23UGPCC-ME301 MATHEMATICS FOR MECHANICAL ENGINEERING

Lectures	: 3 Hrs/Week	**Evaluation Scheme**
Credit	: 2	ISE : 40 Marks
		ESE : 60 Marks

Course Objectives: The objective of the course is to

1. Deliver the basics of Differential equation, Laplace transforms, Fourier series, and Statistics
2. Provide the knowledge to identify and solve different problems of Mechanical engineering

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Solve Linear Differential Equation of higher order	Understand
CO2	Calculate divergence, curl, gradient and directional derivative of a vector And scalar point function	Understand
CO3	Apply Laplace Transform to solve Ordinary differential equations	Apply
CO4	Expand functions in terms of sine and cosine	Understand
CO5	Describe and interpret the statistical data numerically by using statistical methods.	Apply
CO6	Use Binomial, Poisson and Normal distributions to calculate probabilities	Apply

Description:

This course contains Mathematical methods and techniques that are used to solve complex Mechanical engineering problems. This course has six units namely i) Linear Differential equation, ii) Vector Differentiation iii) Laplace Transformation, iv) Fourier Series and, v) Correlation, Regression and curve fitting. vi) Probability Distribution

Prerequisites:	1:	Trigonometric identities and Logarithmic identities
	2:	Differentiation and integration formulae
	3:	Partial Differentiation.

Unit 1	**Linear Differential Equations**	
	Linear Differential Equation with constant coefficients-Definition, Complementary Function , particular integrals ,Short cut methods for finding Particular integral.	7 Hrs
Unit 2	**Vector Differentiation**	
	Differentiation of vectors, Gradient of scalar point function and Directional derivative, Divergence of vector point function, Curl of a vector point function, Solenoidal and Irrotational vector fields, Scalar Potential	6 Hrs
Unit 3	**Laplace Transformation**	
	Definition and Laplace transforms of elementary functions, properties of Laplace transforms, Transforms of derivatives and integrals, Multiplication by t, division by t, Evaluation of integrals by Laplace transforms, Inverse Laplace transform using method of partial fraction and convolution theorem (without proof), Solution of Ordinary differential equation by transform method.	8 Hrs
Unit 4	**Fourier Series**	
	Introduction, Dirchlet's conditions , Euler's formulae .Fourier Series of functions of period 2l,even and odd functions, half range sine and cosine series.	7 Hrs
Unit 5	**Correlation , Regression and Curve Fitting**	
	Introduction , Karl Pearson's Coefficient of Correlation, Lines of regression of bi-variate data, Fitting of Curves by method of Least-squares: Fitting of Straight line, Fitting of second degree Parabolic curve, Fitting of exponential curve.	7 Hrs
Unit 6	**Probability Distributions**	
	Random variable discrete random variable, continuous random variable ,, Probability distribution, Binomial distribution, Poisson distribution and Normal distribution.	7 Hrs

Mapping of Pos & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	--	--	--	--	--	---	--	--	--	1	--	--	--
CO2	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--
CO3	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--
CO4	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--
CO5	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--
CO6	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--

References:

	Text Books
1	Higher Engineering Mathematics,Dr.B.S.Grewal,S.ChandandCompany,40th Edition.
2	Advanced Engineering Mathematics,H.K.Das,S.ChandPublication,8thEdition.
	Reference Books
1	Higher Engineering Mathematics, B.V.Ramana,Tata McGraw Hill, New Delhi
2	A Text Book of Applied Mathematics, Vol.I and II, P. N. Wartikar and J.N.Wartikar, Vidyarthi Griha Prakashan, Pune.
3	AtextbookofEngineeringMathematics,N.P.Bali,Iyengar,LaxmiPublications(P)Ltd,New Delhi
4	Advanced Engineering Mathematics, Erwin Kreyszig,Wiley India Pvt. Ltd

Web Links/Video Lectures

Lectures1.https://nptel.ac.in/courses/111/107/111107098/

2. https://nptel.ac.in/courses/111/105/111105123/

3. https://nptel.ac.in/courses/111/106/111106111/

4. https://nptel.ac.in/courses/111/105/111105122/

5. https://nptel.ac.in/courses/111102111

6. https://nptel.ac.in/courses/111105042

Sr. No.	Description	Signature
1	Name of Faculty Mr. Dhanaji Sambhaji Mane	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME302 APPLIED THERMODYNAMICS

Lectures: 03 hrs/week
Credits: 02

Evaluation Scheme:
ESE :60 Marks
ISE :40 Marks

Course Objectives:

1. To learn about energy interactions in a system and energy balance between system and surrounding.
2. To learn about the application of First law to various energy conversion devices.
3. To understand properties of a pure substance and evaluate the performance of Vapour power cycle using steam table.
4. To understand the working of various gas power cycles.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Bloons Taxonomy
CO1	Understand concepts of energy transformation, basic concepts, fundamental laws and principles	Knowledge Understand
CO2	Understand the properties of pure substance and evaluate Rankine vapour power cycle by using steam table.	Understand Apply Evaluate
CO3	Evaluate condenser performance through concepts like vacuum efficiency and condenser efficiency, and estimate cooling water requirements.	Evaluate
CO4	Analyze nozzle performance through concepts of maximum discharge and design of throat and exit area.	Analyze
CO5	Analyze flow through steam turbine blades using velocity diagrams, and calculate work done and efficiencies.	Analyze
CO6	Understand basic concepts and working of various gas power cycles	Understand

Description:

Thermodynamics is the science of energy that explores the concept of energy and energy transfer particularly between heat and work and their inter conversion. All activities in nature involve some interaction between energy and matter; thus, it is hard to imagine an area that does not relate to thermodynamics. Therefore, developing a good understanding of basic principles of thermodynamics is an essential part of engineering education.

This Course covers aspect of thermodynamics for power generation specifically steam power generation. Hence it is essential for Mechanical engineering students to understand thermodynamic cycle, principles, fundamentals that are useful to engineering applications. The student will learn basic thermodynamic concepts, definitions, cycles, laws, heat and work interaction, enthalpy, entropy etc. By applying thermodynamic concepts for steam power plant (Boiler, Steam nozzles, Steam turbines, and condensers) students are able to understand, analyze and evaluate the performance of a steam power plant.

Prerequisites:	1:	Basic Mechanical Engineering
	2:	Applied Physics
	3:	Basic Engineering Mathematics

Section-I		
	Basic Concepts of Thermodynamics:	
Unit 1	Introduction, thermodynamic system, control volume, thermodynamic property, state & process, Zeroth law, temperature scales, various thermometers, first law, its limitations, Second law of thermodynamics, Kelvin-Plank and Clausius Statements. Statement of third law of thermodynamics. Corollaries of Second law. Numerical treatment on second law of Thermodynamics (Heat engine, Refrigerator and Heat Pump). Introduction of Entropy, Calculation of entropy changes in gases (Numerical Treatment)	07Hrs
	Pure Substances and Vapour Power Cycles	
Unit 2	Pure substances, ideal and real gases, formation of steam, Properties of steam, Use of steam table and Mollier chart, p-v, T-s and Mollier diagram for steam, Carnot cycle, Limitations of Carnot cycle, Rankine cycle, p-v, T-s & h-s diagram, Thermal efficiency, Specific steam consumption. Work ratio, Effect of superheat, boiler and condenser pressure on the performance of Rankine cycle. (Numerical Treatment)	07Hrs
	Steam Condensers	
Unit 3	Steam Condenser, Functions, Elements of condensing plant, Types of steam condensers, surface and jet condensers, Comparison, Vacuum efficiency, Condenser efficiency, Sources of air leakages, Methods of leak detection Estimation of cooling water required (Numerical Treatment)	06Hrs
Section-II		
	Steam Nozzles	
Unit 4	Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of friction, Design of throat and exit areas, Nozzle efficiency, Velocity coefficient, Coefficient of discharge, Supersaturated flow, Degree of under-cooling and degree of super saturation, Effects of super Saturation (Numerical Treatment without friction)	07Hrs
	Steam Turbines	
Unit 5	Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam, turbines Comparison between impulse and reaction turbine. Flow through impulse turbine blades, Velocity diagrams, , Flow through impulse reaction blades, Velocity diagram, degree of reaction, and Parson's reaction turbine, losses in steam turbines (Numerical Treatment on Single stage turbine)	07Hrs
	Gas Power Cycles	
Unit 6	Introduction, Carnot cycle, Stirling cycle, Ericsson cycle, Air standard Otto cycle, Air standard Diesel cycle, Limited pressure cycle or Dual cycle, Comparison of Otto, Diesel and Dual cycles, Brayton Cycle (Simple Gas Turbine Cycle), Reversed Brayton Cycle, p-v and T-s diagrams description.	

Mapping of Pos & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	--	--	--	--	--	--	--	--	--	--	--	--	3	--
CO2	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	--	2	--
CO4	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO5	3	3	3	--	--	--	--	--	--	--	--	--	--	3	--
CO6	3	2	2	--	--	--	--	--	--	--	--	--	--	3	--

References:

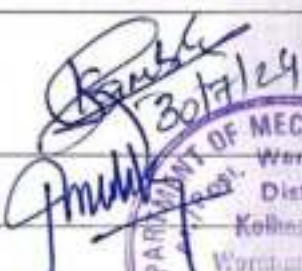| Text Books	
1	"Thermal Engineering", Kumar and Vasandani, D. S. Publisher Metropolitan Book Co, Delhi, 3ª Edition.
2.	"Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27ª Edition.
3.	"Engineering Thermodynamics", P. K. Nag., Tata McGraw Hill, New Delhi, 4ª Edition.
4.	"Thermal Engineering", R. K. Rajput, Laxmi Publications, 3ª Edition.
5.	"Steam and Gas Turbines", R. Yadav, CPH Allahabad, 2ª Edition, 2005.

Reference Books	
1	Y.A. Cengel & M.A. Boles, Thermodynamics: An Engineering Approach, 8th Ed., McGraw Hill Education (India) Pvt. Ltd., New Delhi,2016.
2	R.E. Sonntag, C. Borgnakke & G.J. Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003. 3. T.D. Eastop & A.
3	McConkey, Applied Thermodynamics, 5th Ed., Pearson Education Ltd., New Delhi, 2014.

Video Lectures (NPTEL and SWAYAM Portals)

https://nptel.ac.in/courses/112103307
https://onlinecourses.nptel.ac.in/noc24_me137/preview

Sr. No.	Description	Signature
1	Name of Faculty: Prahlad Vithal Kamble	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME303 FLUID MECHANICS

Lectures: 3 hrs/ week
Credits: 3

Evaluation Scheme:
ESE: 60 Marks
ISE: 40 marks

Course Objectives: The objective of this course is to

1) Introduce fundamental aspects of fluid properties, fluid flow behavior and develop energy balance equation for fluid flow systems.
2) Apply the fundamental equations on fluid flow such as Continuity equation, Bernoulli's equation and Momentum equation to analyze its characteristics.
3) Understand the fluid flow in pipe and determine the different head losses in pipe.
4) Study the concept of boundary layer developed in fluid flow over the surface.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	State and define the different properties of the fluid and fluid flow.	Knowledge
CO2	Describe the principles of continuity, momentum and energy as applied to fluid motions.	Understand
CO3	Derive and apply the governing equations of Fluid Kinematics and Fluid Dynamics.	Apply
CO4	Determine different head losses in flow through pipe and apply this on practical problems associated with fluid systems.	Apply Analyze
CO5	Understand the boundary layer theory of fluid flow as well as estimate the lift and drag coefficient of the fluid flow.	Understand Apply
CO6	Derive and analyze the mathematical expressions related to fluid statics, kinematics, dynamics, pipe flow systems.	Analyze

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Description:

Fluid Mechanics is offered as the program core course. This course contains basic principles and applications in Mechanical Engineering. In this course students will learn about fundamentals, properties, principles and governing equations of fluid behavior in statics and in motion. Students will get new problem solving approaches like control volume concept, streamline patterns and fluid flow analysis. This course has six units namely i) Fluid Statics ii) Fluid Kinematics iii)Fluid Dynamics iv) Momentum Equation and Laminar Flow v)Flow through pipes vi)Boundary Layer Theory and Forces on Immersed bodies.

Prerequisites:	1:	Engineering Mathematics		
	2:	Applied Mechanics		
	3:	Engineering Physics		
	4:	Basic Mechanical Engineering		

		Section-I	
Unit1	**Fluid Properties and Fluid Statics: A) Fluid Properties :** Definition of fluid, Properties of fluid Mass Density, Weight Density, Specific Volume, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Surface Tension, Capillarity and Compressibility, Types of fluid.		7 Hrs.
	B) Fluid Statics: Statement of Pascal's law, Hydrostatic law of pressure, Definition of Buoyancy, Meta-center Condition of Equilibrium of floating and submerged bodies (No Numerical Treatment on fluid Statics).		
Unit2	**Fluid Kinematics :** Eulerian and Langragian approach of fluid flow, Flow visualization, Types of flow, Streamlines, Pathlines, Streaklines, Streamtube. Continuity Equation in Cartesian coordinates in three dimensional flows,		6 Hrs.
	Velocity and Acceleration of fluid particles, Stream function and velocity potential function.		
Unit3	**Fluid Dynamics:** Euler's Equation of motion, Integration of Euler's equation as energy equation. Applications of Bernoulli's equation, venturimeter, orificemeter.		7 Hrs.
	Definition of Notch, Classification and it Applications, Derivation of Flow over triangular and rectangular notches only. Definition of Orifice, classification and it Applications, Hydraulic Coefficients C_d, C_c and C_v and C_r.		
		Section-II	
Unit4	**Momentum Equation and Laminar Flow: A) Momentum Equation:** Applications of momentum equation, Definition of kinetic energy correction factor. Definition of momentum correction factor, Analysis of fluid flow through pipe bends. (No Numerical Treatment).		7 Hrs.
	B)Laminar Flow: Laminar flow through circular pipes and derivation of Hagen Poiseuille's equation, Laminar flow through parallel plates, Introduction of CFD and its applications.		
Unit5	**Fluid Flow through Pipes:** Different energy losses in flow through pipe, Losses due to friction: Darcy's Weisbach equation and Chezy's equation, Minor Losses due to expansion, contraction, pipe fittings, at entrance, at exit, due to obstruction etc,		

	Flow through Series pipe, Parallel pipe, Siphon pipes, Branching pipes and equivalent pipes	
Unit6	**Boundary Layer Theory and Forces on Immersed Body: A) Boundary Layer Theory:** Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, Displacement thickness, Momentum thickness, Energy thickness, separation, boundary layer control. (No Numerical Treatment)	6 Hrs.
	B) Forces on Immersed Bodies: Lift and Drag, Drag on a flat plate and on aerofoil, Types of drags, Development of lift.(Magnus effect) stalling Condition of aerofoil.	

