN 13: 978-087263854-9



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0304	L	T	P	Credit
Course Name:	Analysis of Mechanical Elements	3	-	0	3
Course Pre-Requisites:	Engineering Mechanics				
Course Description:	This subject enables the student to understand the important concepts of stress and strain, their significance in concept with engineering applications and is useful while studying the Subjects like, Kinematics of Machines, Theory of machines, Dynamics of Machines.				

Course Learning Objectives:

1	To gain knowledge of different types of stresses, strains and deformation induced in Mechanical Components due to external loads.
2	To study the distribution of various stresses in Mechanical Elements
3	To study the effect of component dimensions and shape on stresses and deformation.

Course Outcomes:	After the completion of the course the student will be able to
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COs	CO Statement	Blooms Level	Descriptor
CO1	Find stresses and deformations of different loads on structural members	I	Remember
CO2	Interpret elastic behavior of structural members.	II	Understand
CO3	Construct graphical solutions for given loading condition of structures.	III	Apply
CO4	Analyze stresses developed in oblique loading condition.	IV	Analyze
CO5	Determine the parameters of structural members under different loadings.	V	Evaluate

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2								2	3	1	1
CO2	3	2	2								2	3	1	1
CO3	2	2	2								2	2		1
CO4	2	2	2	1							2	2	1	1
CO5	2	2	2	1							2	2	1	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1:--- Stresses and Strains Concept of stress and strain (linear, lateral, shear & volumetric), Hooke's Law, Elastic constants & their relationship, Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, Various strengths of material- Yield strength, Ultimate tensile strength, etc. Normal and shear stresses, Complementary shear stress, Bulk modulus, interrelationship between elastic constants, thermal stresses.	8 Hrs
2	Unit 2:--- Shear Force & Bending Moment Diagram Concept and definition of shear force and Bending Moment in beams due to concentrated load, UDL, uniformly varying loads and couples in determinate beams, Maximum bending moment & positions of points of contra flexure	8 Hrs
3	Unit 3:--- Bending Stresses and Shear Stress in Beams Bending Stresses: Theory of simple bending, Concept and assumptions, Derivation of flexure formula, Bending stresses distribution diagram, Moment of resistance and section modules calculations, design of rectangular and circular (solid and hollow) sections; L, I and T sections Shear Stress in Beams: Concept and derivation of shear stress distribution formula, Shear stress distribution diagram for symmetrical and unsymmetrical section, maximum and average shear stress	8 Hrs

4	Unit 4:--- Deflection of Beams, Axially loaded Struts and Columns Deflection of Beams: Concept and definition, relation between Bending moment, slope and deflection, methods for calculation of slope and deflection. Columns: Theory of Columns, Short columns and long columns, End conditions, Euler’s formula, Rankine’s formula.	7 Hrs
5	Unit 5: Principal stresses and principal strain: Normal and shear stresses on any oblique planes and concept of principal planes, derivation of expression for principal stresses & maximum shear stress, position of principal planes & planes of maximum shear. Graphical solution using Mohr’s circle of stresses.	7 Hrs
6	Unit 6: Design of Simple Machine Elements: Design of joints like Knuckle Joint, Turn Buckle, Cotter Joint Design of Spring : Types of springs, materials and their applications, Styles of end, Stress and deflection equations for Helical Compression Springs, Springs in Series and Parallel. Design of Helical Compression Springs subjected to static loading.	7 Hrs
Text Books:		
Sr. No.		
1	S. Ramamrutham and R. Narayanan, (2003), Strength of Materials, Dhanpat Rai	
2	R.K. Rajput, strength of Material, Laxmi Publication, New Delhi	
3	Bansal, R. K. A Textbook of Strength of Materials. Laxmi Publications	
Reference Books:		
Sr. No.		
1	Robert Norton, Machine Design, Prentice Hall	
2	E.P. Popov, “Introduction to Mechanics of solids”, Prentice Hall Publication	
3	Singer and Pytel, “Strength of Materials”, Harper and Row Publications	
4	Ferdinand P Beer and E.R. Johnston JR. John Dewolf, Mechanics of Materials 3/e,	
5	S. Timoshenko, Strength of Materials: Part-I (Elementary Theory and Problems),CBS	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0331	L	T	P	Credit
Course Name:	Material Engineering Laboratory			2	1
Course Pre-Requisites:	BME, Physics, Chemistry, Fundamental knowledge of materials and their basic properties				
Course Description:	Numerous products are employed in vital applications where a malfunction could cause serious harm or extensive damage. A few instances include manufactured fasteners and parts that are essential to preserving the security of automobiles, bridges, aircraft, nuclear reactors, military hardware, and medical implants. Furthermore, a lot of jurisdictions have passed laws limiting the application of hazardous materials. Governments and regulatory agencies impose compliance requirements on manufacturers in situations such as these. To demonstrate compliance, businesses must follow these standards, which typically outline test protocols.				

Course Objectives:

1	To study principle of Heat treatment, variables and different types of heat treatment processes.
2	To interpret material properties by Destructive and non Destructive tests.
3	To interpret Ferrous and Non ferrous material properties by relating their microstructures and phase diagrams.
4	To prepare specimen as per metallographic procedure.

Course Outcomes:

After the completion of the course the student will be able to			
COs	CO Statement	Blooms Level	Descriptor
CO1	Utilize specimens for metallographic examination with practice and can Make use of optical microscope.	III	Apply
CO2	Analyze the microstructure of metallic materials like Steel, Cast Iron and other alloys using phase diagrams and modify the microstructure and properties using different heat treatments.	IV	Analyse
CO3	Inspect a material by destructive and/or Non destructive testing techniques and based upon results, data analysis and test results, conclude material properties.	IV	Analyze
CO4	Outline the heat treatment process and to Introduce the concept of hardenability.	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	PS03
CO1	3	2			1						1	3		
CO2	3	1									1	3		
CO3	3	2						1			1	3		
CO4	3	1	1								1	3		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	ISE	50 %	ISE is based on ISE are based on practical performance/ Quiz/ Mini-Project assigned/Presentation/ Group Discussion/ Internal oral etc
2	POE	50 %	Assessment based on External Practical_oral examination

Course Contents:

Expt No.	Experiment Name	No. of Sessions in Hr
1	Study of Metallurgical Microscope and Metallography- Preparation of Specimen	4 hr
2	Study of Microstructure of Plain Carbon Steel	2 hr
3	Study of the Microstructure of Cast Irons.	2 hr
4	Study of Microstructure of Non Ferrous Alloys.	2 hr
5	Study and Measurement of Tensile Strength and Ductility of Steel.	2 hr
6	Study and Measurement of Hardness by Brinell and Rockwell Test.	2 hr
7	Study and Measurement of Toughness of Specimens by Izod and Charpy Impact Test.	4 hr
8	Study and Measurement of Modulus of Rigidity of Specimens by Torsion Test.	2 hr
9	Study and Demonstration of Non Destructive Test –Magnetic Particle Inspection.	2 hr
10	Study and Demonstration of Heat Treatment on Steel specimens (Annealing, Normalizing and Hardening).	2 hr
11	Study and Demonstration of Jominy End-Quench Test for Measurement of Steel Hardenability.	4 hr
12	Industrial Visit to observe Industrial Heat Treatment Practices.	4 hr

Text Books:

Sr. No.	
1	S.H. Avner, "Introduction to physical metallurgy", McGraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendra singh, "Physical metallurgy", Standard Publishers Delhi
3	W. D Callister, "Material science and engineering", Wiley India Pvt. Ltd., 5th Edition.
4	V. D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune
5	T.V. Rajan / C.P. Sharma, "Heat Treatments Principles and Practices", Prentice Hall of India Pvt Ltd, New Delhi
6	V Raghwan, "Material Science and Engineering", Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.
7	Principles of Materials Science and Engineering, William F. Smith, Third Edition, 2002, McGraw-Hill
8	Composite Materials: Engineering and Science, Matthews F.L., and Rawlings
9	Kenneth G. Budinski, "Surface Engineering for wear resistance", Prentice Hall of India.

Reference Books:

Sr. No.	
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1	The Science and Engineering of materials, Donald Askeland, Pradeep Fuley, Wendelin J. Wright, 6th Edition, Publisher Global Engineering:
2	Metals Handbook-mechanical testing and evaluation, ASM, Volume 8, USA, 1993.
3	Baldevraj, Practical Non-destructive Testing, Wood head publishing limited, 2002
4	R.A. Higgins, "Engineering Metallurgy", Viva Books Pvt. Ltd., New Delhi, 1 st Edition
5	ASM Handbook Volume no.5 Surface Engineering



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0332	L	T	P	Credit
Course Name:	Object Oriented Programming Laboratory			2	1
Course Pre-Requisites:	Basics of any Programming language.				
Course Description:	This course exposes students with various object-oriented concepts like classes, objects, inheritance and operator overloading etc. This course encourages students to design and solve real life problems using Object oriented concepts.				

Course Objectives:

1	To understand the concepts of Object-Oriented Programming.
2	To learn programming using various Object-Oriented Concepts.
3	To apply the knowledge of OOPs to solve real life problems

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Define object-oriented concepts, principles and techniques.	I	Remember
CO2	Demonstrate use of Object-oriented concepts in programming.	II	Understand
CO3	Develop a C++ program to solve real life problems.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2				2							2		
CO2	2		2		2			1			1	2		2
CO3	2	2	2	1	2		1	1	2	1	2	2	2	2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	ISE	50	ISE is based on practical performance and submission during Lab.
2	ESE(POE)	25	POE: Assessment is based on Practical (programming) and oral examination.

Course Contents:

Expt No.	Experiment Name	No. of Sessions
1	Introduction:Principles of OOPS, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP, A simple C++ Program, Structure of C++ Program, Tokens, expressions and Control Structure.	6 Hrs
2	Arrays and Functions in C++:Introduction to Arrays, Function Prototyping, Types of Function, Call by Value,Call by reference,Inline functions, Recursive Functions.	6 Hrs
3	Classes and Objects: Introduction, Declaration of Class, Function definition inside and outside a class, constructors and destructors.	4 Hrs
4	Inheritance: Introduction, Defining Derived Classes (Public and Private), Types of Inheritance and program on Single Inheritance.	4 Hrs
5	Pointers and Polymorphism: Introduction to Pointers, Types of Polymorphism, Operator overloading, Overloading Unary Operators,Function Overloading, Virtual function	4 Hrs

Text Books:

Sr. No.	
1	Object oriented programming with C++,E.Balagurusamy,Tata McGrawHill Education, 3rd Edition
2	C++: The Complete Reference,Herbert Schildt, McGraw Hill Education,4th Edition
3	C++ Black Book,Steven Holzner,Coriolis Group,U.S.;Pap/Cdredition

Reference Books:

Sr. No.	
1	Professional C++,Solterwiely India.
2	Problem solving with C++,The OOP,Fourth edition,W.Savitch,Pearson education.
3	C++ High Performance, Second Edition: Master the art of optimizing the functioning of your C++ code, Björn Andrist , Viktor S

4	The C++ Programming Language (4th Edition) by Bjarne Stroustrup
5	C++ Primer (5th Edition) by Stanley B. Lippman, Josée Lajoie, and Barbara



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0333	L	T	P	Credit
Course Name:	THERMAL ENGINEERING LAB	0	0	2	1

Course Pre-Requisites: Basic Mechanical Engineering, Physics

Course Description: Basic Concepts in Thermodynamics, Working of Steam generator and Condenser, Working Principle of air compressor, Working Principle of Steam Turbine, Thermo physical properties of Lubricating oil and Grease.

Course Objectives:

1	To Understand types and working of Steam Boilers, steam condensers and steam turbines.
2	To Demonstrate working of air compressors.
3	To Determine Thermo physical properties of Lubricating oil and Grease
4	To estimate efficiency of Reciprocating Compressor

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms	Descriptor
CO1	Explain the working of Thermal Equipments	II	Understand
CO2	Experiment with apparatus for Thermal properties of Lubricants	III	Apply
CO3	Analyze performance of thermal system	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3										1	2		
CO2	2	2	2					2			1	2		
CO3	2	2						2			1	2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	ISE	25 Marks	

Course Contents:

Expt No.	Experiment Name	No. of Sessions
1	Experiment No.1: Test On Carbon Residue Apparatus Aim and Objectives: To determine the percentages of carbon residue after evaporation of oil. Outcomes: Students are able to determine percentages of carbon residue after evaporation of oil.	2 Hrs
2	Experiment No.2: Determination of Flash and Fire Point of Lubricating Oil Aim and Objectives: Determination of flash and fire point of given lubricating oil. Outcomes: Students are able to determine flash and fire point of given lubricating oil.	2 Hrs
3	Experiment No.3: Test on Dropping point apparatus Aim and Objectives: To determine the dropping point of lubricating grease. Outcomes: Students are able to determine dropping point of lubricating grease.	2 Hrs
4	Experiment No.4: Test on Aniline Point apparatus Aim and Objectives: To determine the aniline point of given lubricating oil. Outcomes: Students are able to determine aniline point of given lubricating oil.	2 Hrs
5	Experiment No. 5: Trial on Reciprocating Compressor Aim and Objectives: To determine thermal and volumetric efficiency of reciprocating compressor. Outcomes: Students are able to determine thermal and volumetric efficiency of Reciprocating Compressors.	2 Hrs
6	Experiment No.6: Study and demonstration of Steam condensers Aim and Objectives: To Classify and explain working of Steam Condenser and calculation of performance parameters of condenser. Outcomes: Students are able to Classify and explain working of various steam Condenser and determine performance parameters	2 Hrs
7	Experiment No. 7: Study and Demonstration of Steam Boilers Aim and Objectives: To Classify and explain working of Steam Boilers Outcomes: Students are able to Classify and explain working of various Steam Boilers.	2 Hrs

8	Experiment No.8: Study and demonstration of Boiler mounting and Accessories Aim and Objectives: To Classify and explain working of Boilers Mounting and accessories Outcomes: Students are able to Classify and explain working of various Boilers mountings and accessories.	2 Hrs
9	Experiment No. 9: Study and demonstration of steam turbines Aim and Objectives: To study and demonstrate the working principle of steam turbine Outcomes: The students will be able to understand and demonstrate the working principles of steam turbines.	2 Hrs
10	Experiment No. 10: Study and demonstration of Centrifugal and Axial Compressor Aim and Objectives: To study working and performance of Axial and Centrifugal compressor Outcomes: The students will be able to understand the performance of Axial and Centrifugal compressor.	2 Hrs
11	Experiment No. 11: Industrial visit to steam power plant. Aim and Objectives: To Classify and explain working of Steam Boilers, mounting and accessories. Outcomes: Students are able to Classify and explain working of various steam Boilers, mounting and accessories.	2 Hrs

Text Books:

Sr. No.	
1	Thermodynamics: An Engineering Approach, 3rd Edition, Yunus Çengel and Michael, Boles, Tata McGraw Hill.
2	Basic and Applied Thermodynamics, 2nd Edition, Nag P. K., Tata McGraw-Hill.

Reference Books:

Sr. No.	
1	Fundamentals of Thermodynamics, 5th Edition, Richard E. Songtag, Claus Borgnakke and Gordon J. Van Wylen, John Wiley and Sons, Inc.
2	Thermodynamics, 4th Edition, J.P. Holman, McGraw-Hill.
3	Engineering Thermodynamics, 2nd Edition, Jones J.B. and Hawkins G.A., John Wiley and Sons.
4	Fundamentals of Engineering Thermodynamics, Moran M.S. and Shapiro H.N., John Wiley and Sons, 1988.
5	Thermodynamics, 5th Edition, K. Wark, McGraw-Hill.

Title of the Course: Environmental Studies (Audit Course – I)		L	T	P	Credits
Course Code: UMEVE0305		2	-	-	2
Course Pre-Requisite: Students shall have knowledge of:					
Basic Science (Physics and Chemistry)					
Course Description: The objective of the course is imparting fundamental knowledge and awareness of Environmental Studies among students and importance of conservation of environment.					
Course Learning Objectives:					
At the end of the course students will be able to :					
1. Study scope and importance of natural resources, ecosystems, biodiversity for creating awareness and their conservation in multiple disciplines.					
2. Learn various types of pollution, their impacts and control measures for minimizing pollution and sustainable development.					
3. Understand social issues related to environment, environmental ethics and human rights towards environment.					
4. Study various laws and regulations related to environment and its applicability in society and industries					
Course Outcomes:					
COs	After the completion of the course the student will be able to	Bloom’s Cognitive			
		Level		Descriptor	
CO1	Summarize natural resources, importance of ecosystem and conservation of biodiversity with respect to multiple disciplines	2		Understanding	
CO2	Explain causes, effects, solutions for various pollution problems and its minimization strategies.	2		Understanding	
CO3	Interpret environmental ethics and their implementation for betterment of environment and human life.	2		Understanding	
CO4	Summarize the requirements of laws and regulations for environmental conservation and applicability of legislations in society and industries.	2		Understanding	

CO-PO Mapping:												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							2					
CO2	3											
CO3								2				
CO4						2						

CO	PSO1	PSO2	PSO3
CO1			
CO2	1	1	
CO3		1	
CO4		1	1

Assessment Scheme:	
ISE: Assessment is based on 100% course content	
Assessment Component	Marks
ISE	50

Course Contents:	
Unit 1: Nature of Environmental Studies Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness.	4 Hrs.
Unit 2: Natural Resources and Associated Problems a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.	5 Hrs.
Unit 3: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem :- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	4 Hrs.
Unit 4: Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation, Western Ghat as a biodiversity region. Hot-spot of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man/wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	4 Hrs.
Unit 5: Environmental Pollution Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	4 Hrs.
Unit 6: Social Issues and the Environment Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.	4 Hrs.

Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation.	
Consumerism and waste products.	
Unit 7:Environmental Protection From Unsustainable to Sustainable development. Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights.	5 Hrs.
Textbooks: 1. Environmental Studies by Dr. P.D.Raut (Shivaji University, Kolhapur)	
Reference Books: 1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB). 2. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA,574p 3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines,Compliances and Standards, vol. I and II, Environmental Media (R)	
Unit wise Learning Outcomes: At the end of the course the students will be able to: UO 1: Describe scope and importance of environmental studies. UO 2: Describe types of natural resources, their use and conservation. UO 3: Explain structure and functions of ecosystem, their types and importance. UO 4: Discuss biodiversity, endangered species and methods of biodiversity conservation. UO 5: Explain causes, effects and solutions to pollution problems. UO 6: Discuss environmental ethics and various social issues related to environment. UO 7: Discuss laws and regulations for conservation of environment.	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEEM0306	L		T	P	Credit
Course Name:	Finance Management	2		0	0	2
Course Pre-Requisites:	This course requires the basic knowledge of the following: 1. Basics of Workshop practice. 2. Basics of Mathematics.					
Course Description:	Engineering management relies on the knowledge of Engineering economics to be able to evaluate projects from a financial perspective. Optimizing financial performance of a project is a key responsibility of an Engineer in the decision-making process. This course is designed to present Engineering students the major concepts and techniques of costing that are needed in the decision-making process. The emphasis of this course is on the analytical analysis of cost calculation of component.					

Course Objectives:

1	To understand the basics of Costing and Finance Management
2	To apply analytical formulae to determine the cost of a component.
3	To emphasizes the strong correlation between engineering design and manufacturing of products/systems and the economic issues they involve.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain basic elements of the Costing system	II	Understand
CO2	Make use of Mathematical formulae to calculate the depreciation and the material cost.	III	Apply
CO3	Apply Engineering knowledge to calculate the weight and machining time for a component	III	Apply
CO4	Explain the concept of overheads and Solve Overhead accounting problems.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3
CO1	2						1				2		2		
CO2	3	2	1				1			1	2		3		1
CO3	2	3					1			1	2		2	2	1
CO4	2	2					1			1	2		2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Introduction Concept of cost, cost unit, cost center, classification of cost, Definition of costing, desirable conditions for a costing system. Cost Estimating: Definition, purpose and functions of Cost Estimation, estimating procedures, Depreciation, Causes of depreciation of assets, Depreciation numerical, Review of purchasing procedure, recording of stock and consumption of material by LIFO, FIFO, Weighted average method. (Numerical Treatment expected)	7

2	Estimation of Machining Cost Constitutes, direct cost, indirect cost, Estimation Process for each Operation ,Process of breaking down product drawing in to simpler elements or shapes, estimating the volume, weight and cost. Operation time calculation for turning, knurling, facing, drilling, boring, reaming, threading, milling, tapping, shaping, cutting, various grinding operations, planning etc. Machine Hour Rate Calculation. (Numerical Treatment expected)	8
3	Overheads and Cost Accounting Methods of Overhead Allocation, apportionment, absorption of overheads. (Numerical) Cost Accounting Methods: Job costing, Batch costing, Unit costing, Process costing, Contract costing, Activity based costing. (numerical)	8
4	Finance Management Objectives of Finance Management, Finance Functions, Internal and External, Short, medium and long-term finance, Sources of funds for business organization, Concepts of wants, scarcity, choice, opportunity cost, demand and supply curves, price determination. Minimum Attractive Rate of Returns, Internal Rate of Returns (IRR), Budgetary control, Budget objectives, classification of budgeting, Zero Base Budgeting, ZED Concept.	7

Text Books:

Sr. No.	
1	Mechanical Estimating and Costing By B.P. Sinha. Tata McGraw Hill Publishing Co. Ltd. N. Delhi
2	Mechanical Estimating and Costing T.R. Banga and S.C.Sharma, Khanna Publishers, Delhi-6

Reference Books:

Sr. No.	
1	Principles & Practice of Cost Accounting – N. K. Prasad (Book Syndicate Pvt. Ltd.)
2	Costing Simplified: Wheldom Series – Brown & Owier (ELBS)
3	Cost Accounting: B. Jawaharlal (TMH)
4	Cost Accounting: R.R. Gupta.
5	Cost Accounting, 13/e - B. K. Bhar, (Academic Publishers, Kolkata)
6	Cost Accounting: Jain, Narang (Kalyani Publishers)
7	A Text Book of Estimating and Costing Mechanical – J.S. Charaya & G. S. Narang (Satya Prakashan)
8	Mechanical Estimation and Costing – TTTI, Chennai (TMH)
9	Theory & Problems of Management & Cost Accounting – M.Y. Khan, P. K. Jain
10	Financial Management- I.M.Pande, Vikas Publishing House Pvt Ltd.