Mapping of Pos & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	3	2	1	-	-	2	-	-	-	-	-	-	2	-
CO3	3	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO4	2	2	3	1	-	-	2	-	-	-	-	-	-	3	-
CO5	2	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO6	1	3	2	1	-	-	1	-	-	-	-	-	-	2	-

References:

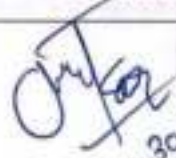| **Text Books**	
1	Fluid Mechanics, R.K.Bansal, Laxmi publications. New Delhi, 1998.
2	Fluid mechanics and Hydraulic Machinery, R.K.Rajput, Laxmi publishers
3	Introduction to Fluid Mechanics and Fluid Machines, S.K.Som, Gautam Biswas, Suman Chakraborty, Tata McGraw-Hill Publication. 3rdEdition 2012.
4	Hydraulics and Fluid Mechanics including Hydraulic Machines, Dr.P.N.Modi and Dr.S.M. Seth, Standard Book House .
Reference Books	
1	Fluid Mechanics–Fundamentals and Application,Y.A.Cengel, J.M.Cimbala, TMI,
2	Fluid Mechanics. K. L. Kumar, S.Chand Publication. New Delhi, 2ndEdition, 2000.
3	Fluid Mechanics, V. L. Streeter and E. B. Wylie, Tata Mc Graw Hill Pvt Ltd., New Delhi, 2ndEdition 1997.

Video Lectures

Lectures1.https://nptel.ac.in/courses/112/105/112105269/

    2. https://nptel.ac.in/courses/112/104/112104118/

    3. https://nptel.ac.in/courses/112/105/112105218/

    4. https://www.youtube.com/watch?v=fa0zHI6nLUo

Sr. No.	Description	Signature
1	Name of Faculty: M.R. Todkar	
2	Syllabus Structure and Content of Course Verified	30/07/2024
3	Approval of Board of Studies Chairman	

23UGPCC-ME304-MATERIALSCIENCEANDMETALLURGY

Lectures: 3 hrs/week
Credits: 02

Evaluation Scheme:
ESE: 60 marks
ISE: 40 Marks

Course Objectives: The objective of the course is to

1) Provide students an understanding of basic structure, crystal arrangement of materials and the phase diagrams.
2) Study the different methods of heat treatment processes and advantages of heat treatment for different steel components.
3) Introduce the fundamental theory of powder metallurgy processes.

Course Outcomes:

Co's	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Visualize the fundamental structure of materials and understand different material defects.	Apply
CO2	Explain nucleation & grain growth and draw Iron – Iron Carbide equilibrium diagram.	Apply
CO3	Explain various destructive and non destructive testing techniques.	Knowledge Apply
CO4	Understand transformation of austenite into Pearlite, Bainite and Martensite on cooling.	Understand
CO5	Compare the heat treatment processes used in mechanical components.	Apply
CO6	Discuss the various stages of techniques used in manufacturing of Powder Metallurgy components.	Understand

Description:

Life of the Mechanical Components is greatly influenced by the material properties and heat treatment provided for it. Hence Material selection is the important task in manufacturing process. To select the appropriate material, One should know about required properties for specified task. This course deals with different engineering material and their properties. It also includes knowledge of heat treatment to change the properties as per the requirement.

Prerequisites:	1:	Basic Mechanical Engineering
	2:	Engineering Physics
	3:	Engineering Chemistry

Section - I

	Introduction to Metals and alloy systems:	
Unit 1	Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites) a) Imperfections in crystals , Defects-Point, Line, Planar, Volume- Slip planes and slip systems. b) Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. c) Solid solutions and intermediate phases. d) Phases and Gibbs phase rule. e) Construction of equilibrium diagrams from cooling curves, Isomorphous system(Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles.	07Hrs
	Study of Phase Diagrams:	
Unit 2	(With respect to typical compositions, Properties and Applications for the following alloys.) a)Fe- Fe3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron) Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types. Tool steels- types, Selection of materials and Specifications based on -IS, BS, SAE, AISI, Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, , Cu- Be, Cu-Ni. Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification), Pb- Sn(Solders and fusible alloys)	11 Hrs
	Principles of Mechanical Testing:	
Unit 3	Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers) Non- Destructive Testing: Dye Penetrant test, Magnetic particle test, sonic and ultrasonic test,Radiography test, Eddy-Current testing.	04 Hrs

Section - II

	Principles of Heat Treatment & heat treatment of Ferrous Alloys:	
Unit 4	Transformation of austenite into Pearlite, Bainite and Martensite on cooling. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance. Heat treatment furnaces and equipments.	06 Hrs
	Heat Treatment Processes:	
Unit 5	a) Heat Treatment of Steels **Annealing** – Types-Full, Partial and Sub critical annealing (Various types) and purposes. **Normalising**- Purposes **Hardening** (Hardening types), Purposes, Austempering and Martempering,	08 Hrs

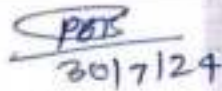|		
	Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method. **Tempering** Types, Structural transformations during tempering, purposes sub zero treatment. **Surface hardening** - Flame and Induction **Chemical heat treatments for case hardening** - Carburising, Nitriding, Cyniding, Carbonitriding Heat treatment defects and remedies	
Unit 6	**Powder Metallurgy:** Advantages, Limitations and Applications of Powder Metallurgy Powder manufacturing types- Mechanical, Physical, Chemical and Electro-Chemical Mixing/ Blending. Compaction- types- Conventional, Powder rolling andextrusion Sintering- Types liquid stage and solid stage sintering.	**04 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	--	--	--	--	--	1	--	--	--	--	--	--	--	--
CO2	2	2	2	--	--	--	1	--	--	--	--	--	--	--	--
CO3	2	--	--	2	--	--	--	--	--	--	--	--	--	--	3
CO4	2	2	3	1	--	--	--	--	--	--	--	--	--	--	2
CO5	2	2	1	--	--	--	--	--	--	--	--	--	--	--	1
CO6	1	--	3	2	--	--	--	--	--	--	--	--	--	--	3

References:

	Text Books
1	S.H. Avner, "Introduction to physical metallurgy", Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendrasingh, "Physical metallurgy", Standard Publishers Delhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G.Rethwisch, Wiley, Tenth Edition, 2010.

4	V.D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune,12th Edition
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.

Reference Books

1	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice-Hall of India (P) Ltd.
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	Foundations of Materials Science and Engineering by William F. Smith, Mc Graw Hill, Third Edition, 2004.
5	Elements of Materials Science and Engineering by H. Van Vlack, Addison – Wesley, Fifth Edition, 2006.
6	Introduction to Materials Science for Engineers by James F. Shackelford, Pearson,Eighth Edition, 2015.
7	Characterization of Materials by P. K. Mitra, PHI Learning, 2014.
8	Mechanical Metallurgy by George E. Dieter, Tata McGraw Hill, 3rd edition, 2013.

Sr. No.	Description	Signature
1	Name of Faculty: P.B.Kadam	POB 30|7|24
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME3051 Economic Analysis of Engineering Projects

Lectures	: 3 Hrs/Week	Evaluation Scheme		
Credit	: 2	ISE	:	40 Marks
		ESE	:	60 Marks

Course Objectives: The objective of the course is to

1. The course focuses on economic and cost analysis of engineering projects.

2. Giving insights on modern techniques and methods used on economic feasibility studies relating to design and implementation of engineering projects.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Relate basic concepts of economics to Projects.	Knowledge Understand
CO2	Utilize the concepts of time value of money and equivalence in economic decision making	Understand
CO3	Analyze basic concepts of economics to Projects	Understand Analyze
CO4	Developing of the project's project economic investment viability and resolution of outstanding economic issues	Understand Apply
CO5	Identify appropriate method to evaluate an engineering project.	Apply Evaluate
CO6	Make use of replacement study considering inflation to make decisions	Apply

Description:

Economic Analysis of Engineering Projects course is offered as the basic Economics course. The course focuses on economic and cost analysis of engineering projects. The basic purpose of this course is to introduce students with concepts and principles of engineering economy and with methods for making rational decisions regarding problems likely to be encountered in professional practice

Prerequisites:	1:	Basic knowledge of Economics and Mathematics	
Unit 1	**SCOPE OF PROJECT ECONOMIC ANALYSIS**		
	Introduction, Macroeconomic Context, Demand Analysis, Economic rational, Alternatives and least cost analysis, Comparing benefits and cost, Distribution Analysis, Sensitivity and Risk Analyses, Project Performance Monitoring System (PPMS)		7 Hrs
Unit 2	**Interest and Equivalence:**		
	Time value of money- simple and compound interest, repaying a debt. Cash flow diagram, Concept of equivalence		6 Hrs
Unit 3	**Area of Analysis**		
	Assess Macroeconomic Context , Assess Sector Context , Assess Demand , Identify Economic Rationale , Identify Project Alternatives , Identify and Compare Benefits and Costs , Assess Financial and Institutional Sustainability , Undertake Distribution Analysis , Undertake Sensitivity and Risk Analyses , Establish a Project Performance Monitoring System (PPMS)		7 Hrs
Unit 4	**AREAS OF ANALYSIS IN ADB's PROJECT PROCESSING CYCLE**		
	Country strategy and Programming sector strategy, Fact findings, Loan Fact findings, Full project demand assessment of confirmation analyses , developing of the project's project economic investment viability and resolution of outstanding economic issues		7 Hrs
Unit 5	**Evaluation of Engineering Projects**		
	Present worth method, Future worth method, Annual worth method, Internal rate of return method		7 Hrs
Unit 6	**Replacement Analysis**		
	Basics of replacement study, Determining economic service life, Performing replacement study.Inflation adjusted decisions		6 Hrs

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		If applicable	
													PSO1	PSO2	PSO3
CO1	2	2	1	--	--	--	--	---	--	--	1	1	--	--	--
CO2	2	2	1	--	--	--	--	--	--	--	1	1	--	--	--
CO3	2	1	1	--	--	--	--	--	--	--	1	1	--	--	--
CO4	2	1	1	--	--	--	--	--	--	--	1	1	--	--	--
CO5	2	2	1	--	--	--	--	--	--	--	1	2	--	--	--
CO6	2	1	1	--	--	--	--	--	--	--	1	1	--	--	--

References:

TextBooks	
1	"R. Paneerselvam, "Engineering Economics", PHI Learning Private Ltd., 2010
2	William G. Sullivan, Elin M. Wicks, & C. Patrick Koelling., "Engineering Economy", Pearson Higher Education Inc., 2015
ReferenceBooks	
1	Chan S. Park, "Contemporary Engineering Economics", Pearson Prentice Hall, 2018
2	Donald G. Newman, Ted G. Eschenbach, & Jerome P. Lavelle, "Engineering Economic Analysis", Oxford University Press, Inc., 2012.
3	Leland Blank, Anthony Tarquin, "Engineering Economy", McGraw Hill, 2012

Sr. No.	Description	Signature
1	Name of Faculty Prof S. S. Mahadik	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME3052 FUNDAMENTALS OF ENGINEERING ECONOMICS

Lectures	: 3Hrs/Week	**Evaluation Scheme**	
Credit	: 2	ISE	: 40 Marks
		ESE	: 60 Marks

Course Objectives : This course enables the student to

1. Acquaint with basic concepts of economics.
2. Educate students about various cost elements of manufactured product or service.
3. Understand the concepts of time value of money and equivalence.
4. Explore different methods for evaluating engineering projects.
5. Acquire basic knowledge of replacement study considering inflation.
6. Perform break even analysis and understand strategies to control the inventory

CourseOutcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Relate basic concepts of economics to real life	Understand
CO2	Classify different cost elements of manufactured product or service	Understand
CO3	Utilize the concepts of time value of money and equivalence in economic decision making	Understand Apply
CO4	Identify appropriate method to evaluate an engineering project.	Understand Apply
CO5	Make use of replacement study considering inflation to make decisions	Understand Apply
CO6	Utilize concepts of break-even analysis and inventory control strategies	Understand Apply

Description:

The course focuses on economic and cost analysis ofengineering projects. The basic purposeof this course is to introduce students with conceptsand principles of engineering economy and with methods for making rational decisionsregarding problems likely to be encountered in professionalpractice.

Prerequisites:	1	Basic knowledge of Economics and Mathematics

	Introduction:	
Unit 1	Introduction to Engineering Economy-Flow in an economy, Law of supply and demand, Definition and Role of Engineering Economics Economic decision-making process, Importance of Ethics in Engineering Economy.	4Hrs

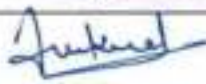|		
Unit 2	**Elements of Costs:**	**8Hrs**
	Fixed, Variable, Marginal, and Average Costs. Sunk costs, Opportunity costs, Recurring and non-recurring costs, Incremental Costs. Cost estimating, Estimating models. Criteria for make or buy, Approaches for make or buy decision. Concept of depreciation and methods of depreciation.	
Unit 3	**Interest and Equivalence:**	**4Hrs**
	Time value of money- simple and compound interest, repaying a debt. Cash flow diagram, Concept of equivalence.	
Unit 4	**Evaluation of Engineering Projects:**	**8Hrs**
	Present worth method, Future worth method, Annual worth method, Internal rate of return method	
Unit 5	**Replacement Analysis:**	**6Hrs**
	Basics of replacement study, Determining economic service life, Performing replacement study. Inflation adjusted decisions	
Unit 6	**Break Even Analysis and Inventory Control**	**6 Hrs**
	Breakeven Analysis for a Single Project and two alternatives. Payback analysis. Purchase model with and without shortages, Manufacturing model with and without shortages.	

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	1	--	--	--	2	3	--	--	1	2	--	--	
CO2	2	1	1	1	--	--	2	3	--	--	2	3	--	--	
CO3	2	1	1	1	--	--	2	3	--	--	2	3	--	--	
CO4	2	2	1	1	--	--	2	3	--	--	2	3	--	--	--
CO5	2	2	1	1	--	--	2	3	--	--	2	3	--	--	--
CO6	2	2	1	1	--	--	2	3	--	--	2	3	--	--	--

References:

TextBooks
1	R. Paneerselvam, "Engineering Economics", PHI Learning Private Ltd., 2010
2	William G. Sullivan, Elin M. Wicks, & C. Patrick Koelling., "Engineering Economy", Pearson Higher Education Inc., 2015.

ReferenceBooks
1	Leland Blank, Anthony Tarquin, "Engineering Economy", McGraw Hill, 2012
2	Chan S. Park, "Contemporary Engineering Economics", Pearson Prentice Hall, 2018

| 3 | Donald G. Newman, Ted G. Eschenbach,& Jerome P. Lavelle,"Engineering Economic Analysis", Oxford University Press, Inc.,2012. |

Sr. No.	Description	Signature
1	Name of Faculty Dr. M. S. Dhuttargaon	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME3053 ENGINEERING ECONOMICS FOR MECHANICAL ENGINEERS

Lectures	: 3Hrs/Week	**Evaluation Scheme**	
Credit	: 2	ISE	: 40 Marks
		ESE	: 60 Marks

CourseObjectives: This course enables the student to

1. Acquaint with basic concepts of economics.
2. Educate students about various cost elements of manufactured product or service.
3. Understand the concepts of time value of money and equivalence.
4. Explore different methods for evaluating engineering projects.
5. Acquire basic knowledge of replacement study considering inflation.
6. Perform break even analysis and understand strategies to control the inventory

CourseOutcomes:

COs	At the end of successful completion of the course, the student will be able to	BloomsT axonomy
CO1	Describe the principles of economics that govern the operation of manufacturing organization under diverse market conditions	Understand
CO2	Comprehend macroeconomic principles and decision making in production business set up	Understand
CO3	Explain the Inflation & Price Change as well as Present Worth Analysis	Understand Apply
CO4	Apply the principles of economics through various case studies related to manufacturing industries	Understand Apply

Description:

Engineering economics for Mechanical Engineers is a field that addresses the dynamic environment of economic calculations and principles through the prism of Mechanical Engineering. It is a fundamental skill that all successfulMechanical Engineeringfirms employ in order to retain competitive advantage and market share. The subject endeavors to provide them with the tools to optimize profits, minimize costs, analyze various scenarios, forecast fluctuations in manufacturing business.