	Effective Documentation: It is necessary for the students to master excellent writing techniques in order to equip our engineering graduates with the ability to create successful documentation. The literature review, problem statement, aim and objectives, system block diagram, system implementation details, discussion and analysis of results, conclusion, system limitations, and future scope are anticipated to be included in the PBL final report. It is expected that PBL mentors and guides will instruct students on how to use reliable information sources (such as scholarly articles, books, and periodicals) relating to their PBL topic.
	Evaluation & Continuous Assessment: The comprehensive and ongoing monitoring and evaluation of student achievement is key to the PBL concept's effectiveness. Regular reporting of all actions is recommended. Students must maintain a PBL log book at the department with regular evaluations of their PBL work. The logbook should record student guidance and information, the PBL guide's weekly oversight, and the evaluation form for the PBL guide to review the PBL work.
	Recommended parameters for assessment, evaluation, and weightage:
1	Idea Inception (kind of survey) — 10%.
2	Documentation (gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) — 15%.
3	Attended reviews, poster presentations, and model exhibitions — 10%.
4	Demonstration (Poster Presentation, Model Exhibition etc.) — 10%.
5	Awareness / Consideration of environment, social, ethics, safety measures, and legal aspects — 5%.
6	Outcome (physical model/prototype/virtual model/product development/assembly & disassembly and analysis of standard mechanism or system, design and development of small application, design of control systems, development of various systems/Hackathon/application
7	Participation in various competitions/publication/copyright/patent — 10%.
	References / Research Articles:
1	John Larmer, John R. Mergendoller, and Suzie Boss, "Setting the Standard for Project Based Learning".
2	John Larmer and Suzie Boss, "Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences".
3	Erin M. Murphy and Ross Cooper, "Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry".
4	Shinde, V. (2014). Design of Course Level Project Based Learning Models for an Indian Engineering Institute: An assessment of students' learning experiences and learning outcomes. Institute for Planning, Aalborg University.
5	Vikas V. Shinde and S. S. Inamdar. (2013). Problem Based Learning (PBL) for Engineering Education in India: Need and Recommendations. Wireless Personal Communications, 69, 1097–1105.
6	Shinde, V. (2011). Relevance of the problem and project based learning (PBL) to the Indian engineering education, across the disciplines: research into best practice. In 3rd International Research Symposium on PBL (pp. 489–501). Coventry University, UK.
7	Rahul C. Bhedasgaonkar et al. (2019). Course Level PBL: an Excellent Teaching Method for Increasing Skill Levels and Learning Motivation in First Year of Engineering Students. Proceedings of Regional Research Symposium on PBL, KLE Tech University, Hubballi, Karnataka, India.



Department of Mechanical Engineering

Course Code:	UMEMM0341	L	T	P	Credit
Course Name:	Introduction to Artificial Intelligence	2	-	-	2

Course Pre-Requisites:	Basics of Programming Concepts, Computer Technology
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[illegible]

Course Description:	Introduction to Artificial Intelligence provides students with a comprehensive understanding of AI fundamentals and practical applications. The course covers topics such as intelligent agents, problem-solving techniques, search algorithms, and the advantages, limitations, and case studies of AI. Through a combination of theoretical study and real-world examples, students gain insights into how AI is transforming industries such as healthcare, transportation, finance, and retail. By exploring cutting-edge developments, students develop the skills and knowledge necessary to navigate the exciting field of artificial intelligence.
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Course Objectives:

1	Understand the fundamental concepts of artificial intelligence, including intelligent agents, problem-solving techniques, and search algorithms.
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2	Explore the practical applications of AI across various industries, such as healthcare, finance, transportation, and retail, through case studies and real-world examples.
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3	Analyze the advantages and limitations of AI technologies, including ethical considerations and societal implications.
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4	Develop critical thinking skills by evaluating the impact of AI on society and identifying opportunities for innovation and problem-solving.

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Course Outcomes:

After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Demonstrate the core concepts of artificial intelligence (AI), including different types of AI, intelligent agents, and problem-solving strategies.	II	Understanding
CO2	Explain the fundamental principles and processes involved in problem-solving, including state space search, production systems, and heuristic techniques.	II	Understanding
CO3	Analyze the advantages and limitations of AI technologies, considering their applications and impact on society, ethical implications, and potential biases in decision-making	IV	Analyzing

CO-PO Mapping:	
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[illegible]

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

Course Contents:		
Unit No.	Unit Content	No. of Lectures
1	Unit 1: Overview of Artificial Intelligence: Introduction to AI, Types of AI, Intelligent Agents, Agents & environment, nature of the environment, structure of agents, goal-based agents, utility-based agents, and learning agents.	8 Hrs.
2	Unit 2: Problem-Solving Approaches in AI: Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs. Problem-solving agents, searching for solutions.	7 Hrs.
3	Unit 3: Search techniques: Informed Search & Uninformed search strategies: breadth-first search, depth-first search, depth-limited search, bidirectional search. Heuristic search strategies	8 Hrs.
4	Unit 4: - Applications and case studies of Artificial Intelligence: Applications of Artificial Intelligence, Advantages of Artificial Intelligence, Limitations of Artificial Intelligence, Case Studies of Artificial Intelligence: AlphaGo, Watson for Oncology, Tesla Autopilot, DeepMind Health, Amazon Recommendation System, Netflix Content Recommendation etc.	7 Hrs.
Text Books:		
Sr. No.		
1	Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009).	
2	Kevin Night and Elaine Rich, Nair B, “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.	
3	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.	
4	Sinan Ozdemir, “Principles of Data Science”, Packt.	
5	Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 4th Edition, Pearson Education, 2024.	
Reference Books:		
Sr. No.		
1	David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, 3rd Edition, Cambridge University Press, 2023.	
2	Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann / Elsevier, 1998.	
3	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.	
4	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.	
5	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O’Reilly Media, 2022.	



Department of Mechanical Engineering

Course Code:	UMEMM0342	L	T	P	Credit
Course Name:	Circuit Design and Analysis	2			2
Course Pre-Requisites:	Physics, Basic Electrical and Electronics				

Course Description:	This course has been designed to introduce students with construction, theory and characteristics of various electronics devices. Also, this course will lay strong fundamental base of discrete electronics and to develop capacity to analyze, interpret and design different electronics circuits.
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Course Objectives:

1	To explain the differences between the various types of diodes.
2	To explain the operation of transistor and its different configurations.
3	To explain the working of electronic circuits like diodes.
4	To explain different transistors used in electronic circuits.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the working of diode and transistors.	II	Understand
CO2	Identify the performance of Power supplies and Voltage Regulators.	III	Apply
CO3	Select an appropriate rectifier, filter and transistor for different application.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											1	1	1
CO2	3		2	2								1	2	2
CO3	1			2	2							1	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Semiconductor Diode : PN Junction Diode: V-I characteristics, current components, drift and diffusion current, Diode current equation, temperature dependence of V-I characteristics, diode equivalent circuits, diode resistance and capacitance, various breakdown mechanisms. Introduction to Special Semiconductor Diodes: Zener diode, PIN diode, Photo diode, LED - construction, characteristics, symbol, equivalent circuits.	8
2	Unregulated Power Supplies: Rectifiers: Study and analysis of Half, Full and Bridge Rectifier. Filters: Need of filters, Types: Capacitor, Inductor, LC, CLC, Design of unregulated power supply with and Without filter.	7
3	Voltage Regulators: Need of voltage regulator, Stabilization factors Analysis & Design of Shunt regulator, Series voltage regulator using Zener diode, Series voltage regulator with Pre- regulator & Overload protection circuit using Zener diode	7
4	Transistors: Bipolar Junction Transistor: Construction, Operation. Common Base Configuration, Transistor Amplifying Action, Common Emitter Configuration, Common Collector Configuration, Limit of Operation, Transistor Data Sheet, Power Dissipation, Heat Sinking. Field Effect Transistor: n-Channel JFET, Characteristics of n – Channel JFET, p – Channel JFET, Introduction to MOSFET.	8

Text Books:

Sr. No.	
1	Electronic Devices and Circuits, R. Boylestad & L. Nashelsky, Prentice Hall International, 8th Edition, 2005.
2	Electronic devices & circuits by Allen Mottershed - 'Prentice- Hall India.
3	A Monograph on Electronics Design Principles by N.C. Goyal & R.K. Khetan'-Vth Edition-Khanna Publishers.
4	Electronic Devices and Circuits by Jacob Millman and Christos C. Halkias
5	A Monograph on Electronics Design Principles N.C. Goyal & R.K. Khetan- 'Vth Edition-Khanna Publishers.

Reference Books:

Sr. No.	
1	David A. Bell - Electronic devices & circuits '- IVth Edition- Prentice- Hall India.
2	Millman & C. Halkias -Electronic devices & circuits '-IInd Edition- Tata McGraw Hill Publication.
3	Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku
4	Design of Analog CMOS Integrated Circuits by Behzad Razavi
5	Microelectronic Circuits by Adel S. Sedra, Kenneth C. Smith, Tony Chan Carusone, and Vincent Gaudet



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEMM0343		L	T	P	Credit
Course Name:	Sensors and Actuators		2			2
Course Pre-Requisites:	Fundamentals of Electronics					
Course Description:	This course gives knowledge about the different sensors and transducers. It also describes different actuating techniques along with fluidics and fluid logic gates and circuits.					

Course Objectives:

1	To understand basic terminologies and concepts of sensors actuators and fluidics
2	To be able to classify different sensors and study their working principles
3	To be able to classify actuators and study their working principles

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain fundamentals, characteristics & classification of sensors, actuators and importance of fluidics and logic gates used in technical applications	II	Understand
CO2	Explain different types of sensors and actuators used in technical applications	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3
CO1	2	2									1		2	2	
CO2	2	2									1		2	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course content

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Sensor fundamentals and characteristics Difference between sensors and transducers, Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, Displacement, position and proximity sensors, LVDT, Hall Effect sensor. Pneumatic transducer.	8
2	Optical sensor-Through-Beam Sensors, Retro-Reflective Sensors, Diffuse Reflection Sensors, Photoelectric sensors – Photo emissive, Photoconductive and Photovoltaic , Optical Encoders – Incremental and Absolute encoders, temperature sensors.	7
3	Electromechanical Actuators: Working principle and applications of D.C motors, A.C motors, Stepper motor- types. Pros and Cons of Hydraulic, Pneumatic and electric actuators. Hydraulic and Pneumatic systems, Differences with fluid power symbols. Hydraulic and pneumatic actuators classification, working and construction. Numerical treatment on linear and rotary actuators. Special valves and actuators.	9
4	Fluidics and Fluid logics: Introduction, working principle. Construction, operation and purpose of the various fluidic devices. Construction, operation and features of the various types of fluid sensors. Fluidic logic circuits for various fluid power systems.	6

Text Books:

Sr. No.	
1	Automated Manufacturing Systems: Sensors, Actuators – S. Brain Morris (McGraw Hill) ISBN 0-07-113999-0
2	Sabrie Soloman, "Sensors and Control Systems in Manufacturing", McGraw Hill, International Editions, 1994
3	Pneumatic Systems: Principles and Maintenance- S. R. Majumdar , McGraw-Hill, 1996

Reference Books:

Sr. No.	
1	Electromechanical Sensors and Actuators (Mechanical Engineering Series) - Ilene J. ,Busch-Vishniac , Springer ISBN 038798495X
2	"Mechatronic Systems, Sensors, and Actuators: Fundamentals and Modeling" by Robert H. Bishop
3	Sensors and Actuators: Engineering System Instrumentation" by Clarence W. de Silva
4	"Sensors, Actuators, and Their Interfaces: A Multidisciplinary Introduction" by Nathan Ida
5	"Fluidics: Components and Circuits" by K. Foster and G. A. Parker



Kolhapur Institute of Technology's College of Engineering Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEPC0401	L	T	P	Credit
Course Name:	Metrology	2			2
Course Pre-Requisites:	This course requires the basic knowledge of the following: 1.Metric and SI units of physical quantities 2.Statistics 3.Trigonometry and basics of manufacturing engineering				
Course Description:	In the era of technology driven life. Products are needed to be manufactured with high accuracy and precision and for accomplishing this dimensional control and measurement of it with the desired accuracy and precision is demanded. Also this is the very important aspect in achieving quality and reliability in the service of any product. Unless the manufactured parts are accurately measured, assurance of quality cannot be granted. In this context measuring instruments and precision measurement techniques plays significant role. This course covers this all the demanded aspects of syllabus like working principle, construction, application, use of measuring instrument and its techniques.				

Course Objectives:

1	Choose suitable instrument / gauge / method of inspection for determining geometrical and dimensional measurements
2	Understand the basic concepts of metrology, various standards and methods of dimensional measurement.
3	Make use of different tools and advance instruments to measure the various parameters of screw threads, gears and surface quality
4	Analyze the quality by appropriate advanced instrument and technique for given application.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Select appropriate measuring instrument for specific application	I	Remember
CO2	Explain basic concepts of metrology, various standards and methods of dimensional measurement.	II	Understand
CO3	Make use of different tools and advance instruments for evaluating different parameters	III	Apply
CO4	Simplify the construction and working of traditional and advance measuring instruments.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2								1	2	1	
CO2	2	1	2								1	2	2	
CO3	2	2	2	2	1						1	2	2	2
CO4	2	2	2	2							1	2	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures in Hrs.
1	Basics of Metrology Need of measurement, errors in measurement, and standards of measurement, Line & End, Calibration & Need for Calibration. Linear measurement & Angular measurement principles Tolerances and Gauging: Unilateral and bilateral tolerances, Limit and Fits, Types of Fits, plain gauges and gauge design (numerical treatment), interchangeability and selective assembly.	7
2	Comparators & Interferometry, Advance metrology Comparators : Mechanical(Sigma, Twisted strip), Pneumatic(Differential),Electrical (LVDT). Optical – (Profile Projector), and their applications Interferometry: Principle of Interferometry and application in checking of flatness, height. Coordinate Measuring Machine (CMM): Fundamental features of CMM – role of CMMs – types of CMM and Applications, – types of probes, Laser in Metrology, Automatic inspection system, Machine vision for online-offline inspection.	7
3	Metrology of Thread, Gears Measurement of Thread form: Thread form errors, Measurement of Minor, Major and Effective diameter (Two Wire Method), Flank angle, pitch & pitch error Floating Carriage Micrometer (Numerical). Gear Metrology: Types of errors, Gear tooth Vernier, Chordal thickness method, Constant chord, Base tangent (Numerical), Gear Rolling Tester.	7

4	Surface finish measurement & GD &T. Surface Finish: Types of textures obtained during m/c operation, CLA(Ra), RMS, Rz assessment methods, direction of lay, texture symbols, instruments used in surface finish assessment. Symbol for designating surface finish, straightness, flatness, squareness, roundness on drawing Geometric dimensioning & Tolerances (GD&T) for geometric features.	7
Text Books:		
Sr. No.		
1	R.K. Jain, — Engineering Metrology, Khanna Publisher,	
2	I.C. Gupta, —Engineering Metrology Dhanpat Rai Publications.,	
3	M. Mahajan, —Statistical Quality Control Dhanpat Rai & Co., 2012	
4	Metrology & Measurement- Anand K. Bewoor , Tata McGraw-Hill.	
4	N.V Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, Oxford	
Reference Books:		
Sr. No.		
1	J.F.W. Gayler and C.R. Shotbolt, —Metrology for Engineers, Cassell, 1990	
2	K.W.B. Sharp, —Practical Engineering Metrology, Pitman London, 1st Edition 1973	
3	Connie L. Dotson - Fundamentals of Dimensional Metrology - Cengage	



Kolhapur Institute of Technology's College of Engineering Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEPC0402	L	T	P	Credit
Course Name:	Manufacturing Technology and Processes	3	--	--	3
Course Pre-Requisites:	Knowledge of basic mechanical engineering, workshop practice, engineering materials				
Course Description:	This course aims to impart knowledge of various manufacturing processes and machine tools used for converting a piece of raw material into semifinished or finished products.				

Course Objectives:

1	To understand the various conventional and basic machine tools and manufacturing processes carried out on these machines for different applications.
2	To gain the basic knowledge about machine tools and its construction and principles of working.
3	To make student aware of tool geometry, tool signature, and mechanics of chip formation, types chip, tool wear, surface finish and need of cutting fluids, machinability of the material
4	To study of various features and capabilities of various machine tool types, parts, accessories attachments, and operations performed and time required, assists in selection of
5	To study of advances in machine tools and finishing processes helps to take decision for selection of proper machine tool for batch and large size machining applications.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the construction and working of various manufacturing processes like casting, metal forming and metal joining processes	II	Understand
CO2	Demonstrate construction and working of various machine tools and CNC machines	II	Understand
CO3	Summarize the fundamental concepts in metal cutting processes.	II	Understand
CO4	Select the manufacturing process to produce the various components required in industry using the fundamental knowledge of different manufacturing processes.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1													
CO2	1													
CO3	2	1		1	1			1				1	1	
CO4	2	1		1	1			1			1	1	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1: Metal Casting Steps in green sand casting, introduction and types of patterns and core boxes, materials used and selection criteria for patterns, pattern allowances, Types of sands used in molding and core making, their properties. Sand molding types such as Green sand Molding, shell Molding, CO2 Molding, Investment casting, Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics. Introduction to permanent mould casting processes	08 Hrs

2	Unit 2: Metal Forming Processes Hot, cold and warm working. Recovery and Recrystallization. Formability and parameters affecting the yield strength of materials. Classification of various metal Forming processes, hot and cold working of metals such as forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects etc.	08 Hrs
3	Unit 3: Metal Joining Processes Overview and classification of joining processes, Surface preparation and various joints, Arc Welding- SMAW, TIG, MIG, Resistance welding- Spot, Seam and Projection welding process, Soldering and Brazing, riveted and bolted joints. Introduction to inspection techniques to inspect the welding joints.	07 Hrs
4	Unit 4: Introduction to Theory of Metal Cutting, Lathe & Drilling Machine A) Classification of Machine tools, Mechanics of machining, Principles, Machining Parameters, forces in machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear, Tool signature, Types of chips, Cutting fluids, machinability, Selection of tool materials. B) Lathe Parts, Accessories, Attachments, Concept of speed, feed, depth of cut, and Machining time calculation for lathe machine.	08 Hrs
5	Unit 5: Milling & Grinding Machine A) Milling machine: Classification of milling machines, construction and working of column and knee type milling machine, milling operations, study of standard accessories - dividing head, gear cutting on milling machine. B) Grinding Machine: Introduction, types of grinding, classification of grinding machines, principle of grinding operations, grinding wheel.	07 Hrs
6	Unit 6: CNC Machines NC machine, Difference between NC & CNC machine tools, CNC types, constructional details, special features, machining centre, Vertical and Horizontal Machining Centre, Recirculating ball screw, Feedback devices, fundamentals of part programming, tooling used for CNC machines, Automatic tool changer (ATC), Automatic pallet changer (APC).	07 Hrs

Text Books:

Sr. No.	
1	Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition, 2002.
2	B.S. Raghuwanshi, "Workshop Technology", Dhanpatrai Publication, 9th Edition, 1999.
3	Rao, P.N., Manufacturing Technology–Metal Cutting and Machine Tools, Tata McGraw Hill, New Delhi, 2000.
4	Hajra Chowdary, S.K., and Hajra Chowdary, A.K., Elements of Workshop Technology, Vol. II, Asia Publishing House, Bombay.
5	Kalpakjian, S. and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson
6	Production Technology by HMT, Tata McGraw-Hill, 2002
7	Khanna, O.P., and Lal, M., A Text Book of Production Technology, Vol II, Dhanpat Rai & Sons, 1992.
8	Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers
9	All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006
10	Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition

Reference Books:

Sr. No.	
1	Manufacturing Science – Amitabha Ghosh and Mallik, Affiliated East Westpress, 2010, 2nd edition.
2	Modern machining Process – Pandey and Shah, Tata McGraw Hill – 2009.
3	Manufacturing processes for Engineering Materials by Serope Kalpakjian and Steven R. Schmid Pearson Education 2009, 5th Edition
4	Materials and Processes in Manufacturing by E. Paul DeGarmo, J T Black, Ronald A Kohser, 8th Edition, Prentice Hall of India



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMEPC0403	L	T	P	Credit
Course Name:	FLUID MECHANICS AND HYDRAULIC MACHINES	3			3
Course Pre-Requisites:	Fundamental Units and Dimensions, Differential and Integral Calculus, Basic Laws of Mechanics and Thermodynamics.				
Course Description:	This is one of the fundamental courses in thermal engineering. The course deals with fluid properties, fluid statics, dynamics and basics of hydraulic machines. The knowledge of this course is essential for design of turbines, pumps, compressors etc.,. Also the course is essential pre-requisite for Heat and Mass Transfer and Computational Fluid Dynamics courses in Mechanical Engineering.				

Course Objectives:

1	To prepare students of Mechanical Engineering to excel in fundamentals of Fluid Mechanics and Hydraulic Machines to succeed in careers in industry, technical professions or entrepreneurship.
2	To provide students with a solid foundation in Fluid Mechanics and Hydraulic Machinery fundamentals required to solve engineering problems in thermal engineering and also to pursue higher studies.
3	To train students with good scientific and engineering breadth in the areas of Fluid Mechanics and Hydraulic Machines, so as to comprehend, analyze, design and create novel products and solutions for the real life problems.
4	To train students for self education and lifelong learning and acquire the necessary knowledge and skills in the area of Fluid Mechanics and Hydraulic Machines to participate and succeed in competitive examinations like GRE, GATE and IES.

Course Outcomes: After the completion of the course the student will be able to

COs	Upon completion of the course, students shall have ability to	Blooms Level	Descriptor
CO1	Explain the fundamental concepts of Fluid Mechanics and Hydraulic Machines.	II	Understand
CO2	Solve problems in Fluid Mechanics and Hydraulic Machines based on the acquired knowledge and techniques.	III	Apply
CO3	Develop expression for parameters used in Fluid Mechanics and Hydraulic Machines.	III	Apply
CO4	Analyze the performance of components and devices based on the information gained in Fluid Mechanics and Hydraulic Machines.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3
CO1	3	2	2								2		3		
CO2	3	2	2								2		3	3	
CO3	2	2	3								2		2		3
CO4	2	2	3								2		2		3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Fluid Properties and Statics: Fluid Properties: Definition of fluid, Fluid as a continuum. Viscosity, Types of Fluid, Compressibility and Bulk modulus of Elasticity, Surface tension, Capillarity and Vapour pressure. Fluid Statics: Pascal's law, Hydrostatic law, Hydrostatic forces on submerged bodies. Buoyancy and Stability. Pressure measuring devices.	6
2	Kinematics and Dynamics of Fluid Flow: Fluid Kinematics: Types of Flow and Flow Lines, Stream and velocity potential Function. Continuity Equation in 3D Cartesian Coordinate System, Velocity and Acceleration of fluid particles. Fluid Dynamics: Equation of Motion, Bernoulli's equation, venturimeter and orifice meter, Momentum Equation, Application of Momentum Equation. Need and Applications of CFD.	8
3	Flow through pipes: Laminar flow through circular pipe and parallel plates, Losses of energy, Darcy's Equation, Chezy's Equation, Major and Minor Losses, Flow Through Series and Parallel Pipes. Branching and equivalent Pipe, Siphon Pipe.	8
4	Boundary Layer Theory and Dimensional Analysis: Boundary Layer Theory: Velocity boundary layer, displacement, momentum and energy thickness, Boundary layer Separation and Control. Dimensional analysis: Buckingham's Π -theorem, model laws and model testing.	7
5	Forces on Immersed Bodies and Compressible Fluid Flow: Forces on Immersed Bodies: Drag and Lift forces on streamlined and bluff bodies. Types of Drag, Magnus effect. Compressible Fluid Flow: Basics of Compressible flow, Energy equation of compressible flows, Mach Cone and Mach number. Stagnation properties. Area velocity relationship in compressible flow.	8

6	Hydraulic Machines: Water Turbines: Classification, Angular-momentum principle (Euler's Equation). Pelton wheel, Francis and Kaplan Turbine: construction, principle of working, Daft tubes. specific speed, Performance characteristics of Pelton wheel and Francis, Kaplan Turbine. Centrifugal Pumps: Classification, principle of working, types of heads, cavitation, NPSH, minimum starting speed, priming of pumps, specific speed, performance characteristics of centrifugal pump, series and parallel operation of pumps.	8
Text Books:		
Sr. No.		
1	Fluid Mechanics-Fundamentals and Applications, Yunus Cengel , John Cimbala , McGraw Hill Education, 4th Edition.	
2	Fluid Mechanics, Frank M White, McGraw Hill Education India Private Limited, 8th Edition.	
3	Introduction to Fluid Mechanics, Robert W. Fox , Alan T. McDonald , John W. Mitchell, Wiley Publication, 10th Edition.	
4	Introduction to Fluid Mechanics and Fluid Machines, S K Som , Gautam Biswas , Suman Chakraborty, Mc Graw Hill India, 3rd Edition.	
Reference Books:		
Sr. No.		
1	Fluid Mechanics and Hydraulic Machines-Problems and Solution, K. Subramanya, McGraw Hill Education, 2nd Edition,.	
2	A Textbook of Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition.	
3	Hydraulics and Fluid Mechanics Including Hydraulics Machines, Dr. P.N. Modi and S.M. Seth, Standard Book House,22nd Edition.	