Prerequisites:	1	Basic knowledge of Economics and Mathematics

	Introduction:	
Unit 1	Economic Decisions Making Mechanical Industries – Overview, Problems, Role, Decision making process.	**4Hrs**

	Costs and Estimation:	
Unit 2	Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types ofEstimates, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world	4Hrs
	Cash Flow, Interest and Equivalence:	
Unit 3	Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.	6 Hrs
	Cash Flow & Rate of Return Analysis:	
Unit 4	Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis,Analysis Periods; Internal Rate of Return, Calculating Rate of Return,Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity andBreakeven Analysis. Economic Analysis in The Public Sector - Quantifying and Valuing Benefits & drawbacks. Case Study – Tata Motors	8Hrs
	Inflation And Price Change:	
Unit 5	Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Case Study – Competition in the Manufacturing Segment in India	8Hrs
	Present Worth Analysis:	
Unit 6	End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.	8Hrs

Mapping of POs & COs:

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

References:

TextBooks	
1	R. Paneerselvam, "Engineering Economics", PHI Learning Private Ltd., 2010
2	William G. Sullivan, Elin M. Wicks, & C. Patrick Koelling., "Engineering Economy", Pearson Higher Education Inc., 2015.

ReferenceBooks	
1	N.Gregory Mankiw, Principles of Economics, Thomson South Western , Pearson

| 2 | Chan S. Park, "Contemporary Engineering Economics", Pearson Prentice Hall, 2018 |
| 3 | C.Rangarajan and B.H.Dholakia, Principles of Macro Economics, The McGraw Hill |

Sr. No.	Description	Signature
1	Name of FacultyDr. M. S. Dhuttargaon	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGVEC-ME306L PERSONAL VALUES AND ETHICS

Lectures: 02hrs/week

Credits: 02

Evaluation Scheme:

ISA: 50 Marks

Course Objectives: The objective of the course is to

1. To raise consciousness of human principles and ethics in engineering
2. To ingrain loyalty, moral principles, and social values
3. To respect other people's rights.
4. To raise awareness about safety and risk evaluations

Course Outcomes:

Co's	At the end of successful completion of the course, the student willbeable to	Blooms Taxonomy
CO1	Determine and evaluate an ethical dilemma in the area of study or in a related topic.	Knowledge
CO2	Analyze the numerous ethical concerns that are raised by a certain scenario or activity in the actual world.	Understand
CO3	Describe what makes a specific course of conduct morally justifiable.	Understand
CO4	Evaluate the societal context of the issues and their own ethical principles.	Knowledge
CO5	Determine which ethical issues, such as academic integrity, the usage and citation of sources, the impartial presentation of facts, and the treatment of people	Understand Apply
CO6	Show your understanding of moral principles in extracurricular activities like field work, internships, and service learning. Integrate, synthesize, and apply your understanding of moral conundrums and answers in academic contexts like focused and multidisciplinary study.	Knowledge Apply Evaluate

Description:

The course provides an in-depth exploration of personal values and ethics, focusing on the development, analysis, and application of ethical principles in personal and professional contexts.

Students will engage with various ethical theories, reflect on their own values and learn to navigate complex moral dilemmas.

Prerequisites:	1:	Basic understanding of the philosophy, which can provide a background of ethical theories.
	2:	Critical thinking skills that develop the logical reasoning and communication skills.
	3:	Cultural awareness understands different perspectives and social contexts can be helpful.

Unit-I	Human Values:	Hours
	Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others –Living Peacefully –Caring –Sharing –Honesty - Courage-Cooperation– Commitment – Empathy –Self Confidence Character –Spirituality-Case Study.	04 Hrs
Unit-II	**Engineering Ethics:**	
	Senses of 'Engineering Ethics-Variety of moral issued –Types of inquiry – Moral dilemmas – Moral autonomy –Models of professional roles-Theories about right action-Self-interest -Customs and religion –Uses of Ethical theories –Valuing time –Cooperation –Commitment-Case Study	04 Hrs
Unit-III	**Engineering As Social Experimentation**	
	Engineering As Social Experimentation –Framing the problem – Determining the facts – Codes of Ethics –Clarifying Concepts –Application issues –Common Ground –General Principles –Utilitarian thinking respect for persons-Case study	04 Hrs
Unit-IV	**Variety of Moral Issues**	Hours
	Understanding the Harmony in the Society (society being an extension of family), Integrity, Work Ethic, Courage, Empathy, Self Confidence, Moral Autonomy, Concensensus and Controversy, Professional and Professionalism, Professional Ideas and Virtues	04 Hrs
Unit-V	**Principals of Ethics and Morality**	
	Ethics as a Subset of Morality, Ethics and Organizations, Employee Duties and Rights, Discriminatory and Pre-judicial Employee Practices, Understanding Harmony in Nature, Natural Acceptance of Human Values.	04 Hrs
Unit-VI	**Risk Benefit Analysis**	
	Reducing Risk, The Government Regulators Approach to Risk, Handling Ethical Dilemmas at Work, Market Strategy and Ethics, Ethical Practice in Market Place, Ethics in Finance, Ethics in Business and Environment.	04 Hrs

**Note- FOR ISA Minimum 6 Assignments should be given covering all units.
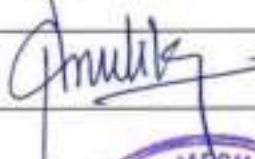
Mapping of Pos &COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	-	1	-	1	-	-	-	1	2	-	-	1	-	-	1
CO2	1	1	-	2	-	-	2	-	1	-	-	2	-	-	-
CO3	2	-	-	2	-	1	-	3	-	3	1	-	-	1	-
CO4	1	-	2	-	1	-	2	-	-	-	-	2	1	-	-
CO5	-	2	1	-	-	1	-	2	3	2	-	-	-	-	-
CO6	-	-	-	1	-	3	-	1	-	-	2	1	-	1	-

References:

Text Books	
1	Mike W. Martin and Roland Schinzinger "*Ethics in Engineering*" Tata McGraw-Hill–2003.
2	Prof. A. R. Aryasri, Dharanikota Suyodhana "*Professional Ethics and Morals*".Maruthi Publications
3	PSR Murthy "*Indian Culture, Values and Professional Ethics*" BS Publication.
4	Alavudeen, R. Kalil Rahman and M. Jayakumaran "*Professional Ethics and Human Values*" –Laxmi Publications.
Reference Books	
1	M. Govindarajan, S. Natarajananad, V. S. Senthil Kumar "*Engineering Ethics includes Human Values*" -PHI Learning Pvt. Ltd-2009
2	Prof. D. R. Kiran "*Professional Ethics and Human Values*
3	Harris, Pritchard and Rabins "*Engineering Ethics*", CENGAGE Learning, India Edition, 2009.

Video Lectures Link :
https://www.youtube.com/watch?v=cFOZplkRqsk

Sr. No.	Description	Signature
1	Name of Faculty Dr Amol Subhash Todkar	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGMDM1-ME307L MULTIDISCIPLINARY MINOR-1 (3D CAD MODELLING)

Lectures	: 2 Hr./week	**Examination Scheme**	
Credits	: 2	**ISA**	: 50 Marks

Course Objectives: The objective of the course is to

1. Develop an ability to create constrained 2-D Sketches.
2. Create 3D Part models of industrial components.
3. Prepare Assemblies comprising various Part models.
4. Transform 3D views into Orthographic views.

Course Outcomes:

COs	After the successful course completion, student will be able to	Blooms Taxonomy
CO1	Sketch a 2D drawing compatible for 3D modeling.	Remember Understand
CO2	Create Part models from 2D drawings.	Remember Understand
CO3	Create Assemblies containing Parts and Sub-assemblies.	Remember Understand
CO4	Generate Orthographic views from 3D Part model & Assembly.	Remember Understand

Description:

The concept of 3D CAD Modeling is applicable to almost all the branches of Engineering, as the constituent components of any system, small or large, has to be modelled and manufactured, which makes this subject essential. This Course has been offered by Mechanical Engineering Program as one of the Multidisciplinary MINOR (MDM) courses and is one of the courses to be studied by Third Semester students pertaining to the Program other than Mechanical Engineering. The Course contains Five Units namely, Introduction to CAD, Sketcher Workbench, Part Design Workbench, Assembly Design Workbench and Drafting Workbench.

Prerequisites:	1:	Fundamentals of Engineering Drawing
	2:	Basic AutoCAD skills

Unit 1	**Introduction to CAD**	02 Hrs.
	Introduction to the concept of CAD, CAM and CAE, Applications of CAD in view of CAM and CAE, 2D Drawings and 3D CAD Model, Importance of CAD data, Various CAD Softwares and their specific domain, Introduction to CATIA-GUI, Specification Tree, Sketch planes, Navigations through various Workbenches.	
Unit 2	**Sketcher Workbench**	03 Hrs.
	Profile Toolbar: Line, Circle, Rectangle, Profile line. **Operation** Toolbar: Trim, Extend, Fillet, Offset, Mirror **Constraint** Toolbar: Geometrical Constraints: Tangent, Parallel, Perpendicular. Dimensional Constraints: Length, Radius, Diameter, Angle, etc.	
Unit 3	**Part Design Workbench**	05 Hrs.
	Sketch-based Features: Pad, Pocket, Shaft, Grove **Dress-up Features:** Draft, Fillet, Chamfer **Transformation Features:** Pattern (Rectangular & Circular)	
Unit 4	**Assembly Design Workbench**	03 Hrs.
	Building assembly using existing Part models Building Assembly as a part of another Assembly. Manipulation and Constraints	
Unit 5	**Drafting Workbench**	02 Hrs.
	Setting up Sheet for Drafting, Inserting Primary View, Inserting additional views, Dimensions, Title blocks	

TERMWORK:

No.	Topic	Hrs.	Bloom's Taxonomy
1	An Assignment on Intro. to 3D CAD Modeling	2	Remember, Understand
2	2 Exercises on Part Modeling (Prints on A4 sheet)	4	Apply, Create
3	1 Exercise on Assembly Modeling (Contg. at least 5 parts) (Print on A3 sheet)	2	Apply, Create
4	2 Exercises on Drafting (Prints on A4 sheet)	4	Apply, Create

Mapping of POs & COs:

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

References:

Text Books	
1	CATIA V5R20 for Engineers and Designers, Shyam Tickoo &Deepak Maini, Dream-Tech Press.
2.	CAD/CAM and Automation, Farazdak Haideri, Nirali Prakashan
3.	CAD/CAM Theory and Concepts, Kuldeep Sarin, Chandandeep Grewal, S. Chand
Reference Books	
1.	CAD/CAM- Theory and Practice by Ibrahim Zeid, R. Sivasubramanian, McGraw-Hill, India
2.	Respective Software manuals.

Sr. No.	Description	Signature
1	Name of Faculty: *Prof. Krishnakumar D Joshi*	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGCEP-ME308L COMMUNITY CONNECTED PROJECT

Practical: 2 hrs. /week
Credits: 2

Tutorials: NA
ISA: 50 Marks

Course Objectives: The objective of the course is to
1. Gain a thorough understanding of community engagement principles and ethics, with a focus on local dynamics and rural culture.
2. Aassess the roles of NGOs and self-help groups in promoting rural development and their contributions to community improvement.
3. Exhibit the ability to communicate effectively and work collaboratively with community members, local authorities, and other stakeholders to achieve common goals.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Bloom's Taxonomy
CO1	Understand Community Engagement Concepts	Knowledge, Understand.
CO2	Identify community issues, needs, problems, strengths, and resources & Recognize the value of service and social responsibility	Knowledge, Understand,
CO3	Understand how NGOs and self-help groups contribute to rural development	Understand
CO4	Demonstrate the ability to communicate effectively and collaborate with others	Application,

Description:

The NGO Internship Program is designed to provide students with practical experience in community engagement and rural development. Through this program, students will gain insights into the functioning of NGOs, the challenges faced by rural communities, and the social impact of various government programs. The internship emphasizes the importance of ethical practices, community involvement, and the application of theoretical knowledge to real-world settings. By working closely with NGOs, students will develop a deeper understanding of local community needs and the strategies employed to address these needs effectively.

Prerequisites:	1:	Awareness towards community development
	2:	Basic Communication skills
	3:	Report writing and Presentations Skills

Program Details:

- **Duration**: The internship program spans 04 hours per week of immersive learning and training.

- **Group Size**: Students will participate in groups of 5 to 6, promoting teamwork and collaborative learning.

- **Permission**: Prior to beginning the internship, students must obtain permission from the NGO to ensure a structured and organized experience.

- **Report Submission**: At the conclusion of the internship, students are required to submit a detailed report in a standard format to their department. This report will reflect their learning experiences, insights, and contributions during the internship.

Internship Report Structure:

1. **Introduction:**

   - Brief overview of the internship experience.
   - Objectives and purpose of the internship.

2. **Organizational Structure:**

   - Description of the NGO's structure.
   - Key departments and their functions.

3. **Role of Students in the Organization:**

   - Specific tasks and responsibilities undertaken.
   - Contributions made by the students during the internship.

4. **Suggestions and Recommendations:**

   - Insights on how the NGO could improve its operations.
   - Recommendations based on the students' observations and experiences.

5. **Conclusion:**

   - Summary of the internship experience.
   - Reflection on the learning outcomes and their applicability to future endeavors.

Course Assessment:

The assessment for the NGO Internship Program will be based on the following components:

1. **Internship Performance (40%):**

   - Evaluation by the faculty supervisor on tasks performed, engagement level, and overall contribution.

- Feedback on teamwork, initiative, and adherence to ethical practices.
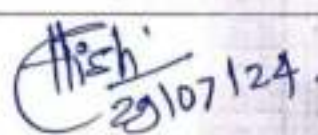
2. **Internship Report (40%):**

   - Quality and thoroughness of the report, including all required sections (Introduction, Organizational Structure, Role of Students, Suggestions and Recommendations, Conclusion).
   - Clarity, coherence, and reflection on the learning outcomes.

3. **Presentation (20%):**

   - Oral presentation of the internship experience and findings to the department.
   - Ability to articulate experiences, insights, and recommendations.

Mapping of POs & COs:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO 3
CO1	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO2	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO3	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
CO4	--	--	--	--	--	2	--	--	3	3	--	--	--	--	--
CO5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Sr. No.	Description	Signature
1	Name of Faculty A·S· Chavan	Hish 29|07|24.
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME302L APPLIED THERMODYNAMICS LAB

Practical's: 02 hrs/week
Credits: 01

Examination Scheme
ISA: 25 Marks

Course Objectives: The objective of the course is to

1. Learn about the detailed construction working of steam power plant
2. Learn about different types of boilers, mountings and accessories
3. Learn about different types of steam condensers and cooling tower.

CourseOutcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the construction and working of steam power plant	Knowledge Understand
CO2	Understand the construction, working and classification of different types of steam boilers.	Understand
CO3	Understand the use and functioning of Boiler mountings used in steam power plant	Understand
CO4	Understand the use and functioning of Boiler Accessories used in steam power plant	Understand
CO5	Understand construction, working and classification of different types of steam condensers and cooling towers used in steam power plant	Understand
CO6	Analyse and evaluate Heat balance sheet of steam power plant	Analysis Evaluate

Description:

The Applied thermodynamics laboratory consists of a number of models of steam boiler, steam condenser, steam turbines, various boiler mountings and accessories.Students are able to enhance their basic and fundamental knowledge of applied thermodynamics by effective using of these demo models.

Prerequisites:	1:	Basic Mechanical Engineering
	2:	Applied Physics
	3:	Basic Engineering Mathematics

Practicals:

Sr.No.	PracticalTopic	Hrs.	Bloom'sTaxonomy
1	Study of steam power plant	2	KnowledgeUnderstand
2	Study and Demonstration of water tube and fire tube boilers..	2	Understand
3	Study and Demonstration of boiler mountings	2	Understand
4	Study and Demonstration of boiler accessories	2	Understand
5	Study and demonstration of steam condensers and cooling towers used in steam power plants	2	Understand
6	Heat balance sheet of steam power plant	2	Analysis Evaluate
7	Industrial visit to steam generating unit/cogeneration plant		Apply

MappingofPOs&COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Ifapplicable		
													PSO1	PSO2	PSO3
CO1	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO2	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO3	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO4	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO5	3	--	--	--	--	--	--	---	--	--	--	--	--	3	--
CO6	3	3	3	--	--	--	--	---	--	--	--	--	--	3	--

References:

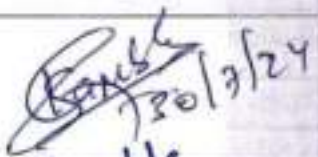| TextBooks |
|-----------|
| 1 "Thermal Engineering", Kumar and Vasandani, D. S. Publisher Metropolitan Book Co, Delhi, 3rd Edition. |
| 2. "Thermal Engineering", Ballaney P. L, Khanna Publishers, New Delhi, 27th Edition. |
| 3. "Engineering Thermodynamics", P .K. Nag., TataMcGrawHill, New Delhi, 4th Edition. |
| 4. "Thermal Engineering", R .K. Rajput, Laxmi Publications, 3rd Edition. |
| 5. "Steam and Gas Turbines", R. Yadav, CPH Allahabad, 2nd Edition, 2005. |

6.	"Principles of Engineering Thermodynamics", Moran, Shapiro, Boettner, Wiley, 8ᵗʰ Edition.
ReferenceBooks	
1	Y.A. Cengel & M.A. Boles, Thermodynamics: An Engineering Approach, 8th Ed., McGraw Hill Education (India) Pvt. Ltd., New Delhi,2016.
2	R.E. Sonntag, C. Borgnakke & G.J. Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003. 3. T.D. Eastop& A.
3	McConkey, Applied Thermodynamics, 5th Ed., Pearson Education Ltd., New Delhi, 2014.

VideoLectures/Practicals

Practicals1to6.https://nptel.ac.in/courses/112103307

https://onlinecourses.nptel.ac.in/noc24_me137/preview

Sr. No.	Description	Signature
1	Name of Faculty: Prahlad Vithal Kamble	
2	Syllabus Structure and Content of Course Verified	30/3/24
3	Approval of Board of Studies Chairman	

23UGPCC-ME303LP FLUID MECHANICS LAB

Practicals: 02 hrs/ week
Credits: 01

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify and use different pressure measuring devices used fluid system.	Knowledge Understand
CO2	Understand different types of fluid flow and determine laminar or turbulent fluid flow.	Understand
CO3	Verify Bernoulli's Theorm.	Apply Analyze
CO4	Calibrate the different discharge measuring devices to determine coefficient of discharge.	Apply Analyze
CO5	Determine the major and minor losses in pipe system.	Apply

Practicals:

List of Assignments and Experiments: (Any 8 from the following):

Number	Practical/Experiment/Tutorial Topic	Hrs.	Blooms Taxonomy
1	Assignment on Study and demonstration of Pressure Measuring Devices.	2	Knowledge
2	Flow visualization by plotting of streamlines (Heleshaw's apparatus).	2	Knowledge
3	Reynold's experiment.	2	Apply Analyze
4	Verification of Bernoulli's equation.	2	Analyze
5	Calibration of Venturimeter	2	Analyze
6	Calibration of Orificemeter	2	Analyze
7	Calibration of Notches	2	Analyze
8	Calibration of orifice under steady and unsteady flow condition.	2	Application Analyze
9	Determination of minor losses in pips-fittings.	2	Analyze
10	Determination of coefficient of friction in pipes of different materials.	2	Analyze

Mapping of Pos & COs:

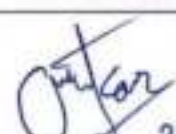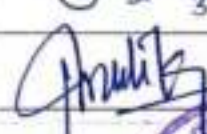|	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	1	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	2	2	-	-	-	-	-	-	-	-	-	2	-

References:

Text Books	
1	Fluid Mechanics, R.K.Bansal, Laxmi publications, New Delhi, 1998.
2	Fluid mechanics and Hydraulic Machinery, R.K.Rajput, Laxmi publishers
3	Experiments in Fluid Mechanics, Sarbjit Singh, PHIL earning, New Delhi
4	Hydraulics and Fluid Mechanics including Hydraulic Machines, Dr. P. N. Modi and Dr. S.M.Seth, Standard Book House .

Links of V-Labs

Practical

1. https://fm-nitk.vlabs.ac.in/#

2. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html

3. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/fluid_mechanics/experimentlist.html

Sr. No.	Description	Signature
1	Name of Faculty: M.R. Todkar	
2	Syllabus Structure and Content of Course Verified	30/07/2024
3	Approval of Board of Studies Chairman	

23UGPCC-ME304LP MATERIAL SCIENCE AND METALLURGY LAB

Practical's: 2 hrs / week

Credits: 1

Examination Scheme:

ISA: 25 Marks

POE: 25 Marks

Course Objectives: The objective of the course is to

1) To familiarize the students with the use equipments to determine mechanical properties of materials to acquire the knowledge in Destructive Material Testing.
2) To familiarize the students with various heat treatment processes.

Course Outcomes:

COs	At the end of successful completion of the course the student will beable to	Blooms Taxonomy
CO1	Determine different properties like strength, elongation, toughness, hardness bydoing tests like Tensile test, Impact test, Hardness test.	Knowledge, Apply
CO2	Choose different NDT techniques for determining surface and sub surface Cracks.	Analyze
CO3	Explain various heat treatment processes and their micro structural changes.	Analyze
CO4	Explain the concept of hardenability and estimate the hardenability.	Understand Analyze

Practical's:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
1	Tensile testing on mild steel specimen by using a universal testing machine.	2	Apply
2	Brinell Hardness testing.	2	Knowledge Apply
3	Impact testing (Izod and Charpy) on mild steel specimen.	2	Apply
4	Non Destructive testing-Dye penetrant and magnetic particle testing.	2	Knowledge, Analyze
5	Macroscopic Examinations -Spark Test.	2	Knowledge
6	Preparation of specimen for microstructure analysis	2	Analyze

7	Study of microstructure of steels and Cast Irons.	2	Analyze
8	Study of microstructure of Non-ferrous alloys.	2	Evaluate
9	Jominy end quench test for hardenability.	2	Knowledge Apply
10	Industrial visit should be conducted to observe industrial heat treatment practices.	2	Understan dApply

Mapping of POs & COs:

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

References:

Text Books	
1	S.H. Avner, "Introduction to physical metallurgy", Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendrasingh, "Physical metallurgy", Standard Publishers Delhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G.Rethwisch, Wiley, Tenth Edition, 2010.
4	V.D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune, 12th Edition
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.

Reference Books	
1	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice-Hall of India (P) Ltd.
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	Foundations of Materials Science and Engineering by William F. Smith, Mc Graw Hill, Third Edition, 2004.
5	Elements of Materials Science and Engineering by H. Van Vlack, Addison – Wesley, Fifth Edition, 2006.

6	Introduction to Materials Science for Engineers by James F. Shackelford, Pearson,Eighth Edition, 2015.
7	Characterization of Materials by P. K. Mitra, PHI Learning, 2014.
8	Mechanical Metallurgy by George E. Dieter, Tata McGraw Hill, 3rd edition, 2013.

S N	P	B
1	Name of Faculty: P.B.Kadam	PBK 30/7/24
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME309L MACHINE DRAWING & GEOMETRIC MODELING LAB

Practicals	: 2 hrs/ week	Evaluation Scheme:
Credits	: 1	ISA : 25

Course Objective: The objective of the course is to

1. To study and identify BIS conventions used in machine drawing.
2. To develop an ability to create constrained 2-D Sketches and 3-D modeling.
3. To create solid models of machine components.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Bloom's Taxonomy
CO1	Understanding BIS conventions and Standard machine components	Understand
CO2	Draw 2D drawings and 3D models of simple components.	Apply
CO3	Creating the skills for drawing assembly from details and details from assembly drawing by using CATIA software	Create
CO4	Analyze production Drawing and Understand use of limit fits and tolerances on production drawing.	Analysis

Description:

The Machine Drawing & Geometric Modeling includes study of AutoCAD & CATIA modeling software to make 2D and 3D object. This study is beneficial for students to enhance their basic and fundamental knowledge of machine drawing to make 2D and 3D models effectively. This is required skills of Mechanical Engineer will be achieved by this subject.

Prerequisites:	1:	Computer Aided Engineering Drawing
	2:	AutoCAD Basics

	Study of B.I.S. Conventions & Sketching of Machine Component	
Unit 1	Importance of BIS Conventions, BIS Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles (Internal and external threads) BIS Conventional representation of Splined shaft, Serrated shaft Freehand Sketches- Nuts and Bolts (Square & Hex) Flanged nut, Capstan nut, Wing nut, Square headed bolt, Cup headed bolt, T-headed bolt, Foundation bolts (Eye foundation Bolt), Muff coupling, Flat and V-belt pulleys. **(Drawing Sheet on AutoCAD in A3 size printout)**	4 hrs

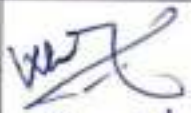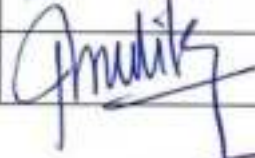| Unit 2 | **Solid Modeling with Drafting** | |
	Drawing of solid Modeling of four simple mechanical components with its drafting in CATIA **(Drawing Sheet in CATIA in A4 size printout)**	6 hrs
Unit 3	**Details and Assembly Drawings**	
	Preparing detail and assembly drawings in 3D & 2D. Preparing Bill of Material (BOM). Maximum number of parts 5. Entering limits, fits, Tolerances and surface finish symbols on detail and assembly drawings. Preparation of detail and assembly drawing from the following examples such as Machine tool parts: Tool post, Tailstock, Machine vice, Chucks etc. Engine parts: Stuffing box, Crosshead assembly, Piston and connecting rod, etc. Miscellaneous parts: Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc. **(Drawing Sheet in CATIA in A3 size printout of two detail and assembly of mechanical components)**	6 hrs
Unit 4	**Production Drawing**	
	Production drawing including removed cross section, detailed views, Cross sectional views, dimensions and tolerances etc. Applying various tolerance symbols like Straightness, Flatness, Perpendicularity, Angularity, Roundness, Concentricity, Cylindricity, Run out, Profile, Parallelism etc. Entering limits, fits, tolerances surface finish symbols and Machining Symbols on drawings Significance of limits and fits and tolerances, Definitions, Types, Recommendations and selections in relation with limits fits and tolerance system, Tolerances of form and position, surface finish symbols as per BIS conventions, Selection and entering of all these symbols with reference to details and assembly drawings. Tolerancing an individual dimensions of details drawing. **(Drawing Sheet in CATIA in A3 size printout)**	6 hrs

TERMWORK

No.	Topic	Hrs.	Bloom's Taxonomy
1	An A3 print on BIS Conventions & Free-hand Sketches	4	Remember, Knowledge
2	Two A4 prints each on Solid modeling & Drafting	6	Apply, Create
3	An A4 print each on Assembly and Details.	6	Apply, Create
4	An A3 print of a Production drawing	6	Apply, Create

Mapping of POs & COs:

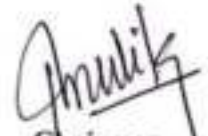| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | If applicable | | |
													PSO1	PSO2	PSO3
CO1	3	2	2	-	3	1	-	-	3	1	3	2	1	-	1
CO2	3	2	2	-	3	1	-	-	3	1	3	2	3	-	3
CO3	3	2	2	-	3	1	-	-	3	1	3	2	3	-	2
CO4	3	2	2	-	3	1	-	-	3	1	3	2	3	-	3

Textbooks

1.	P.S. Gill, Machine Drawing. S. K. Kataria and Sons, Delhi, 7th Edition, 2008
2.	N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay, 42th Edition, 2007
3.	CAD/CAM- Principals and Applications", P.N. Rao, Tata McGraw Hill, 2nd Edition.
4.	CAD/CAM/CAE",N.K. Chougule, SciTech Publication, Revised Edition.

Reference Books

1.	IS: SP46-Engineering Drawing Practice for Schools and Colleges, B.I.S. Publications.
2.	IS: 696-Code of Practice for General Engineering Drawings B.I.S. Publications.
3.	CAD/CAM by M. P. Grover. and E. W. Zimmer, Prentice Hall of India Pvt. Ltd.
4.	CATIA V5R20 for Engineers and Designers, Shyam Tickoo and Deepak Maini, Dream Tech Press
5.	AutoCAD Training Guide by Linkan Sagar, BPB Publications

Sr. No.	Description	Signature
1	Name of Faculty *Prof. Vivek V. Patil*	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

Member Secretary
Board of Studies

Chairman
Board of Studies
Chairman
Board of Studies
MECHANICAL ENGG. DEPT
... ... Kore Institute of Engg
. Technology (Autonomous)
Warananagar, Dist. Kolhapur

Academic Dean
T.K.I.E.T., Warananagar
Dean, Academic
Tatyasaheb Kore Institute of Engg
& Technology (Autonomous)
Warananagar, Dist. Kolhapur

Principal
T.K.I.E.T., Warananagar
PRINCIPAL
Tatyasaheb Kore Institute of Engg.
& Technology (Autonomous)
Warananagar, Dist Kolhapur

23UGPCC-ME401 ANALYSIS OF MECHANICAL ELEMENTS

Lectures	: 3 hrs. /week	**Evaluation Scheme:**	
Credits	: 2	ESE	:60 Marks
		ISE	: 40Marks

Course Objective: The objective of the course is to

1. To develop understanding of the basic concepts related to tensile, compressive and shear stresses in engineering components and basic knowledge of principal stresses and strains.
2. To discuss the basic principles of torsion in shafts, shear force and bending moment in beams, deflection in beams, buckling in mechanical elements.
3. To enable the students to calculate distribution of bending stresses and shear stresses in mechanical components of various cross sections.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Bloom's Taxonomy
CO1	Define different types of stresses and strains induced in any machine component due to various loading conditions.	Remember
CO2	Interpret the nature of internal stresses that will develop within the mechanical components for different types of loading.	Understand
CO3	Utilize mathematics and basic engineering principle to evaluate stress, strain, torque, buckling load, slope and deflection.	Apply
CO4	Examine the effect of different loading conditions in various machine elements such as simple machine components, beams, shafts, columns.	Analyze
CO5	Determine the mechanical design parameters of structural member under different loadings.	Evaluate
CO6	Apply and Construct graphical solutions for given loading conditions of structure.	Apply Create

Description:

Analysis of Mechanical Elements is a fundamental subject needed primarily for the students of Mechanical sciences. The course provides an introductory study on stresses and strains on deformable solids. It focuses on the analysis of members subjected to axial, bending, and torsional loads. The course discusses in detail, the shear force and bending moments on beams. It introduces the concept of principal stresses in the analysis of structural members. In a nutshell, the course aims at developing the skill to solve design problems on Analysis of Mechanical Elements which is basic need of mechanical engineering.