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0404	L	T	P	Credit
Course Name:	Control Systems Engineering	2			2
Course Pre-Requisites:	There are no formal prerequisites for this course; however you will need some knowledge of material from the following courses: physics, mathematics and electrical engineering.				
Course Description:	This course provides an introduction to linear systems, transfer functions, and Laplace transforms. It covers stability and feedback, and provides basic design tools for specifications of transient response				

Course Objectives:

1	Understand different dynamic systems and to be able to model such systems. This assists in understanding the wider implications of these engineering concepts, including responsibility in social, cultural and environmental issues
2	Understand the concept of feedback and how it influences the response of a system
3	Understand the response of a dynamic system to an input signal and to be able to predict the response of a particular system. This applies the mathematical and engineering sciences, including physics, to real-life problems.
4	To synthesize and demonstrate the efficacy of solutions to part or all of complex engineering problems, including formulating models from first principles of engineering science and mathematics

Course Outcomes:

COs	CO Statement	Blooms Level	Descriptor
CO1	Build model of physical systems in the forms suitable for use in the analysis and design of control systems	III	Apply
CO2	Make use of block diagram reduction, signal flow Technique and state space to represent control system	III	Apply
CO3	Identify the time domain responses of first and second-order systems to inputs like step, impulse etc.	III	Apply
CO4	Analyze time domain control system by applying stability criteria and sketching Root locus	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2										2		
CO2	2	2	2										2		
CO3	2	2	2		1								2		
CO4	2	3	2	1	1								2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Basic Elements and Mathematical Modeling of Control System : Classification of control system: Open loop and Closed loop systems, Linear-non linear, SISO-MIMO, etc. Advantages and limitations of open loop and closed loop systems and its applications. Modeling of Electric systems, Translational and rotational mechanical systems	8
2	Control system representation: Block diagram Algebra, Signal flow graph reduction using mason's gain formula. State space representation-concept of state, state variables and state model	7
3	Time Response Analysis: Time response of first order systems for impulse, step inputs, Transient response of second order systems for unit step input. Time domain specifications. Steady state Error and Error Constants	8
4	Stability & Root Locus Analysis: Stability criterion-Routh's stability. Root Locus-significance and Construction. Effect of addition of Poles and Zeros.	7

Text Books:

Sr. No.	
1	Control System Engineering, R Anand Natarajan, P. Ramesh Babu, SciTech Publication, 2nd Edition.
2	Automatic Control Engineering, F.H. Raven Tata McGraw Hill Publication, 5th Edition.
3	Feedback Control Systems, R.A. Barapate, Tech-Max publications.

Reference Books:

Sr. No.	
1	Modern Control Systems, K Ogata, , Prentice Hall Publication ,3rd Edition.
2	Automatic Control Systems, B.C. Kuo, Willey India Ltd. / Prentice Hall Publication, 7th Edition.
3	Automatic Control Engineering, D. Roy and Choudhari, Orient Longman Publication. Calcutta
4	Modern Control Engineering, K. Ogata, Pearson Education
5	Control Systems ,A. Anand Kumar, Prentice Hall Publication.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0405	L	T	P	Credit
Course Name:	Theory of Machines	3			3
Course Pre-Requisites:	1. Engineering Mathematics 2. Engineering Physics 3. Engineering Mechanics				
Course Description:	Theory of Machines may be defined as that branch of Engineering-science, which deals with the study of relative motion between the various parts of a machine, and forces which act on them. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine.				

Course Objectives:

1	Define various terminology related to kinematics of mechanism.
2	Discuss effect of friction in various mechanism.
3	Perform force analysis of simple mechanisms.
4	Design cam with follower for different applications.
5	Select different power transmitting elements.
6	Analyze the gyroscopic effects on vehicles, aero plane and ship.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Define various terminology related to kinematics of machine elements.	I	Remember
CO2	Identify the various mechanisms and its components.	III	Apply
CO3	Apply analytical formulae to simple mechanisms.	III	Apply
CO4	Analyze kinematics and dynamics of simple mechanisms.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2									2	3	2	
CO2	2	2	2	1							2	2	2	
CO3	2	2	2	1							2	2	2	1
CO4	2	2	2	1							2	2	1	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10% (10 marks)	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30% (30 marks)	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10% (10 marks)	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50% (50 marks)	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Basic of Kinematics:- Structure, Machine, Link and its types, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubler's criterion, Degree of Freedom, Inversions of slider crank chain, Double slider crank chain, Four bar chain.	7
2	Friction:- Introduction of friction, Friction in pivot bearings, Friction in power screw, Friction in clutch, Uniform wear and Uniform pressure for the clutch & bearing.	8
3	Kinetic analysis of Mechanisms:- Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D'Alembert's principle, Dynamically equivalent system, Force analysis of reciprocating engine mechanism.	8
4	Cam and Follower:- Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams, Motions of the follower, Graphical construction of cam profile.	7
5	Theory of Gears:- Classification of gears, Types of gears, Spur gears - terminology, fundamental law of toothed gearing, involute and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, Interference and under cutting.	8
6	Gyroscope:- Gyroscopic couple, Spinning and Precessional motion, Gyroscopic couple and its effect on - i) Aero plane ii) Ship iii) Four-Wheeler iv) Two - Wheeler.	7

Text Books:

Sr. No.	
1	Rattan, S.S.: "Theory of Machines", 2 nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.
2	Bansal, R. K., "Theory of machines", Laxmi Publications Pvt. Ltd, New Delhi
3	Rao, J.S., and Dukkipati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.
4	Ghosh, A, and Mallick, A. K. "Theory of Mechanisms and Machines" 3 rd Edition, East West Press Pvt. Ltd., 2000.
5	Bevan T., "Theory of Machines: a text book for engineering students", 3 rd Edition, CBS, New Delhi.

Reference Books:

Sr. No.	
1	Shigley, J.E. and Uicker, J.J. and Pennock, G. R.. "Theory of Machines and Mechanisms", 3 rd Edition, Oxford University Press, 2005.
2	Bevan T., "Theory of Machines: a text book for engineering students", 3 rd Edition, CBS, New Delhi.
3	Rattan, S.S.: "Theory of Machines", 2 nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.

4	Rao, J.S., and Duggipati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.
5	Ghosh, A, and Mallick, A. K. "Theory of Mechanisms and Machines" 3 rd Edition, East West Press Pvt. Ltd., 2000.
6	Norton, R.L., Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 1st Edition, 2009



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMEPC0431	L	T	P	Credit
Course Name:	FLUID MECHANICS AND HYDRAULIC MACHINES LAB			2	1
Course Pre-Requisites:	Fundamental Units and Dimensions, Basic Laws of Mechanics and Thermodynamics and Fluid Mechanics and Hydraulic Machines.				
Course Description:	The course aims at experimentation on flow types, measurement of fluid properties, flow measurement and turbo machines like Pelton wheel, Francis turbine, centrifugal pumps etc.,. The knowledge gained in Fluid Mechanics and Hydraulic Machines is demonstrated and experimented in this laboratory.				

Course Objectives:

1	To prepare students in Fluid Mechanics and Hydraulic Machines Laboratory to succeed in careers in industry, technical professions or entrepreneurship.
2	To provide students with a solid foundation in Fluid Mechanics and Hydraulic Machines Laboratory experiments to solve engineering problems.
3	To train students with good scientific and engineering breadth in the areas of Fluid Mechanics and Hydraulic Machines Laboratory, so as to comprehend, analyze the real life problems.
4	To prepare students to work in a team and effectively contribute in Fluid Mechanics and Hydraulic Machines laboratories.

Course Outcomes: After the completion of the course the student will be able to

COs	Upon completion of the course, students shall have ability to	Blooms Level	Descriptor
CO1	Demonstrate the working principles of devices in Fluid Mechanics and Hydraulic Machines.	II	Understand
CO2	Apply the knowledge, facts and techniques gained in Fluid Mechanics and Hydraulic Machines to perform the experiments.	III	Apply
CO3	Analyze the performance of devices in Fluid Mechanics and Machines experimentally and analytically.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3
CO1	3	2	2		1				3	2					
CO2	3	2	2		1				3	2	2		3		3
CO3	2	2	3		1				3	2	2			3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	100%	Experiments conducted and Journal
2	End Semester Examination (ESE)	100%	Experiments conducted and Journal

Course Contents:

Expt No.	Experiment Name	No. of Hours
1	Reynolds Apparatus.	2
2	Bernoulli's Apparatus.	2
3	Venturi meter and Orifice meter	2
4	Rectangular and Triangular notch.	2
5	Friction in pipes.	2
6	Orifice under Steady Flow	2
7	Trial on Pelton Wheel Turbine	2
8	Trial on Francis Turbine	2
9	Trial on Centrifugal Pump	2
10	Visit to pump working station / Industry	2

Text Books:

Sr. No.	
1	Fluid Mechanics-Fundamentals and Applications, Yunus Cengel , John Cimbala , McGraw Hill Education, 4th Edition.
2	Fluid Mechanics, Frank M White, McGraw Hill Education India Private Limited, 8th Edition.
3	Introduction to Fluid Mechanics, Robert W. Fox , Alan T. McDonald , John W. Mitchell, Wiley Publication, 10th Edition.

4	Introduction to Fluid Mechanics and Fluid Machines, S K Som , Gautam Biswas , Suman Chakraborty, Mc Graw Hill India, 3rd Edition.
Reference Books:	
Sr. No.	
1	Fluid Mechanics and Hydraulic Machines-Problems and Solution, K. Subramanya, McGraw Hill Education, 2nd Edition,.
2	A Textbook of Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition.
3	Hydraulics and Fluid Mechanics Including Hydraulics Machines, Dr. P.N. Modi and S.M. Seth, Standard Book House, 22nd Edition.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEPC0432	L	T	P	Credit
Course Name:	Theory of Machines Lab			2	1
Course Pre-Requisites:	1. Engineering Mathematics 2. Engineering Physics 3. Engineering Mechanics				
Course Description:	Theory of Machines may be defined as that branch of Engineering-science, which deals with the study of relative motion between the various parts of a machine, and forces which act on them. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine.				

Course Objectives:

1	Define various terminology related to kinematics of mechanism.
2	Discuss effect of friction in various mechanism.
3	Perform force analysis of simple mechanisms.
4	Design cam with follower for different applications.
5	Select different power transmitting elements.
6	Analyze the gyroscopic effects on vehicles, aero plane and ship.

Course Outcomes:

COs	CO Statement	Blooms Level	Descriptor
CO1	Define various terminology related to kinematics of machine elements.	I	Remember
CO2	Identify the various mechanisms and its components.	III	Apply
CO3	Apply analytical formulae to simple mechanisms.	III	Apply
CO4	Analyze kinematics and dynamics of simple mechanisms.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2						1	1	1	2	3	2	
CO2	2	2	2	1				1	1	1	2	2	2	
CO3	2	2	2	1				1	1	1	2	2	2	1
CO4	2	2	2	1				1	1	1	2	2	1	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50% (25 marks)	Based on neatness, timely submission and understanding of the experiments
2	End Semester Examination (ESE) POE	50% (25 marks)	Assessment is based on practical performance of experiments included in journal

*Perform any eight out of ten experiments.

Course Contents:

Experiment No.	Details of Experiment	No. of Hours
1	Study of Basic of Kinematics Aim and Objectives: To study basic concept of kinematics, verify the different laws related to mechanisms and Case Study on Basic of Kinematics. Outcomes: Students should be able to understand different types of mechanisms and their applications Theoretical Background: Basic of Kinematics	2
2	Sleep & Creep of Belts Aim and Objectives: To study the sleep & creep of belts Outcomes: Students should be able to understand sleep & creep of belts Theoretical Background: Theory of Belt Drive Experimentation: Calculation of percentage of sleep and creep using apparatus Results and Discussions: Compare Sleep & Creep percentage for different load Conclusion: Find out effect of sleep and creep on belt drive	2
3	Study of Rope Brake Dynamometer Aim and Objectives: To conduct load test on rope brake using an electrical motor and to find efficiency of the motor Outcomes: Students should be able to understand construction and working of rope brake dynamometer Theoretical Background: Theory of dynamometer Experimentation: Calculation of input power, output power and mechanical efficiency Results and Discussions: Compare efficiency of motor for different load Conclusion: Find out effect of load on efficiency of the motor	2
4	Determination of M.I. using Bifilar suspension system. Aim & Objectives: To determine radius of gyration of rectangular bar using Bifilar suspension method. Outcomes: Able to determine radius of gyration of components. Experimentation: To determine value of Radius of gyration and M.I. of rectangular bar Experimentally. Results and Discussions: To verify the Radius of gyration and M.I. analytically and experimentally.	2

5	Determination of M.I. using Trifilar suspension system. Aim & Objectives: To determine radius of gyration of Circular disc using Trifilar suspension method. Outcomes: Able to determine radius of gyration of components. Experimentation: To determine value of Radius of gyration and M.I. of Circular disc Experimentally. Results and Discussions: To verify the Radius of gyration and M.I. analytically and experimentally.	2
6	Determination of M.I. of connecting rod by Compound pendulum method. Aim & Objectives: To determine radius of gyration of connecting rod as Compound Pendulum. Outcomes: Able to determine radius of gyration and M.I. of components like Connecting rod. Experimentation: To determine value of Radius of gyration and M.I. of connecting rod Experimentally. Results and Discussions: To verify the Radius of gyration and M.I. analytically and experimentally.	2
7	Construction of cam profile by considering different follower motion Aim and Objectives: To study basic of cam & follower and Construct different types of cam profile from given data Outcomes: Students should be able to design cam with follower for different applications Theoretical Background: Cams-To draw the layout of cam profile for different follower by considering different follower motion	2
8	Verification of gyroscopic principle and determination of gyroscopic couple. Aim & Objectives: To Verify experimentally the principles of Gyroscope. Outcomes: Able to describe effect of gyroscopic couple on various systems. Experimentation: Verification of active and reactive gyroscopic couples values using experimental setup. Results and Discussions: Calculation of active and reactive gyroscopic couples.	2
9	Demonstration of different Gear Train. Aim & Objectives: To study various types of gear trains and analysis of Gear Train. Outcomes: Able to Identify different Gear Train. Experimentation: Use of Tabular method for the Analysis of gear train model available in laboratory. Results and Discussions: Determination of speeds of different wheels in gear train.	2
10	Demonstration and Torque Measurement in Epicyclic Gear Train. Aim & Objectives: To study various types of gear trains and analysis of Epicyclic Gear Train. Outcomes: Able to analyze the Epicyclic Gear Train. Experimentation: Use of Tabular method for the Analysis of gear train model available in laboratory. Results and Discussions: Determination of speeds of different wheels in gear train.	2

Text Books:

Sr. No.	
1	Rattan, S.S.: "Theory of Machines", 2 nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.
2	Bansal, R. K., "Theory of machines", Laxmi Publications Pvt. Ltd, New Delhi
3	Rao, J.S., and Duggipati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.
4	Ghosh, A, and Malick, A. K. "Theory of Mechanisms and Machines" 3 rd Edition, East West Press Pvt. Ltd., 2000.
5	Bevan T., "Theory of Machines: a text book for engineering students", 3 rd Edition, CBS, New Delhi.

Reference Books:

Sr. No.	
1	Shigley, J.E. and Uicker, J.J. and Pennock, G. R.. "Theory of Machines and Mechanisms", 3 rd Edition, OxfordUniversity Press, 2005.
2	Bevan T., "Theory of Machines: a text book for engineering students", 3 rd Edition, CBS, New Delhi.
3	Rattan, S.S.: "Theory of Machines", 2 nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.
4	Rao, J.S., and Duggipati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.
5	Ghosh, A, and Malick, A. K. "Theory of Mechanisms and Machines" 3 rd Edition, East West Press Pvt. Ltd., 2000.
6	Norton, R.L., Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 1st Edition, 2009

Title of the Course: Constitution of India													L	T	P	Credit
													2	--	--	2
Course Code: UMEVE0406																
Course Pre-Requisite: Basics of Indian History, Independence Movement, Fundamentals of Civics.																
Course Description: This Course is an introduction of Indian Constitution and basic concepts highlighted in this course for understanding the Constitution of India. This course is structured to give a deeper insight for making the nexus between the other law subjects.																
Course Objectives																
At the end of the course the student is expected to have acquired:																
1. A basic understanding of Constitution of India.																
2. Builds the ability to apply the knowledge gained from the course to current social legal issues.																
3. Ability to understand and solve the contemporary challenges.																
4. Understanding constitutional remedies.																
Course Learning Outcomes:																
CO	After the completion of the course the student should be able to												Bloom's Cognitive			
													level	Descriptor		
CO1	Explain the significance of Indian Constitution as the fundamental law of the land												II	Cognitive (Understand)		
CO2	Exercise his fundamental rights in proper sense at the same time Identifies his responsibilities in national building.												II	Cognitive (Applying)		
CO3	Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail												II	Cognitive (Understand)		
CO4	Understand Electoral Process, Emergency provisions and Amendment procedure.												II	Cognitive (Understand)		
CO-PO Mapping:																
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3	
CO1						3		3				3				
CO2						3		3	3	3		3				
CO3						3			3			3				
CO4						3			3			3				
Assessments:																
Teacher Assessment:																
One In Semester Evaluation (ISE) having 100% weights respectively.																
Assessment									Marks							
ISE									50							
ISE: Assessment is based on 100% course content																
Course Contents:																
Unit 1:- Constitution – Structure and Principles														(03) Hrs.		
1.1: Meaning and importance of Constitution																
1.2: Making of Indian Constitution – Sources																

1.3: Salient features of Indian Constitution	
Unit 2:- Fundamental Rights and Directive Principles 2.1: Fundamental Rights & Fundamental Duties 2.2: Directive Principles of State Policy	(10) Hrs.
Unit 3:- Union Government & Executive 3.1: President of India – Qualification, Powers and Impeachment 3.2: Lok Sabha & Rajya Sabha- Composition, Powers & Functions, Scope to amendment in Constitution	(04) Hrs.
Unit 4:- State Government & Executive 4.1: Governor – Qualification, Appointment, Powers & Functions 4.2: Legislative Assembly & Legislative Council – Composition, Powers & Functions	(03) Hrs.
Unit 5:- The Judiciary 5.1: Features of Judicial System in India 5.2: Hierarchy of Courts, Composition and Jurisdiction	(03) Hrs.
Unit 6:- Local Self Government and other constitutional Organizations 6.1: 73rd and 74th Constitutional Amendments 6.2: Public Service Commission, Election Commission, CAG, National Commissions for SC, ST etc.	(03) Hrs.
Textbooks: 1. M.P. Jain, Indian Constitutional Law 2. M.P. Singh (ed.), V.N. Shukla, Constitutional Law of India 3. D.D. Basu, Commentary on the Constitution of India 4. S.S. Desai, Constitutional Law--I & II	
References: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.) 2. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.) 3. Shripad Shridhar Desai, Constitutional Law--I, S.S. Law Publication, 2021 4. Shripad Shridhar Desai, Constitutional Law --II, S.S. Law Publication, 2021 5. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf 6. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015	



Kolhapur Institute of Technology's College of Engineering Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEVS0433	L	T	P	Credit
Course Name:	Geometric Dimensioning & Tolerances Labrotary			2	1
Course Pre-Requisites:	Basic of Physics, Mathematics, Statistics Basic Knowledge of different units, types of errors in measurement and basic electrical components with their principle. Basic nowlge of scale, scale factor and different measurement with units. Also knowledge of Basics of Geometrical Dimensional Tolerances, limit, fits				
Course Description:	The course integrates measurements of industrial parts with various mechanical and Electro- Mechanical measuring instruments and their usage.				

Course Objectives:

- 1 To develop students knowledge of basics of Measurements, Metrology and measuring devices.
- 2 To know the concepts of various measurement systems & standards with regards to realistic applications.
- 3 The application of principle of metrology and measurements in industries.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	List various geometrical tolerances used in production drawing	I	Remember
CO2	Demonstrate use of metrological tools for linear, angular measurements	II	Understand
CO3	Apply the basics of standards of measurement, limits, fits & tolerances industrial applications	III	Apply
CO4	List different dimensional parameters of any component by different measuring instruments.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2				2						1	2	2	
CO2	2	2	2								1	2		
CO3	2	1		2	2						1	2	2	1
CO4	2	2	2	2							1	2		1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	100% (25M)	Practical Performance and inernal oral ,Seminar, Presentation, etc.