	1:	Knowledge of Basic Mechanical Engineering
Prerequisites:	2:	Knowledge of applied mechanics

	Section-I		
	Stresses and Strains		
Unit 1	Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Stress-strain diagram for ductile and brittle material, Factor of safety, Elastic constants and Inter-relationship between elastic constants, Stresses, stains and deformation in composite bars, Thermal Stresses.		06Hrs
	Principal Stresses and Strains		
Unit 2	Normal and shear stresses on any oblique planes, Concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses.		06Hrs
	Shear Force and Bending Moment Diagram		
Unit 3	Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated load, UDL, UVL.		08Hrs
	Section-II		
	Bending Stresses in Beams		
Unit 4	Symmetric pure bending of beams, flexure formula, moment of resistance of cross-sections, Design of rectangular, circular(solid and hollow) sections, I and T sections.		08 Hrs
	Shear Stresses in Beams		
	Distribution of shear stresses in beams of various commonly used sections such as rectangular, circular, I and T.(Only numerical)		
	Slope and Deflection of Beams		
Unit 5	Slope and deflection of beam using double integration method for simply supported beam and cantilever beam due to concentrated load and UDL.		06Hrs
	Torsion		
Unit 6	Introduction to Torsion, Basic assumptions, Torsion equation, Stresses in hollow and solid circular shafts, power transmitted by shaft.		06 Hrs
	Columns		
	Euler's formula & assumptions, Euler's formula for different end connections, Concept of equivalent length, limitations of Euler's formula.		

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO2	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO4	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO5	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO6	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--

References:

	TextBooks
1	"Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3	"Strength of Materials", Khurmi Gupta, S. Chand Publication.
4	"Strength of Materials", R.K. Rajput, S. Chad Publication.
5	"Mechanics of structure", S.BJunnerkar, Charotar Publication House.
6	"Strength of Materials", S. S. Bhavikatti, Vikas Publication House.
	ReferenceBooks
1	"Strength of Materials", Beer and Johnson, CBS Publication.
2	"Strength of Materials", G.H. Rider, Mac Millan India Ltd.
3	"Strength of Materials", Nag and Chanda, Willey India Publication.
4	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
5	"Strength of Materials", Den Hartong, McGraw Hill Publication.

Web Links/ Video Lectures :
1. https://nptel.ac.in/courses/112/107/112107146/
2. https://nptel.ac.in/courses/112/106/112106141/

Sr. No.	Description	Signature
1	Name of Faculty Prof. A.R.Koli Prof. V. N. More	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME402 THEORY OF MACHINES-I

Lectures	:	3 Hrs/Week		Evaluation Scheme		
Credit	:	2	ISE	:	40 Marks	
			ESE	:	60 Marks	

Course Objectives: The objective of the course is to	
1	Provide the students with basic knowledge of mechanism and its application in mechanical engineering including power transmitting devices.
2	Explain types of Cam with Followers and select according to their applications.
3	Introduce working principle and construction of governors as well as comparing different types of governing mechanisms.
4	Study the fundamental theory of friction and its analysis in different Mechanisms and machines.

Course Outcomes:		
COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	List different types of mechanisms and their applications in mechanical engineering.	Remember
CO2	Describe and apply kinematic theories of mechanism to plot velocity and acceleration diagrams of links used in machines.	Understand
CO3	Apply knowledge of cam to draw the cam profile with follower for different applications.	Apply
CO4	Compare power transmitting elements used in different machines and select the appropriate as per requirement.	Analyze
CO5	Evaluate suitability of given governing mechanisms based on speed control parameter analysis.	Evaluate
CO6	Select and design an appropriate mechanism for given proposed machine by considering various parameters like friction, power transmitting capacity and other parameters.	Create

Description:
The effectiveness of mechanical machines depends upon mechanism used for transmission of motion in different components. Engineer can deal with these machines only if he has fundamental knowledge of mechanisms. Theory of Machine subject is introduced in syllabus to get the students acquainted with mechanism which is used in machine to transmit power from a source to its various parts as well as to transform motion from one form in to another form. It includes kinematics and kinetics of mechanism, design of cam and follower , theory of governor etc.

		1	Applied mechanics
Prerequisites:		2	Basic Mathematics
		3	Basic Mechanical Engineering

Section – I		
Unit 1	**Basic Concept of Mechanisms:**	[5]
	Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubblers criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Hooke's joint (only theoretical treatment).	
Unit 2	**Velocity and Acceleration in Mechanisms:**	[10]
	Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.	
Unit 3	**Friction:**	[5]
	Introduction to friction, Friction in pivot bearings, Inclined plane theory, Friction in screws	
Section – II		
Unit 1	**Cams:**	[8]
	Cams Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.	
Unit 2	**Belts:**	[6]
	Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt.	
Unit 3	**Governors:**	[6]
	Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronisms, Governor effort and power, Insensitiveness of governors.	

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	--	--	--	--	--	--	--	--	--	2	--	--
CO2	2	2	3	--	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	3	--	--	--	--	--	--	--	--	2	--	--
CO4	2	2	2	--	--	--	--	--	--	--	--	--	2	--	--
CO5	2	2	2	2	--	--	--	--	--	--	--	--	2	--	--
CO6	3	3	2	2	--	--	--	--	--	--	--	--	3	--	--

References:

Text Books	
1	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition..
2	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
3	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.
Reference Books	
1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	"Theory of Machines", Thomas Bevan, CBS Publishe
Video Link	
1	https://archive.nptel.ac.in/courses/112/106/112106270/#.
2	https://nptel.ac.in/courses/112105268

Sr. No.	Description	Signature
1	Name of Faculty Dr Lingaraju SV, Prof. A. M. Patil	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME403 MANUFACTURING PROCESSES AND MACHINE TOOLS

Lectures	:3 hrs. / Week	Evaluation Scheme:	
Credits	:2	ESE :60 Marks	
		ISE :40Marks	

Course Objectives: The objective of the course is

1. To understand different methods of Molding and Casting.
2. To study different types of forming processes
3. To learn various plastic shaping processes and welding processes.
4. To understand theories of lathe, drilling and boring machine, shaping, milling and gear manufacturing process & Non conventional Machining.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to:	Bloom's Taxonomy
CO1	Explain the construction & working of various machine tools used in Manufacturing processes.	Understand
CO2	Describe various metal casting, metal cutting, metal forming & metal joining processes.	Understand,
CO3	Discuss various plastic processing and tools includes thermoforming, extrusion etc.	Understand
CO4	Apply the fundamental theory of machining processes to calculate Machining time and Metal removal rate.	Apply, Analysis
CO5	Summarize various Gear manufacturing processes and select the appropriate process as per the requirement.	Evaluation
CO6	Illustrate the principles and applications of Non- traditional machining (NTM) processes	Understand, Apply

Description:

Manufacturing processes used in industry for converting raw materials into finished products. This course contains basic knowledge of different types of manufacturing process and its advantages, applications.

Machining and machine tools is an important subject with application in several industries. Traditional machining is the broad term used to describe removal of material from a work piece. This course has six units namely i) Casting Process ii) Metal Forming Process iii) Plastic Shaping Process and Welding Process iv) Metal Cutting Processes-I v) Metal Cutting Processes-II and vi) Non Traditional Machining

Prerequisites:	1:	Basic Mechanical Engineering
	2:	Metallurgy and Material science

Section - I			
	Casting Processes:		
Unit 1		Importance of casting as manufacturing process, advantages and limitations of casting processes, introduction and types of patterns and core boxes, materials used and selection criteria for patterns, pattern allowances, Types of sands used in moulding and core making, their properties. Sand moulding types such as Green sand Moulding, shell Moulding, CO_2 Moulding, Investment casting. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics. Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Cupola furnace, Induction and Arc Furnace, casting defects	08 Hrs
	Forming Processes:		
Unit 2		**Introduction** - Hot, cold and worm working, Classification of various metal Forming processes. a) **Rolling:** Introduction, Hot and cold rolling, Rolling Mill Classification, Defects in rolling. b) **Forging:** Introduction, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer), Open and Closed die Forging, Defects in forging. c) **Extrusion:** Introduction, Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in extrusion.	08 Hrs
	Plastic Shaping and welding process		
Unit 3		a) Thermosetting and thermoplastic materials, their properties and applications, Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming. b) Definition of welding ,classification of welding, construction and working of Metal inert gas(MIG),Tungsten inert gas(TIG)	04 Hrs
Section - II			
	Machine Tools for Metal Cutting I:		
Unit 4	a)	**Lathe:** Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations.	07 Hrs

	b) **Drilling Machines:** Classification of drilling machines, Construction and working of radial drilling machine, various accessories and various operations and C) **Boring Machines:** Introduction to boring machines, Types of boring machine, different operations.	
Unit 5	**Machine Tools for Metal Cutting II:** a)**Milling Machine:** Types- Horizontal, Vertical milling machines, Milling cutters, construction and working of column and knee type, milling operations, simple and compound indexing. b)**Shaping & Planning Machine:** Construction & working of shaper and Planer machine, Comparison between planer and shaper machine c)**Gear Manufacturing processes:** Study of various processes like gear shaping, gear hobbing, Gear finishing processes –Gear shaving, Gear burnishing and gear rolling.	07 Hrs
Unit 6	**Nonconventional Machining:** Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro-Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining	06Hrs

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	--	--	2	--	--	--	--	--	--	--	--	--	
CO2	2	2	--	--	3	--	--	--	--	--	--	--	--	--	2
CO3	2	2	--	--	3	--	--	--	--	--	--	--	--	--	2
CO4	3	2	--	--	--	--	--	--	--	--	--	--	--	--	3
CO5	3	3	--	--	2	--	--	--	--	--	--	--	--	--	2
CO6	3	2	1	--	3	1	1	--	--	--	1	--	--	--	2

References:

Text Books

1	"Manufacturing Technology- Foundry, Forming and Welding, Vol. I", P. N. Rao, Tata McGraw-Hill, New Delhi,3rd edition, 2009.
2	"A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt.Ltd, New Delhi.7thEdition,2010.
3	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition, 2000.
4	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd Viva Books Pvt.Ltd,NewDelhi,1stEdition,2001.
5	"Elements of Workshop Technology vol. II", S.K.Hajra Choudhury and A.K. Hajra Choudhury, Media promoters and Publishers Pvt.Ltd,NewDelhi,13thEdition,2012.
6	"Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000.

Reference Books

1	"Principles of metal casting", Haineand Rosenthal, Tata McGraw-Hill Book, Company. New Delhi.
2	"Workshop Technology", W.A.J.Chapman, CBS Publishing and Distributors, N.DelhiVol.I [ISBN-13:9788123904016]2001, Vol.II [9788123904115] 2007 andVol.III [9788123904122] 1995.
3	"Machine Tools and Manufacturing Technology", Steve F. Krar, Mario Rapisarda,Albert F. Check.

Web Links/ Video Lectures:

1. http://msvs-dei.vlabs.ac.in/
2. https://nptel.ac.in/courses/112/107/112107083/
3. https://nptel.ac.in/courses/112/107/112107250/

Sr. No.	Description	Signature
1	Name of Faculty Dr. M. R. Jadhav	Myadhw.
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME4041 ENTREPRENEURSHIP/ECONOMICS/ MANAGEMENT COURSES (EEC)
INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	2	ISE	:	40 Marks
			ESE	:	60 Marks

Course Objectives: The objective of the course is to

1. State various functions of management.

2. Know Production and marketing functional area of management.

Course Outcomes:

COs	Attheendofsuccessfulcompletionofthecourse,thestudentwillbeableto	Blooms Taxonomy
CO1	Apply the concepts of Industrial management and operations research approaches. Know various functional areas of management.	Knowledge Understand
CO2	They will analyses issues in Managing operations and projects and various approaches to resolve those issues.	Understand
CO3	They will Study MIS, Entrepreneurship Development	Understand
CO4	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Linear programming problems.	Understand Apply
CO5	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Transportation and Assignment problems.	Apply Evaluate
CO6	Apply the various techniques of Project Management such as Network Model and Sequencing Model.	Apply

Description:

Industrial Management and Operation Research course is offered as the basic management course. This course contains Mathematical methods and techniques that are used to solve complex Mechanical engineering problems. This course has six units namely i) **Functions of Management** ii) **Functional areas of Management** iii) **Entrepreneurship Development** , iv) **Introduction to Operations Research and Linear Programming Problems**, v) **Assignment Model and transportation model** and vi) **Network model and sequencing**

Prerequisites:	1:	Provide the knowledge to identify and solve different problems of Optimization.

Section – I		
Unit 1	**Functions of Management**	

Unit 1	Definition of Management, Planning –Objectives, Steps in Planning, elements of planning, Organizing – Process of Organizing importance and principle of organizing, departmentation, Span of control. Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure, training and development, appraisal methods. Leading – Leadership style, Communication process, Barriers, remedies, Motivation, importance Herzberg's theory, Maslow's theory, McGregor's theory . Controlling–Process, Requirement for control management.	7 Hrs
	Functional areas of Management	
Unit 2	Production Management-Product mix, line balancing, break even analysis, Material Handling Equipments, TPM, Problem solving Techniques. Marketing Management –Principles & Functions, Types of Market, Market Research, Market Segmentation, Marketing Mix, Advertisement, Channel Of Distribution.	6 Hrs
	Entrepreneurship Development	
Unit 3	Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety, Management Information System.	7 Hrs
Section – II		
	Introduction to Operations Research and Linear Programming Problems	
Unit 4	History and development of OR, Applications, OR models and their Applications, Formulation of LPP problem, Graphical solution of LPP, Simplex procedure for maximization, Simplex procedure for minimization, Duality concept.	7 Hrs
	Assignment Model and transportation model	
Unit 5	Assignment Model- Mathematical statement, Methods to solve balanced assignment problems, Unbalanced assignment problems, Maximization problems, Assignment with restrictions. Transportation model- Mathematical formulation, methods to obtain initial basic feasible solution (IBFS)- NWCR ,LCM and VAM, Conditions for testing optimality, MODI method for testing optimality of solution of balanced problems and unbalanced problems	6 Hrs
	Network model and sequencing	
Unit 6	CPM-Construction of network, Critical path, forward and backward Path, Floats and their significance. PERT- construction of networks, Time estimates, Probability of completing project by given date. Sequencing-Sequencing of n jobs & 2 machines, Sequencing of n jobs & 3 machines	7 Hrs

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	--	--	--	--	1	--	--	--
CO2	3	2	1	--	--	--	--	--	--	--	--	1	--	--	--
CO3	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO4	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO5	2	2	1	--	--	--	--	--	--	--	--	2	--	--	--
CO6	2	1	1	--	--	--	--	--	--	--	1	.1	--	--	--

References:

TextBooks

1. "Industrial Engineering and Management", Vishwanath ,Scitech Publication,1st Edition.