Course Contents:

Experiment No.	Unit Content	No. of sessions
1	Study & Use of various linear measuring instruments Vernier Aim and Objectives: Outcomes: Demonstrate use of linear Measuring Instruments Theoretical Background: Experimentation: Use of instrument, Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
2	Study & Use of various linear measuring instruments micrometers Aim and Objectives: Outcomes: Demonstrate use of linear Measuring Instruments Theoretical Background: Experimentation: Use of instrument, Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
3	Study and use of mechanical & pneumatic comparator Outcomes: Demonstrate use of comparators Theoretical Background: Construction & Working of comparators Experimentation: Use of instrument, calibration , Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
4	Study & use of Bevel protractor and Sine Bar for measurement of Angle. Outcomes: Demonstrate use of Angle Measuring Instruments Theoretical Background: Construction & Working of angle measuring instruments Experimentation: Use of instrument, calibration , Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1

5	An assignment on geometric dimension and tolerance (concept, symbols, inspection) Aim and Objectives: Outcomes: Demonstrate geometric dimension and tolerance Theoretical Background: Concept ,symbol, application Results and Discussions Conclusions	1
6	Measurements of Screw thread parameters using two wire method Outcomes: Demonstrate the method of measurement of thread parameters Theoretical Background: Experimentation: Use of instrument, Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
7	Measurement of gear tooth thickness using gear tooth vernier caliper. Outcomes: Demonstrate use of Gear Measuring Instruments Theoretical Background: Experimentation: Use of instrument, Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
8	Study & Use of Coordinate measuring machine (CMM) for dimension measurement (Linear & Geometric) Outcomes: Demonstrate use of CMM Theoretical Background: Experimentation: Use of CMM, Measurement and Calculation with Interpretation Results and Discussions: Conclusion:	1
9	Study and use of dial indicator as a mechanical comparator for run out (eccentricity), roundness measurement Outcomes: Demonstrate use dial & bench center for roundness & runout inspection Theoretical Background: Experimentation: Setting of instrument, method of measurement, calculation, plotting of graph with interpretation Results and Discussions: Conclusion:	1
10	Industrial visit in group of 4 to 5 students Outcomes: Observe and Demonstrate use different measuring instruments used in industry. Theoretical Background: acquainted with the all basic instruments Experimentation: Data collection, Use of instrument, Measurement and Calculation with Interpretation ,Prepare a report and submit to course teacher Results and Discussions:	2
11	A seminar by group of two students on advanced measuring instrument Outcomes: Demonstration on advanced measuring instruments Theoretical Background: Would be familiar with the source and method of collecting the information Experimentation: Literature review to search for advanced instrument. Results and Discussions: Conclusion:	2

Text Books:

Sr. No.	
1	R.K. Jain, — Engineering Metrology, Khanna Publisher,
2	I.C. Gupta, —Engineering Metrology Dhanpat Rai Publications.,
3	M. Mahajan, —Statistical Quality Control Dhanpat Rai & Co., 2012
4	Metrology & Measurement- Anand K. Bewoor , Tata McGraw-Hill.
5	N.V Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, Oxford

Reference Books:

Sr. No.	
1	J.F.W. Gayler and C.R. Shotbolt, —Metrology for Engineers, Cassell, 1990
2	K.W.B. Sharp, —Practical Engineering Metrology, Pitman London, 1st Edition 1973
3	Connie L. Dotson - Fundamentals of Dimensional Metrology - Cengage



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMECC0434	L	T	P	Credit
Course Name:	Co -Curricular Activities-II	-	-	2	1
Course Pre-Requisites:	None: This course is open to all second-year engineering students interested in enhancing their personal and professional development through co-curricular activities.				
Course Description:	Co-Curricular activities are an integral part of curriculum which provides educational activities to the students and thereby help in broadening their experiences. Co-Curricular activities can be defined as the activities that enhance and enrich the regular curriculum during the normal college hours. All CoCurricular activities are organized with specific purpose which may according to the nature and form of activities. This course introduces students to a variety of co-curricular activities aimed at enhancing their professional and personal development within the field of engineering and technology. Through practical projects, competitions, workshops, and community engagement, students will develop teamwork, leadership, communication, and technical skills essential for success in their careers.				

Course Learning Objectives:

CLO1	To encourage students to showcase their intellectual and independent thinking skills.
CLO2	To imbibe a sense of confidence and managerial capabilities among students.
CLO3	To promote the ability to work in team, organize and analyse available resources.
CLO4	To build responsiveness among students about the social and cultural responsibilities.

Course Outcomes:

After the completion of the course the student will be able to			
COs	CO Statement	Blooms Level	Descriptor
CO1	Demonstrate the ability to critically analyse information and apply independent judgment in decision-making within the context of the activity.	II	Understand
CO2	Apply principles of management and organizational skills to plan, coordinate, and execute tasks related to the co-curricular activity	III	Apply
CO3	Collaborate effectively with peers to achieve common goals and objectives within the cocurricular activity. .	III	Apply
CO4	Reflect on their roles and responsibilities as members of a diverse community, fostering empathy and inclusivity.	IV	Analyze

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (Lab ISE)	100%	50 Marks
ISE: Assessment is based on the student's participation in various Co-Curricular Activities and Guidelines given in "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document			

Course Contents:

	Course Guidelines: - Students are entitled to gain academic knowledge in this fast-paced environment, but it is also necessary for them to develop their personalities in both internal and external situations. - Co-curricular activities help students grow and develop their personalities. These activities contribute to a student's total personality development. - Not every student is intellectually inclined. Similarly, not all pupils are interested in co-curricular activities. Therefore, there is a need to provide a solid balance of co-curricular and extra-curricular activities in order to achieve the course learning objectives. - It primarily refers to intellectual, physical, emotional, and social growth that can be attained by a careful mix of academic, co-curricular, and extra-curricular activities. - So, keeping the course learning objectives the "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document is proposed. - Student participation is assessed and reflected in the final activity performance report in order to get most students involved in extra-curricular activities (Group A) and co-curricular activities (Group B) as shown in Table 1 in the Policy Document. - All undergraduate students must choose at least ONE activity/event from each group i.e. (Group A and B). - Students shall choose one activity/ event from Group A and One from Group B that take place on campus or off-campus. - Freedom shall be given to the students to take part in more than one activity under the group. - Students are expected to actively participate in activities, participate in contests, and earn grade points. - One student in each group must earn up to 50 grades in one semester so that they can achieve up to 100 grades in one year. - Grades for each semester are awarded based on the points achieved by the student, as shown in Table 2 in the Policy Document.	
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Course Structure: (Refer Rules for Assigning Activity Points: Activity – Event Grade Point Scheme)

Sr. No.	Initiatives	Criteria, Activities and Assignments
1	Introduction to Co-Curricular Activities	Orientation, Induction, Course Overview
2	National Initiatives Participation	Participation, Achievement Levels and Assigned Activity Points in NCC, NSS, Unnat
3	Sports and Games Participation	Participation, Achievement Levels and Assigned Activity Points in Sports and Games
4	Cultural Activities Participation	Participation, Achievement Levels and Assigned Activity Points in Music, Performing Arts,
5	Professional Self Initiatives	Participation, Achievement Levels and Assigned Activity Points in 1. Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc. 2. MOOC/ NPTEL/ SWAYAM/ Coursera etc. 3. Competitions/ Events Conducted by Professional Societies (ISTE, IEL, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 4. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities 5. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at KITCoEK 6. Paper Presentation in National/ International Conference of High Repute 7. Poster Presentation in National/ International Conference of High Repute 8. Paper Publication in National/ International Journal of High Repute 9. Industrial Training/ Internship (at least for 04 Weeks) 10. Participation in Institute Level Student Clubs
6	Entrepreneurship and Innovation	Participation, Achievement Levels and Assigned Activity Points in 1. Prototype Developed and Tested 2. Awards for Products Developed 3. Innovative Technologies Developed and Used by Industries 4. Got Funding from Government/ Industry for Innovative Ideas 5. Patent-Filed/ Published/ Approved/ Licensed 6. Social Innovations
7	Leadership & Management of Clubs/ Activities	Participation, Achievement Levels and Assigned Activity Points in 1. Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members) 2. Office Bearer of Professional Society Chapter (ISTE, IEL, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 3. Office Bearer of Institute Level Student Club (Developer Student Club, Gaganvedhi, Walk With World, Team Mavericks, Cultural Club, Aura, Amateur Write Club, Rotaract Club of KIT Sunshine, Women Development and Gender Equality Cell, Shourya, Lead India etc.) 4. Office Bearer of Departmental Student Association 5. Office Bearer of ECell, Digital Content Lab etc. 6. Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc. 7. Editorial Board Member of Annual Magazine 8. Editorial Board Member of E-Newsletter 9. Member of Governance Committee/ Statutory Committee
8	Culminating Event and Reflection	Final Presentations, Course Reflection, Documentation, Assessment and Evaluation

Participation Levels:

1. Level: I College Level Events
2. Level: II District/ Central/ Zonal Level Events
3. Level: III State Level Events
4. Level: IV National Level Events
5. Level: V International Level Events

Approval Documents:

1. Certificate
2. Letter from Authorities
3. Appreciation recognition letter
4. Documentary evidence
5. Legal Proof

Grading Scheme:

Grade Range	Grade Academic	Performance
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90-100	O	Outstanding
71 to 90	A+	Excellent
68-71	A	Very Good
65-68	B+	Good
60-65	B	Average
55-60	C	Below Average
50-55	D	Marginal
< 50	F1	Fail due to Poor Performance



Kolhapur Institute of Technology's College of Engineering Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEIL0471	L	T	P	Credit
Course Name:	Workshop Practice	-	-	2	1
Course Pre-Requisites:	Machine Drawing Interpretation, Use of workshop equipments, Safety measures. Knowledge of basic mechanical engineering, workshop practice, engineering materials				
Course Description:	This course is designed to provide the students with hands on knowledge and the practical learning experience on various machine tools and operations on it.				

Course Objectives:

- To practice basic metal cutting processes and acquire elementary skills.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Demonstrate the components and accessories of various machine tools	II	Understand
CO2	Identify the suitable machining process for a given component.	III	Apply
CO3	Make use of part programming principles to develop a program in CNC machining.	III	Apply
CO4	Identify the properties of molding sand.	III	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2											2		
CO2	2	2	2								1	2		
CO3	2	2	2		2			1			2	2	1	1
CO4	2	2						1			2	2	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	LAB ISE	25 Marks	ISE is based on practical performance and submission during Lab.

Course Contents:

Experiment No.	Unit Content	No. of Sessions
1	Demonstration of Lathe machine to understand constructional details, various mechanism, accessories, attachments & different operations	1
2	Reading the component Drawing, selecting and preparing operation sequence	2
3	Job 1: Manufacturing of component on lathe, Milling and Drilling Machine. This Job consists of operations such as turning, facing, grooving, Taper turning, Threading, Knurling, centre drilling, straddle milling etc	6
4	Job 2: Demonstration of CNC machine, Completion of Job containing part programming	2
5	To determine moisture contents in molding sand	1
6	To determine compression strength of molding sand	1
7	To determine the hardness and permeability of molding sand	1
8	Industrial visit to study various manufacturing activities.	1

Reference Books:

Sr. No.	
1	Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition, 2002.
2	B.S. Raghuwanshi, "Workshop Technology", Dhanpatrai Publication, 9th Edition, 1999.
3	Rao, P.N., Manufacturing Technology–Metal Cutting and Machine Tools, Tata McGraw Hill, New Delhi, 2000.
4	Hajra Chowdary, S.K., and Hajra Chowdary, A.K., Elements of Workshop Technology, Vol. II, Asia Publishing House, Bombay, 2003.
5	Kalpakjian, S. and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson
6	Production Technology by HMT, Tata McGraw-Hill, 2002
7	Khanna, O.P., and Lal, M., A Text Book of Production Technology, Vol II, Dhanpat Rai & Sons, 1992.

8	Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, 2003
9	All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006
10	Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition.



Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur

Department of Mechanical Engineering

Course Code:	UMEMM0441	L	T	P	Credit
Course Name:	Introduction to Data Science	3	0	0	3
Course Pre-Requisites:	This course requires the basic knowledge of the following: 1. Basics of Python Programming 2. Basics of Statistical concepts				
Course Description:	Introduction to Data Science provides a comprehensive overview of foundational concepts and practical skills essential for harnessing the power of data. Through case studies and hands-on exercises, students explore data types, processing steps, programming tools, and machine-learning techniques. The course covers data visualization, manipulation, and real-world applications such as weather forecasting, stock market prediction, and sentiment analysis. Students learn to analyze data effectively, communicate insights, and understand the advantages and limitations of data science approaches in solving complex problems.				

Course Objectives:

1	To understand the fundamental concepts and terminology of data science.
2	To develop proficiency in data manipulation, visualization, and analysis using Python
3	To gain insights into the role of machine learning in data science and its practical applications.
4	To evaluate real-world case studies to identify and address the advantages and limitations of data science techniques.