2. "Industrial Management and Operation Research", Nandkumar Hukeri, Electrotech Publication.

3. "Operations Research", J. K. Sharma, McMillan India Publication New Delhi,5th Edition

4. "Operations Research", Hira and Gupta, S.Chand and Co. New Delhi.

5. "Operation Research an Introduction", Hamdy A. Taha, Pearson,10 th Edition

ReferenceBooks

1. "Management, Today – Principles and Practice", Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.

2. "Essentials of Management", Koontz and H.Weinrich, Tata McGraw Hill Publication, 12th Edition.

3. "Business Management", J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,

4. "Production and Operation Management", Tripathy, Scitech Publication, 2nd Edition.

5. "Management", James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.

6. "Introduction to Operation Research", Paneer-Selvam, Prentice Hall of India publication, 2nd Edition.

7. "Operation Research", Pradeep J. Jha, Tata McGraw Hill Publication.

8. "Operation Research", Mariappan, Pearson Education.

9. "Operation Research – Principle and Applications", G.Shriniwasan, Prentice Hall of India Publication, 3rd Edition.

Web Links/ Video Lectures

Lectures 1. https://nptel.ac.in/courses

2 https://onlinecourses.nptel.ac.in/noc21_ma62/preview

Sr. No.	Description	Signature
1	Name of Faculty Prof S. S. Mahadik	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME4042 ENTREPRENEURSHIP ECONOMICS MANAGEMENT COURSES (EEC)
INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Lectures: 03 hours/week
Credits: 02

Evaluation Scheme:
ESE :60 Marks
ISE : 40 Marks

Course Objectives: The objective of the course is to

1. To familiarize students with the essentials of intellectual property rights, since they will be heavily involved in the creation and oversight of creative initiatives in the business world.
2. To spread information about patents, the Indian and international patent systems, and the issues of registration.
3. To propagate awareness of copyrights, the rights associated with them, and the registration process.
4. To be updated on IPR developments and government initiatives to promote IPR.

Course Outcomes:

Co's	At the end of successful completion of the course, the student willbeable to	Blooms Taxonomy
CO1	Students will receive sufficient training in patent and copyright for their creative research works after completing their academic assignments.	Knowledge
CO2	Information from patent filings offers valuable insight about the uniqueness of their idea,based on cutting edge researches.This offers an additional avenue for refining their concepts to improvements.	Understand
CO3	The process of conducting a literature review and professional reading	Knowledge Understand
CO4	To summarize, the effects of patent law and drafting procedure.	Knowledge
CO5	Recognizing copyright rules and topics related to designs and copyrights	Understand Apply
CO6	Understanding the benchmark principles of design rights	Knowledge Apply Evaluate

Description:

The course provides an in-depth exploration of intellectual properties and rights, focusing on the research, development, and application of rights in personal and professional contexts.

Students will engage with various design and copyrights theories, reflect on their own values and learn to navigate complex moral dilemmas.

Prerequisites:	1:	Basic understanding of the design, patients, and rights which can provide a background of research theories.
	2:	Critical thinking skills that develop the innovation design and good basic

3:	The concept of Literature Review, Technical Reading, Attributions and Citations	

Unit-I	**INTRODUCTION:**	Hours
	Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Types of IP, IP Acts in India, Value creation through IP, Advantages of IP protection	06
Unit-II	**PATENTS AND COPYRIGHTS:**	Hours
	Objectives, Rights, Patent Acts 1970 and its amendments. Procedure of obtaining patents, working of patent, Infringement, Industrial Application: Non-Patentable Subject Matter. Registration Procedure, Rights and duties of Patentees. Introduction, works protected under copyright law, Rights, Transfer of Copyrights, Infringement, Remedies and Penalties.	09
Unit-III	**Trademark & Infringement**	Hours
	Types of trademarks, Brands and logos, Criteria for Registration of Trademarks, Trademark Registration process, Well-Known Trademarks, Trademark classification, Trademark filing, Trademark Infringement and case studies, Madrid convention	06
Unit-IV	**Protection of traditional knowledge**	Hours
	Objectives, Concept of traditional knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability. Traditional Knowledge Digital Library.	06
Unit-V	**Industrial Design**	Hours
	Industrial design, Requirements, Article- Not registrable as Designs, Term of designs, Design registration, examples of Industrial Designs, Design infringement, Industrial Designs vs Trademarks, Industrial Designs vs Patents.	06
Unit-VI	Geographical Indications and Protection of Plant	Hours
	Option for protection, UPOV, Protection system in India, Implementation of the PPV&FR Act, Biodiversity act. What are Trade Secrets, How trade secrets are maintained in trade and business, examples of Trade Secrets	03

Mapping of Pos&COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-
CO5	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
CO6	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-

References:

	Text Books
1	Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, In: Cengage Learning India Private Limited.
2	Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, In: Lexis Nexis.
3	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
4	Neeraj, P. and Khusdeep, D. 2014. Intellectual Property Rights. India, In: PHI learning Private Limited.
	Reference Books
1	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
2	Intellectual Property A Primer for Academia by Prof. RupinderTewari Ms. MamtaBhardwa
3	Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.

Video LecturesLink :
https://www.youtube.com/watch?v=QzMKDNS5S9Y
https://youtube.com/live/FjM2pj2g-MA
https://youtube.com/live/s65WosGaBLQ
https://youtube.com/live/R3fzEvfWPp0
https://youtube.com/live/2UmSSvL5MYU
https://youtube.com/live/jdILvxN5UOg
https://www.youtube.com/watch?v=F9u79b7hyYM&t=2793s
https://youtube.com/live/aErX45eX_ak
(http://cipam.gov.in/)

Sr. No.	Description	Signature
1	Name of Faculty Dr. Amol S. Todkar	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGEEC-ME4043 ENTREPRENEURSHIP/ECONOMICS/ MANAGEMENT COURSES (EEC)
STAT UP MANAGEMENT

Lectures	: 3 Hrs/Week	**Evaluation Scheme**		
Credit	: 2	ISE	:	40 Marks
		ESE	:	60 Marks

Course Objectives: The objective of the course is to

1 To introduce the students to the concept of Startups and Entrepreneurship..

2. To provide the knowledge of becoming an entrepreneur by identifying business opportunities and developing business plans

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Relate basic concepts of economics to Projects.	Knowledge Understand
CO2	Utilize the concepts of time value of money and equivalence in economic decision making	Understand
CO3	Analyze basic concepts of economics to Projects	Understand Analyze
CO4	Developing of the project's project economic investment viability and resolution of outstanding economic issues	Understand Apply
CO5	Identify appropriate method to evaluate an engineering project.	Apply Evaluate
CO6	Make use of replacement study considering inflation to make decisions	Apply

Description:

The subject aims to provide a detailed coverage of fundamental concepts and important issues associated with Start Up Management. It highlights on the essential skill set a successful entrepreneur should possess as well as the essential elements of an entrepreneurial ecosystem. The subject focuses on the discussion of important procedures to convert innovative ideas into result-oriented actions and emphasizes use of critical and innovative thinking to add value. It also discusses important aspects of scaling up process and application of risk management strategies to avoid failure.

Prerequisites:	1: Basic knowledge of Economics and Mathematics		
Unit 1	**Importance of Entrepreneurship**		
	Introduction: Meaning and importance of Entrepreneurship, Evolution of the term entrepreneurship, Factors influencing entrepreneurship, characteristics of entrepreneurship, types of entrepreneurship, objectives of entrepreneurship development, Startups- Definition, Types.	7 Hrs
Unit 2	**Types of business- Manufacturing – Services**		
	Types of business- Manufacturing – Services- Merchandise – Hybrid, Forms of Organisation Sole proprietorship- Partnership- Corporation- Limited Liability Company (LLC)- 19 Cooperatives, Choice of form of Organisations. Management and Society- Ecological environment, Ethics and Social responsibility.	6 Hrs
Unit 3	**Entrepreneurship Development Skills:**		
	Types of entrepreneurial skills - team work and leadership skill, analytical and problem solving skills, critical thinking skills, branding, marketing and networking skills. Role of entrepreneurship development programmes (EDP)	7 Hrs
Unit 4	**Entrepreneurship Development**		
	Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety, Management Information System.	7 Hrs
Unit 5	**Entrepreneurial opportunity and enterprise planning**		
	Sensing entrepreneurial opportunities, selecting the right opportunity, Site Selection, Feasibility Analysis.	7 Hrs
Unit 6	**Preparation of Business model/Plan:**		
	Business plan - concept, format, components of business plan. Significance of Business Plan, Making of a Business plan	6 Hrs

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	1	--	--	--	--	---	--	--	--	1	--	--	--
CO2	2	2	1	--	--	--	--	--	--	--	--	1	--	--	--
CO3	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO4	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--
CO5	2	2	1	--	--	--	--	--	--	--	--	1	--	--	--
CO6	2	1	1	--	--	--	--	--	--	--	--	1	--	--	--

References:

TextBooks	
1	Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning
2	Anjan Raichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International.

ReferenceBooks	
1	S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International
2	Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd.
3	Byrd Megginson, Small Business Management An Entrepreneur's Guidebook, 7th ed, McGrawHill
4	A Fayolle Entrepreneurship and new value creation, Cambridge, Cambridge University Press

Sr. No.	Description	Signature
1	Name of Faculty Prof S. S. Mahadik	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGOE1-ME4051 OPEN ELECTIVE (OE-1)
MACHINING PROCESSES (INCLUDING CNC)

Lectures : 3 hrs/ week

Credits : 3

Evaluation Scheme-

ESE : 60 marks

ISE : 40 marks

Course Objectives: The objective of this course is to

1) Understand turning and milling operations
2) Introduce basics of CNC lathe
3) Study the Components of CNC Vertical Machining Centre
4) Introduction to tool setting
5) Know selection of tools
6) Train students into Basic CNC Turning Programming

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Demonstration of Lathe machine and Milling Machine.	Knowledge
CO2	Explain applications and advantages of CNC machines and technology.	Understand
CO3	Demonstration of CNC and VMC with elements,power drives and spindle drives.	Apply
CO4	Prepare programs , demonstrate , simulate and operate CNC lathe machines for various machining operations.	Apply Analyze
CO5	Prepare programs , demonstrate , simulate and operate CNC milling machines for various machining operations.	Understand Apply
CO6	Demonstration of tooling and work holding devices.	Analyze

Description:

Today's manufacturing utilizes innovative technologies, including sophisticated Computer numerical control (CNC), Computer Aided Manufacturing (CAM) software and specialty industry materials to develop and build the products of tomorrow. Students will be walked through all aspects of CNC machining, how to import a CAD model in to CAM software, how to get it ready for machining and how to apply machining techniques to machine that part. At the end students will spend some time on the machine learning how to machine a part on a CNC milling machining center. This last step is critical to put together pieces of the puzzle, so that one can understand the whole process. Students will be applying machining techniques in the virtual world and then apply and see how a virtual object comes in to reality on a CNC machine.

Prerequisites:	1:	Workshop Technology

Prerequisites:	2:	Manufacturing Processes
	3:	Tool Engineering
	4:	Auto CAD

Section-I

Unit1	**Lathe and Milling Machine Basics:** a) **Lathe:** Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations. b) **Milling Machine:** Types- Horizontal, Vertical milling machines, Milling cutters, construction and working of column and knee type, milling operations, simple and compound indexing.	7 Hrs.
Unit2	**Introduction to CNC Machine Tools :**Conventional Vs. non-conventional machine tool, History & development of CNC technology, Classification of NC & CNC Machine Tools, CNC Machine Components, Co-ordinate systems, Working Principle of Various CNC Systems, Direct Numerical Control, Adaptive Control, Concept of ATC & APC, Advantages of CNC machine tools, Limitations of CNC , CNC Safety Practices	7 Hrs.
Unit3	**Drives and Control:** **Spindle drives** – DC shunt motor, 3 phase AC induction motor, **Feed drives** –Stepper motor, servo principle, DC and AC servomotors, **Control system-** Types of encoders, absolute and incremental optical encoders, synchro, synchro-resolver, gratings, moire fringe gratings, inductosyn, laser interferometer.	7 Hrs.

Section-II

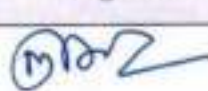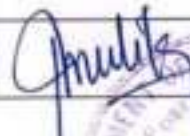|		
Unit4	**CNC Machining -Lathe:** Basics of CNC Programming, Plan and optimize programs for CNC turning operations, Implementation of 'G' codes & 'M' codes of Turning, Calculate parameters like speed, feed, depth of cut etc. and set a references for the various operations. Prepare operation and operation sequence for the lathe operations like turning, grooving etc. Modern CNC Systems.	7 Hrs.
Unit 5	**CNC Machining -Milling:** Basics of CNC Programming on Milling. Plan and optimize programs for CNC milling operation. Implementation of G codes & M codes of milling	5 Hrs.
Unit6	**Tooling and Work Holding Devices:** Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification, qualified, semi qualified and pre-set tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, modular fixtures, economics of CNC, maintenance of CNC machines.	7 Hrs.

Mapping of Pos & COs:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | If applicable | | |
													PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	3	2	1	-	-	2	-	-	-	-	-	-	2	-
CO3	3	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO4	2	2	3	1	-	-	2	-	-	-	-	-	-	3	-
CO5	2	2	2	1	-	-	2	-	-	-	-	-	-	3	-
CO6	1	3	2	1	-	-	1	-	-	-	-	-	-	2	-

References:

	Text Books
1	Rao, P.N. (2013). Manufacturing Technology: Metal Cutting and Machine Tools (Vol. 2). New Delhi: McGraw Hill Education. ISBN: 978-1259029561.
2	Hajra Choudhury, S.K., & Hajra Choudhury, A.K. (2009). Elements of Workshop Technology: Volume II (Machine Tools). New Delhi: Media Promoters & Publishers Pvt. Ltd. ISBN: 978-8174092328.
3	Pabla, B.S., & Adithan, M. (2008). CNC Machines. New Delhi: New Age International Publishers. ISBN: 978-8122427180.

	Reference Books
1	Ghosh, A., & Mallik, A.K. (2010). Manufacturing Science. New Delhi: East-West Press Pvt. Ltd. ISBN: 978-8185938795.
2	Kundra, T.K., Rao, P.N., & Tewari, N.K. (1987). Numerical Control and Computer-Aided Manufacturing. New Delhi: Tata McGraw-Hill. ISBN: 978-0070087477.

Web Links/Video Lectures:

1) https://archive.nptel.ac.in/courses/112/105/112105211/

2) https://youtu.be/_5r2XR1h1aQ?si=38jR_PmkbB8anYUf

Sr. No.	Description	Signature
1	Name of Faculty: M. V. Jadhav	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGOE1-ME4052 OPEN ELECTIVE (OE-1)
RENEWABLE ENERGY SYSTEMS

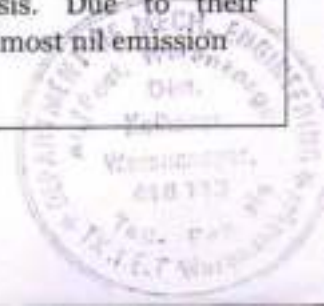Lectures: 3 hrs/week   **Evaluation Scheme**:
Credits: 3   ESE: 60Marks
       ISE: 40 Marks

Course Objectives: The objective of the course is to

1. To learn about renewable energy scenario, energy sources and understand the potential of various renewable energy sources and their utilization.

2. To understand society's present needs and future energy demands and also explore the future potential sources of energy.

3. To Study the principles of renewable energy conversion systems.

CourseOutcomes:

Cos	At the end of successful completion of the course, the student will be able to	BloomsTaxonomy
CO1	Understand the importance of renewable energy sources, their potential and utilization in the present world energy scenario along with their limitations and applications.	Knowledge Understand
CO2	Understand Solar radiation measurement, illustrate its conversion and analyze different solar collectors.	Understand Apply
CO3	Understand the principles of wind energy conversion and the factors influencing site selection.	Understand
CO4	Understand biomass conversion technologies and the process of biogas production and Identify factors affecting biogas generation and the types of biofuels.	Understand Analyze
CO5	Understand the principles of harnessing tidal energy and Ocean Thermal Energy	Understand
CO6	Understand energy conversion from hydrogen and application of fuel cell for electric vehicles	Understand

Description:

Renewable energy (RE) is the key element of sustainable, environmentally friendly, and cost-effective electricity generation. Nowadays, more sustainable energy technologies are required to replace conventional electricity generation resources such as fossil fuel, due to the worldwide demands especially in developed and developing countries. Fossil fuel-based energy sources are causing detrimental environmental issues such as global warming and climate change. The greenhouse gas emission into the atmosphere from power generation has increased exponentially in the past few decades.

Therefore, RE technologies such as solar, wind, hydro, biomass and hydrogen energies have been introduced to generate electricity to overcome current environmental crisis. Due to their environmentally friendly characteristics and ability to generate power with zero or almost nil emission

of air pollutants, RE is getting more and more attention, due to the increasing awareness of clean environment among the society. RE not only helps in sustainability but also has economic importance. It benefits the economy by reducing the cost of electricity generation, as it generates energy using natural, renewable resources.

Syllabus:

Section-I		
Introduction to Renewable energy		
Unit 1	Introduction to renewable energy sources and their potential, Global and Indian renewable energy scenario. Brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oilshale. Introduction to Internet of energy (IOE).	05 Hrs
Solar Energy		
Unit 2	**Introduction to Solar Radiation**, Estimation of solar radiation on horizontal and inclined , surfaces, Solar radiation Measurements-Pyrheliometers, Pyrometer, Sunshine Recorder, application of solar energy. **Solar Photovoltaic:** Solar PV system stand alone and grid connected, Photo cell materials, Maximum power point tracking system. **Solar energy collector:** Classification, evacuated tube collector, Concentrating collector and comparison between them.	08 Hrs
Wind Energy		
Unit 3	Wind Energy: Introduction, availability of wind energy in India, Wind parameters and wind data, principle of working, Site selection, Basic components of wind energy conversion system (WECS), Classification, working of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and Darrieus types.	07 Hrs
Section-II		
Biomass and Bio gas Energy		
Unit 4	Introduction to Biomass Energy, Biomass Resources, energy plantation, Biomass conversion technologies, bio gas production from organic wastes by anaerobic fermentation, factors affecting bio- gas generation, advantages, disadvantages and applications of Bio-gas. Bio fuels its types and applications., urban waste to energy conversion,	07Hrs
Tidal and Ocean Energy		
Unit 5	**Tidal Power:** Tides and waves as energy source and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. **Ocean Thermal Energy Conversion:** Principle of working, classification, working, OTEC power stations in the world, problems associated with OTEC.	07Hrs

	Fuel Cell and Hydrogen energy	
Unit 6	Fuel cell: Introduction, Principle of operation, classification, applications advantages and disadvantages. Introduction to fuel cell electric vehicles (FCEV'S). Hydrogen Energy: Properties of Hydrogen with respect to its utilization as a renewable form of energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.	06Hrs

Tutorial: Six Assignments/Seminar/quiz/group discussion /field survey & report presentation should be conducted based on above chapters.

Mapping of Pos & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Ifapplicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	--	--	--	3	--	--	--	--	3	--	3	--
CO2	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO3	3	3	3	--	--	--	3	--	--	--	--	3	--	2	--
CO4	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO5	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--
CO6	3	3	3	--	--	--	3	--	--	--	--	3	--	3	--

References:

Text Books	
1	Non conventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2	Energy Technology, S. Rao and Dr. B.B. Parulekar, Khanna Publication. Solarenergy, Subhas P Sukhatme, Tata McGraw-Hill,
Reference Books	
1	Principles of Energy conversion, A. W. Culp Jr., McGraw Hill
2	Non-Convention Energy Resources, Shobh Nath Singh, Pearson, 2018

Useful links/Web Links/ Video Lectures
Lecture

	Links
1	NPTEL Course on Physics of Renewable Energy Systems, IIT Kharagpur https://nptel.ac.in/courses/115105127
2.	SWAYAM Course Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems IIT Guwahati https://nptel.ac.in/courses/103103206
3	https://nptel.ac.in/courses/112103307
4	https://onlinecourses.nptel.ac.in/noc24_me137/preview
5	https://mnre.gov.in/
6	https://beeindia.gov.in/
7	https://www.nrel.gov

Sr. No.	Description	Signature
1	Name of Faculty: Prahlad Vithal Kamble	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGMDM2-ME406L MULTIDISCIPLINARY MINOR-2
MATERIALS AND APPLICATIONS

Lectures: 2 hrs / week

Credits: 2

Evaluation Scheme:

ISA: 50 marks

Course Objectives: The objective of the course is to

1) Understand the relationship between the structure of materials at atomic or molecular scales and their macroscopic properties.

2) Develop the ability to select appropriate materials for various engineering applications.

Course Outcomes:

Co's	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understanding Metals and Metallic Bonds, Crystal Structures and Imperfections	Understanding
CO2	Relate the composition of materials to their mechanical properties.	Apply
CO3	Describe the role of material specifications and standards in engineering design and manufacturing.	Apply
CO4	Explain Properties and applications of Smart Materials	Understanding
CO5	Explain Properties and applications of Magnetic Materials	Understanding
CO6	Discuss the various stages of techniques used in manufacturing ofPowder Metallurgy components.	Understand

Description:

This course introduces the fundamental concepts of materials science and engineering. Topics include the structure of materials, their properties, and how they can be manipulated and used in engineering applications.

Prerequisites:	1:	Basic Mechanical Engineering
	2:	Engineering Physics
	3:	Engineering Chemistry

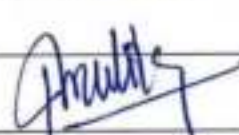| Section - I		
	Introduction to Metals and alloy systems	
Unit 1	Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals , Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. Solid solutions and intermediate phases, Phases and Gibbs phase rule Construction of equilibrium diagrams from cooling curves,	05Hrs
	Ferrous Alloys	
Unit 2	Fe-Fe3C Diagram, Plain carbon steels, Steel Specifications based on -IS, BS, SAE, AISI Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types. cast iron	05 Hrs
	Section - II	
	Introduction to Non Ferrous metals	
Unit 3	Alloys of Copper, Aluminum, other alloys of lead, zinc, Bearing alloys	03 Hrs
	Smart Materials	
Unit 4	Introduction to Smart Materials, Classification of Smart Materials, Properties of Smart Materials, Applications of Smart Materials	05 Hrs
	Magnetic Materials	
Unit 5	Introduction to Magnetic Materials, Classification of Magnetic Materials, Properties of Magnetic Materials, Applications of Magnetic Materials	05 Hrs
Unit 6	**Powder Metallurgy:**	
	Advantages, Limitations and Applications of Powder Metallurgy Powder manufacturing types- Mechanical, Physical, Chemical and Electro-Chemical Mixing/ Blending. Compaction- types- Conventional, Powder rolling andextrusion. Sintering- Types liquid stage and solid stage sintering	03 Hrs

Mapping of POs & COs:

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

References:

	Text Books
1	S.H. Avner, "Introduction to physical metallurgy", Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.
2	Vijendrasingh, "Physical metallurgy", Standard Publishers Delhi
3	Materials Science and – An Introduction by William D. Callister Jr. and David G.Rethwisch, Wiley, Tenth Edition, 2010.
4	V.D. Kodgire, "Material science and metallurgy for engineers", Everest Publishers Pune,12th Edition
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.

	Reference Books
1	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice-Hall of India (P) Ltd.
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	Foundations of Materials Science and Engineering by William F. Smith, Mc Graw Hill, Third Edition, 2004.
5	Elements of Materials Science and Engineering by H. Van Vlack, Addison – Wesley, Fifth Edition, 2006.
6	Introduction to Materials Science for Engineers by James F. Shackelford, Pearson,Eighth Edition, 2015.
7	Characterization of Materials by P. K. Mitra, PHI Learning, 2014.
8	Mechanical Metallurgy by George E. Dieter, Tata McGraw Hill, 3rd edition, 2013.

Sr. No.	Description	Signature
1	Name of Faculty Dr. M. R. Jadhav	MJadhav.
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGVSEC-ME407L C++ PROGRAMMING LAB

Practical's: 02 hrs/week

Credits: 1

Examination Scheme

ISA: 50 Marks

Course Objectives: The objective of the course is to

- To understand how C++ improves C with object-oriented features.
- After the students have successfully completed the course, they shall have sufficient knowledge of the basic computer operations and various programming techniques
- To develop and enhance the programming skills amongst the students in general as well as application of it in the field of Mechanical Engineering.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain the evolution of programming methodologies from procedural to object-oriented programming, identifying key features and advantages of Object-Oriented Programming (OOP).	Knowledge
CO2	Demonstrate understanding by categorizing different data types in C++, explaining their usage, and identifying appropriate scenarios for using arrays, multidimensional arrays, and strings.	Comprehension
CO3	Apply their knowledge by writing C++ functions to manipulate data, passing arguments by value and reference, and implementing functions with appropriate scope and visibility of variables.	Application
CO4	Analyze and compare the concepts of classes and structures in C++, evaluating when to use classes versus structures based on their design requirements.	Analysis
CO5	Synthesize their understanding by designing and implementing C++ classes that overload unary and binary operators, demonstrating creativity in enhancing class functionality.	Synthesis
CO6	Evaluate the advantages and potential pitfalls of multiple inheritance in C++, critically assessing scenarios where virtual functions and polymorphism provide solutions to common programming challenges.	Evaluation

Description:

In the modern age, computers play a pivotal role across all engineering sectors, necessitating a foundational understanding of essential programming languages like C++. C++ is widely recognized for its extensive applications, including games, GUI-based applications, database software, operating systems, web browsers, advanced computational tasks, graphics rendering, and banking applications. This course aims to introduce C++ to mechanical engineering students, equipping them with practical skills applicable across various domains.

Prerequisites:	1:	Fundamentals of computer programming.
	2:	Fundamentals of c programming and Object-oriented programming

Syllabus: -

Unit 1	Evolution of Programming Methodologies Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Selection control statements in C++.	04 Hrs
Unit 2	Data Types, Expression and Control Statements Iteration statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.	04 Hrs
Unit 3	Functions Passing Data to Functions, Scope and Visibility of variables in Functions	04 Hrs
Unit 4	Creating Classes and Abstraction Classes objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions. Structures in C++, Constructors and Destructors, Static variables and Functions in class.	06 Hrs
Unit 5	Operator Overloading Overloading Unary Operators, Overloading binary operators.	02 Hrs
Unit 6	Inheritance in C++ Types of Inheritance, Pointers, Objects and Pointers, Multiple Inheritances. Virtual Functions, Polymorphism, Abstract classes.	04 Hrs

Course Outcomes	Program Outcomes												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	-	2	-	-	-	-	3	-	2	2	-	-
CO2	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-
CO3	3	2	2	2	2	-	-	-	-	3	-	2	2	-	-
CO4	3	2	2	-	2	-	-	-	-	2	-	2	2	-	-
CO5	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-
CO6	3	3	2	-	2	-	-	-	-	2	-	2	2	-	-
AVG	3	2.6	2	2	2	-	-	-	-	2.3	-	2	2	-	-

Text Books:-

1. Object Oriented Programming, E. Balguruswami, Tata McGraw Hill Publication.

2. Let us C++ ,YashwantKanitkar , BPB Publication, New Delhi

3. C++ Programming, AlstevanswielyIndia,7th Edition.

4. Object oriented Programming with C++, SouravSahay, Oxford University Press.

5. Object-Oriented Programming in C++, Rajesh K Shukla, Wiley India

Reference Books:-

1. The C++ Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall

2. C++: The Complete Reference, Schildt H., Tata McGraw Hill.

Link of VLAB http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/index.php

Sr. No.	Description	Signature
1	Name of Faculty _Prof. S. M. Patil_	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGAEC-ME4081L MODERN INDIAN LANGUAGE

KANNADA

Lectures: 2 hrs / week
Credits: 2

Evaluation Scheme:
ISA: 25 Marks

Course objectives:

1. To create the awareness regarding the necessity of learning regional language

2. To enable learners to Listen and understand the Kannada language properly.

3. To speak, read and write Kannada language as per requirement.

4. To train the learners for correct and polite conservation.

Course outcomes:

At the end of the course the student will be able to:

1	To understand the necessity of learning of other regional language.
2	To speak, read and write Kannada language as per requirement.
3	To communicate in Kannada in their daily life with Kannada speakers.
4	To Listen and understand the Kannada language.

Description:

Kannada language has been offered under Ability Enhancement Courses for Engineering students with an objective of enabling them to learn and use other regional Indian languages. As the technical education is delivered in English, a gap has arisen between an Indian student and his regional language. To narrow this distance is another objective of this course. The Course syllabus has been divided into four Units, namely Introduction to Kannada Alphabets & Numerals, Basic Grammar of Kannada, Sentence formation in Kannada and Conversations.