Course Outcomes:

After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Summarize the basic principles and terminology of data science, including types of data and levels of measurement.	II	Understand
CO2	Apply Python programming tools such as matplotlib, NumPy, and Scikit-learn to manipulate, visualize, and data analysis effectively.	III	Apply
CO3	Interpret machine learning concepts such as overfitting, train/test splits, and types of machine learning algorithms	II	Understand
CO4	Explain the advantages and limitations of data science techniques in solving engineering problems across various domains, considering ethical implications and biases.	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1									1	1		1
CO2	2	2	2		1						1	2	2	1
CO3	2	1										2		1
CO4	1						1					1		1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents with equal weightage for all units.

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Unit 1: Introduction to Data Science The data science Venn diagram, Terminology, Data science case studies, Summary, Types of Data, Flavors of Data: Structured versus unstructured data, Quantitative and qualitative data, The four levels of data: Nominal level, Ordinal level, Interval level, and Ratio level	8
2	Unit 2: Processing Steps of Data Science, Introduction to Data Science, Overview of the five steps, Explore the data, obtain the data, model the data, communicate and visualize the results.	7
3	Unit 3: Tools for Data Science: Traits of Big data, Web Scraping, Analysis vs Reporting, Introduction to Programming, Tools for Data Science, Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK	8
4	Unit 4: Role of Machine Learning in Data Science Overview of Machine learning concepts Overfitting and train/test splits, Types of Machine learning Supervised, Unsupervised, Reinforcement learning	7
5	Unit 5: Visualizing Data: Working with data: Reading Files, Scraping the Web, Cleaning and Munging, Manipulating Data, Rescaling	8
6	Unit 6: Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real-Time Sentiment Analysis, Advantages and Limitations of DS	7

Text Books:

Sr. No.	
1	Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009)
2	Kevin Night and Elaine Rich, Nair B, ial Intelligence (Mc Graw Hill-2008.
3	Dan W. Patterson, Introduction to AI and ES, Education, 2007.

4	Sinan Ozdemir, "Principle sof data science", Packt
Reference Books:	
Sr. No.	
1	Rich E, Knight K, Nair S B, Artificial Intelligence,3rd edition, Tata McGraw-Hill,2009.
2	Luger George F, Artificial Intelligence: Structures and Strategies for Complex Problem solving,6th edition,Pearson Education, 2009.
3	WesLey J. Chun, "Core Python Programming", Second Edition, Pearson Education, 2010.
4	Carter M, Minds and Computers: An Introduction to the Philosophy of Artificial Intelligence, Edinburgh University Press, 2007.



Kolhapur Institute of Technology's College of Engineering, Kolhapur (Empowered Autonomous)

Department of Mechanical Engineering

Course Code:	UMEMM0442	L	T	P	Credit
Course Name:	Sensors, Electrical Machines and Drives	3			3
Course Pre-Requisites:	Physics Foundations, Basic Electrical Engineering Knowledge				
Course Description:	This course provides second-year mechanical engineering students with an introduction to electrical and electronics technology essential for modern engineering practice. The course covers fundamental concepts of digital electronics and Electrical Machines and Drive systems. Emphasis is placed on understanding the principles of operation, analysis, and application of electrical components and circuits relevant to mechanical engineering.				

Course Objectives:

1	To provide students with a comprehensive understanding of electrical and electronics principles, including digital electronics essential for modern mechanical engineering practice
2	To provide details of operation and performance of asynchronous and synchronous machines
3	To understand concept and configuration of electric drives. The dynamics and operational modes of electric drives. Process of selection of a motor for a specific application

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain the working principle, construction, operation and features of Sensors, transducers and Actuators.	II	Understand
CO2	Explain the construction and operation of DC & AC Machines.	II	Understand
CO3	Select Electrical Drives for various applications	III	Apply
CO4	Explain dynamics and control of electrical drives	II	Understand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1										2		
CO2	2	1										2		1
CO3	2	1	1									2		1
CO4	2	1										2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Lectures
1	Sensors and Transducers: Definition & Classification of transducers, Difference between sensor and transducer. Performance terminologies of sensors. Classification of the Sensors, Displacement, Position, and Proximity Sensor: Potentiometer Sensors, Capacitive element-based sensors, Linear variable differential transformer (LVDT), Eddy current proximity sensors, Inductive proximity switch, Optical encoders, Pneumatic Sensors, Tachogenerator, Pressure Switches, Temperature Measurement- Thermistor, Thermocouple- types and their ranges. Resistance thermometer (RTD), Smart Sensors. .	8
2	Actuators: Classification and selection of the actuators, AC and DC motors introduction, Servomotors—AC and DC, Stepper motor and Synchros, BLDC & Linear actuators	7
3	D.C. Motors : Concept of back E.M.F., types, torque equation, speed equation, characteristics of D.C. motors, applications, 4 point of starter, method of speed control, electrical braking, Losses and efficiency, Testing & specifications of D.C. machines: Swinburn's test, Hopkinson's test, Field test on D.C. series motor.	8
4	Basics of Electrical Drives and Control: Definition of Electrical drive, Types, Advantages of electrical drives, Parts of Electrical drives, Choice of electrical drives for typical applications, Status of DC and AC drives. Industrial Drives Application-Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools.	7
5	Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi quadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Steady State Stability, Load Equalization.	7
6	Control of Electrical Drives: Modes of operation, Concept of Constant torque control, constant power control, role of a gear in conventional drive and the concept of elimination of gear in electrical drive., speed control and drive classification, close loop control of drives. Closed loop torque control, Closed loop speed Control, Closed loop speed Control of multi motor drives, speed sensing, current sensing, Phase-locked- loop(PLL) control.	8

Text Books:

Sr. No.	
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1	J. Nagrath and D. P. Kothari. "Electric Machines", McGraw Hill Education, 2010.
2	Fundamentals of Electrical Engineering – 4th Edition, Ashfaq Husain, Dhanapat Rai & Company
3	A. E. Clayton, "DC Machines", Mc Graw Hill publication, 3rd Edition
4	Fundamentals of the electrical drives :Gopal K Dubey-Narosa publication.
5	Electrical Drives Concept and application :Vedam Subrahnyam.

Reference Books:

Sr. No.	
1	M. G. Say, Performance and Design of AC Machines, CBS Publishers
2	P. S. Bimbhra, Power Electronics, Khanna Publishers
3	Electrical & Electronic Measurement & instrumentation – A. K. Sawhney,
4	B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology – Volume II, S. Chand.
5	A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.



Kolhapur Institute of Technology's College of Engineering Kolhapur (Autonomous)

Department of Mechanical Engineering

Course Code:	UMEMM0443	L	T	P	Credit
Course Name:	Numerical Methods & Simulation Techniques	3	1	-	3
Course Pre-Requisites:	Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III, Numerical Methods in Engineering				
Course Description:	The course is aimed to provide elementary knowledge of numerical methods and statistical techniques and enable students to apply various tools and techniques to solve problems in mechanical engineering. The subject provides the students with a strong background on numerical approximation strategies and a basic knowledge on the theory that supports numerical algorithms. The course starts with introduction of numerical methods and its applicability in mechanical engineering with an introduction to basic computation using C++ or MATLAB. It covers the concepts of solution techniques of linear and non-linear equations and systems of equations. Differentiation and integration using numerical methods are covered. Application of different initial value and boundary value problems in mechanical engineering using finite difference method is taught. An introduction to solution of partial differential equation and finite element method is also covered.				

Course Objectives: The course aims to

1	Introduce students to fundamental numerical methods for solving algebraic, transcendental, differential, and integral equations. Develop computational skills for obtaining approximate solutions to engineering problems using numerical techniques.
2	Develop computational skills for obtaining approximate solutions to engineering problems using numerical techniques.
3	Familiarize students with simulation techniques and computational tools used for modeling and analysis of engineering systems.
4	Develop the ability to select and apply appropriate numerical and simulation methods for solving practical engineering problems.

Course Outcomes: After the completion of the course the student will be able to

COs	CO Statement	Blooms Level	Descriptor
CO1	Explain basic concepts of Numerical Methods.	II	Understand
CO2	Solve introductory engineering problems using Numerical methods.	III	Apply
CO3	Explain basic functions and advantages of various numerical methods.	II	Understand
CO4	Analyze numerical results & approximations with mechanical engineering field problems.	IV	Analyze

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1									2		
CO2	2	2	1		1						1	2	1	
CO3	2	2	2									2	1	
CO4	2	2	3		1						1	2	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

Course Contents:

Unit No.	Unit Content	No. of Session
1	Unit 1: Errors & Roots of equation Errors: Introduction of Numerical error and accuracy, Types of errors, Rules for estimate errors, Error Analysis, accuracy of numerical results. Roots of Equation Bisection method, Regula falsi method, Newton Raphson's, Multiple Roots, Iteration system of non-linear Equations.	8
2	Unit 2: Linear Algebraic Equation: 1. Gauss Elimination Method- Naïve Gauss Elimination, Pitfalls of Elimination, Techniques of improving solutions, Gauss- Jordan method Matrix Inversion- LU decomposition, Gauss Seidel, Jacobi Iteration method, System of linear equations	8
3	Unit 3: Curve Fitting, Interpolation & Statistics i. Least Square Regression – Linear regression, Polynomial Regression ii. Interpolation – Newton's divided difference, Interpolating polynomial, Lagrange's interpolating polynomial. Statistics: Mean, Mode, Median and standard deviation, Normal distribution.	8
4	Unit 4: Numerical Differentiation and Integration Numerical Integration (Simpsons, Trapezoidal and Gauss Quadrature methods). Solution of Nonlinear equations, Integration of Equation: Romberg's Integration and Gauss Quadrature. a. Numerical differentiation, Differentiation formulae, Forward difference, Central difference, Backward difference, Problems based on engineering applications.	7
5	Unit 5: Numerical Solution of Ordinary Differential Equations: Taylor's series method – Picard's method - Euler's - modified Euler's Method – Fourth order Runge-Kutta method, Determination of Eigen values by Power method, Problems based on engineering applications.	7
6	Unit 6: Partial Differential Equation & MATLAB Finite Difference – Elliptic equation, Laplace's equation, Liebmen's Method, Parabolic, hyperbolic and elliptic equation, Boundary conditions. Problem solving approach by Optimization techniques Problems based on engineering application. Parabolic Equation, Explicit Method, Introduction of MATLAB, Mechanical Engineering Problem solving approach by using MATLAB.	7

Text Books:	
Sr. No.	
1	Dr. B. S. Grewal, “Numerical Methods”, Khanna Publishers, New Delhi.
2	E. Balguruswamy, “Numerical Methods”, Tata Mcgraw Hill Publication Company Ltd.
3	Steven C. Chapra, “Numerical Methods for Engineers”, Tata McGraw Hill Publications, New Delhi
4	“Numerical Methods”, S.Arumugam, A. Thangapandi Isaac and A.Somasundaram, Scitech Publications India Pvt.Ltd.,Chennai.
Reference Books:	
Sr. No.	
1	J.N. Kapoor, “Mathematical Modeling”,New Age Mumbai, first Edition,2005. Kreyszig, “Advanced Mathematics”,LaurieRosatone, USA.
2	S.C. Chapra, “Applied Numerical Methods with MATLAB for Engineers and Scientists”, Tata McGraw Hill Education Pvt. Ltd., New
3	Sigiresu S Rao, “Engineering Optimization”,New Age International Publisher.
4	R. L. Burden and J. D. Faires, “Numerical Analysis Theory and Applications”, Cengage Learning India Pvt. Ltd., New Delhi