ಇತರ ಪ್ರಾದೇಶಿಕ ಭಾರತೀಯ ಭಾಷೆಗಳನ್ನು ಕಲಿಯಲು ಮತ್ತು ಬಳಸಲು ಅನುವು ಮಾಡಿಕೊಡುವ ಉದ್ದೇಶದಿಂದ ಎಂಜಿನಿಯರಿಂಗ್ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸಾಮರ್ಥ್ಯ ವರ್ಧನೆಯ ಕೋರ್ಸೇಗಳ ಅಡಿಯಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ನೀಡಲಾಗುತ್ತದೆ. ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣವನ್ನು ಇಂಗ್ಲಿಷ್‌ನಲ್ಲಿ ನೀಡುವುದರಿಂದ ಭಾರತೀಯ ವಿದ್ಯಾರ್ಥಿ ಮತ್ತು ಅವನ ಪ್ರಾದೇಶಿಕ ಭಾಷೆಯ ನಡುವೆ ಅಂತರ ಉಂಟಾಗಿದೆ. ಈ ಅಂತರವನ್ನು ಕಡಿಮೆ ಮಾಡುವುದು ಈ ಕೋರ್ಸ್‌ನ ಮತ್ತೊಂದು ಉದ್ದೇಶವಾಗಿದೆ. ಕೋರ್ಸ್ ಪಠ್ಯಕ್ರಮವನ್ನು ನಾಲ್ಕು ಘಟಕಗಳಾಗಿ ವಿಂಗಡಿಸಲಾಗಿದೆ, ಅವುಗಳೆಂದರೆ ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ ಮತ್ತು ಅಂಕಿಗಳ ಪರಿಚಯ, ಕನ್ನಡದ ಮೂಲ ವ್ಯಾಕರಣ, ಕನ್ನಡದಲ್ಲಿ ವಾಕ್ಯ ರಚನೆ ಮತ್ತು ಸಂಭಾಷಣೆಗಳು.

Unit 1	Introduction to Kannada Alphabets (Varnamale) and Numerals	
	Kannada Alphabets, Kannada Numerals and Ordinals, Conjunctive letters, Writing Words. (Category-wise) Fruits, Colors, Vegetables, Vehicles, Relations, Things, Human Body parts, Natural things like Hill, River etc. Seasons, Grains, Cereals, Milk products, Groceries etc.	5 Hrs.
Unit 2	Fundamental Grammar	
	Nouns (Roodhanama, Ankitanaam, Anvarth naam), Pronouns (Nanu, Naavu, Neenu, Neevu, Avanu, Avalu, avaru, Adu, Idu), Forms of Verbs, Adjectives (gunavachak, sankhyavachak, bhaavavachak), Adverbs, Singular Plural, Genders.	5 Hrs.
Unit 3	Tenses	
	Simple Present, Simple Past and Simple Future tense. Formation of Sentences using Tenses.	5 Hrs.
Unit 4	Conversation	
	Activities like Self Introduction, Information, Story-telling, Newspaper reading etc.	5 Hrs.

TERMWORK:
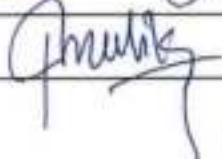
A. Written Assignments:

1. Translating Marathi words into Kannada.

2. Translating a Marathi/English paragraph into Kannada.

B. Activity based Assignments:

3. Quiz to recognize the images.

4. Discuss a day to day activity.

References:	
1.	Balake Kannada by Dr. L. Thimmesh
2.	Kannada Kali by Lingadevaru Halemane, Kannada University Press, Hampi
3.	Spoken Kannada by Kannada Sahitya Parishat, Bengaluru

Sr. No.	Description	Signature
1.	Name of Faculty: Dr. S.V. Lingaraju/ Prof. K. D. Joshi	
2.	Verified the Structure & Syllabus	
3.	Approved by Chairman Board of Studies	

23UGAEC-ME4082L MODERN INDIAN LANGUAGE
MARATHI

Lectures: 2 hrs / week
Credits: 2

Evaluation Scheme:
ISA: 25 Marks

उद्दिष्टे:

१. विद्यार्थ्यांच्यात मराठी भाषा आणि साहित्याविषयी जिज्ञासा निर्माण धारणे.

२. मराठी भाषेतील प्रतिभावंत साहित्यिकांच्या कृतींचा अभ्यास करणे.

३. मराठी साहित्याच्या वाचनाची आवड निर्माण करणे.

४. मराठी भाषेच्या प्रचार-प्रसारासाठी विविध उपक्रम राबवणे.

५. यांत्रिक अभियांत्रिकीतील संकल्पना मराठी भाषेतून विशद करणे.

विधेये:

अभ्यासक्रम यशस्वीरीत्या पूर्ण केल्यावर विद्यार्थी खालील विधेये साध्य करेल

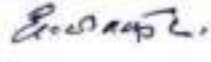|	
वि. १	मराठीतील विख्यात साहित्याचा आणि साहित्यिकांचा धांडोळा घेईल.
वि. २	अभ्यासक्रमाव्यतिरिक्त इतर साहित्यिकांच्या साहित्याचा आस्वाद घेईल.
वि. ३	विद्यार्थ्यांच्यात अवांतर वाचनाची गोडी लागेल.
वि. ४	सभाधीटपणा, नाट्य, संभाषण, वक्तृत्व अश्या विविध कला अवगत होतील.
वि. ५	यांत्रिक अभियांत्रिकीतील संकल्पना अधिक स्पष्ट होतील.

विवरण:

'मराठी भाषेतील विशेष साहित्यकृतींचा अभ्यास' या विषयाचा क्षमतावृद्धिंगत अभ्यासक्रमांतर्गत समावेश करणेत आलेला आहे. यांत्रिक अभियांत्रिकीतील संकल्पना मातृभाषेतून स्पष्ट केल्यास, विद्यार्थ्यांना त्या संकल्पना प्रभावीरीत्या समजण्यास मदत होते. अभियांत्रिकीच्या इंग्रजीतील शिक्षणामुळे विद्यार्थी आपल्या मातृभाषेपासून आणि पर्यायाने त्यातील साहित्या पासून दूर जाऊ शकतो. हा दुरावा कमी करणे, हा या विषयाचा मूळ उद्देश आहे. या विषयांतर्गत, मराठी भाषा :उत्पत्ती आणि विकास, विशेष साहित्य कृतींचा अभ्यास – गद्य, विशेष साहित्य कृतींचा अभ्यास -- पद्य, मराठी रंगभूमी – एक सांस्कृतिक वारसा आणि उपक्रम असे एकूण पाच घटक समाविष्ट करण्यात आलेले आहेत.

घटक १	मराठी भाषा : उत्पत्ती आणि विकास	
	प्राचीनकाल, मध्ययुग, मध्ययुगीनकाल, साहित्य आणि सांस्कृतिक विकास, मराठा साम्राज्यातील मराठी साहित्य, २० व्या शतकातील मराठी भाषेची उत्क्रान्ती, मराठी भाषेची सद्यस्थिती	०४ तास
घटक २	विशेष साहित्यकृतींचा अभ्यास - गद्य	
	मराठी साहित्यातील ख्यातनाम साहित्यिकांची ओळख आणि त्यांच्या साहित्यकृती– आचार्य प्र. कै. अत्रे, पु. ल. देशपांडे, रणजीत देसाई, विश्वास पाटील इत्यादी	०४ तास
घटक ३	विशेष साहित्य कृतींचा अभ्यास -पद्य	
	मराठी साहित्यातील ख्यातनाम कवी आणि कवयित्रींची ओळख व त्यांच्या पद्यकृती– बहिणाबाई चौधरी, मंगेश पाडगावकर, इंदिरा संत, बा. भ. बोरकर, सुरेश भट इत्यादी	०४ तास
घटक ४	मराठी रंगभूमी – एक सांस्कृतिक वारसा	
	मराठी रंगभूमीची ओळख, मराठी नाट्यप्रकार, विख्यात मराठी नाटककार – गोविंद बल्लाळ देवल, आचार्य प्र. के. अत्रे, पु. ल. देशपांडे, शंकरराव किर्लोस्कर इत्यादी	०४ तास
घटक ५	उपक्रम	
	वरील साहित्य कृतींचे सादरीकरण, हिप – हॉप शो, नाटिका, काव्यवाचन, कवितेचे रसग्रहण, अभिवाचन यांत्रिक अभियांत्रिकीतील एखाद्या संकल्पनेचे मराठी भाषेत अधिव्याख्यान, इत्यादी	०८ तास

संदर्भ ग्रंथसूची	
१	अमृतसिद्धी: १ व २, मंगला गोडबोले व स. ह. देशपांडे, मौज प्रकाशन गृह
२	व्यक्ती आणि वल्ली, पु. ल. देशपांडे मौज प्रकाशन गृह
३	मी कसा झालो?, प्र. के. अत्रे, परचुरे प्रकाशन
४	स्वामी, रणजीत देसाई, मेहता पब्लिशिंग हाउस
५	झाडाझडती, विश्वास पाटील, राजहंस प्रकाशन
६	बहिणाबाईंची गाणी, बहिणाबाई चौधरी, सुचित्रा प्रकाशन
७	बोलगाणी, मंगेश पाडगावकर, मौज प्रकाशन गृह
८	बोरकरांची समग्रकविता, खंड १ व २, बा. भ. बोरकर, देशमुख आणि कंपनी
९	मृद्गंध, इंदिरा संत, मेहता पब्लिशिंग हाउस
१०	रंग माझा वेगळा, सुरेश भट, मौज प्रकाशन गृह,

Sr. No.	Description	Signature
1	Name of Faculty *Dr. N.S. Dharashivkar*	*signature*
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	*signature & stamp*

आधुनिक भारतीय भाषा

ME-4083L- प्रयोजनमूलक हिंदी

अधिव्याख्याने   : २ घंटे प्रति सप्ताह
श्रेयांक   : २
ट्यूटोरियल   : लागू नही

मूल्यांकन पद्धति
सत्रांत परीक्षा: लागू नही
सत्र मूल्यांकन: २५ गुण

उद्देश्य:

1. हिंदी के व्यावहारिक पक्ष से परिचित कराना

2. वाणिज्यिक व्यवहार में हिंदी भाषा को प्रज्चलित कराना

3. हिंदी में कार्य करने की रुचि विकसित कराना

4. राष्ट्रभाषा के प्रति रूचि उत्पन्न कराना

5. कार्यालय और व्यवसाय में हिंदी प्रयोग का कौशल विकसित कराना.

परिणाम:

पाठ्यक्रम के सफल समापन पर छात्र निम्नलिखित उद्देश्यों को प्राप्त करेगा

१	हिंदी के व्यावहारिक और वाणिज्यिक पहलू से परिचित होगा.
२	अपने व्यावहारिक काम हिंदी में करने की क्षमता रखेगा
३	किसी भी अंग्रेजी लेख का प्रभावी हिंदी में अनुवाद कर सकेगा
४	राष्ट्रभाषा के प्रयोग को वरीयता दे पायेगा

विवरण:

"प्रयोजनमूलक हिंदी" इस विषय को क्षमता निर्माण पाठ्यक्रम के अंतर्गत शामिल किया गया है। मैकेनिकल इंजीनियरिंग

अवधारणाओं को राष्ट्रभाषा में समझाने से छात्रों को अवधारणाओं को प्रभावी ढंग से समझने में मदद मिलती है। अंग्रेजी में

इंजीनियरिंग शिक्षा एक छात्र को उसकी राष्ट्रभाषा से दूर ले जा सकती है। इस अंतर को पाटना ही इस विषय का मुख्य उद्देश्य

है। इस विषय के अंतर्गत, कार्यालयीन पत्राचार, अनुवाद, वृत्तांत लेखन और वाणिज्य पत्राचार इन इकाइयों को शामिल किया
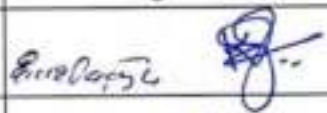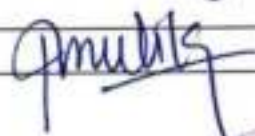
गया है।

इकाई निहाय पाठ्यक्रम

इकाई १	**कार्यालयीन पत्राचार**	
	नौकरी के लिए आवेदन पत्र, पदाधिकारियोंके नाम पत्र, छुट्टी के लिए प्रार्थना पत्र, परिपत्र	०४ तास
इकाई २	**अनुवाद**	
	अनुवाद की परिभाषा, अनुवाद का स्वरूप, अनुवाद की उपयोगिता, अनुवादक के गुण	०४ तास
इकाई ३	**वृत्तांत लेखन**	
	महाविद्यालयीन समारोह का वृत्तान्त लेखन, सामाजिक समारोह का वृत्तान्त लेखन, प्राकृतिक आपदाओंका वृत्तान्त लेखन, दुर्घटनाओंका वृत्तान्त लेखन	०४ तास
इकाई ४	**वाणिज्य पत्राचार**	
	पूछताछ के पत्र, क्रयादेश के पत्र, सन्दर्भ के पत्र, शिकायत के पत्र	०४ तास

संदर्भ ग्रंथसूची

१	हिंदी और उसका व्यवहार- डॉ. व्ही. के. मोरे, फडके प्रकाशन, कोल्हापूर.
२	अनुवादचिन्तन- डॉ. अर्जुन चव्हाण, अमन प्रकाशन, कानपुर.
३	प्रयोजनमूलक हिंदी व्याकरण एवं पत्रलेखन- डॉ. बापूराव देसाई, विनय प्रकाशन, कानपुर
४	रोजगारोन्मुख हिंदी- डॉ. गणेश ठाकुर, विजय प्रकाशन, कानपुर

Sr. No.	Description	Signature
1	**Name of Faculty** Dr. N. S. Dharashivkar, Prof. K. D. Joshi	
2	Verified the Structure and Syllabus	
3	Approved by Chairman, Board of Studies	

23UGVEC-ME409L -SUSTAINABLE ENGINEERING IN MECHANICAL SYSTEMS

Lectures	:	1 Hrs/Week	**Evaluation Scheme**		
Practical's	:	2 Hrs/Week	ISA	:	50 Marks
Credit	:	02			

Course Objectives: The objective of the course is to	
1	To understand the basics of sustainability and its importance in engineering.
2	To learn sustainable manufacturing and renewable energy practices in mechanical systems
3	To explore energy-efficient and environmentally friendly practices in mechanical engineering.

Course Outcomes:		
COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Define sustainability and its environmental, social, and economic aspects, and identify key global environmental challenges such as climate change, resource depletion, and pollution.	Remember
CO2	Explain the principles of sustainable manufacturing processes, such as additive manufacturing, lean manufacturing, and green machining, and summarize their benefits in reducing energy consumption and material waste.	Understand
CO3	Apply the methodology of Life Cycle Assessment (LCA) to demonstrate how to evaluate the environmental impact of mechanical engineering products	Apply
CO4	Explain the significance of renewable energy sources, such as solar, wind, and hydro, in mechanical systems, and discuss their importance in promoting sustainable energy solutions in mechanical engineering.	Understand
CO5	Discuss the principles of sustainable design in mechanical systems and outline the strategies for integrating renewable materials and energy-efficient tools.	Understand
CO6	List real-world applications of renewable energy systems in mechanical engineering and describe their implementation in energy-efficient system designs	Remember

Description:

This course explores sustainability in mechanical engineering, covering its environmental, social, and economic aspects. Topics include sustainable manufacturing, Life Cycle Assessment (LCA), renewable energy systems, energy-efficient design, and the use of sustainable materials. Real-world applications and case studies emphasize the role of sustainability in engineering practices.

Prerequisites:	1	Basic Principles of Mechanical Engineering
	2	Introduction to Environmental Science
	3	Fundamentals of Energy Systems

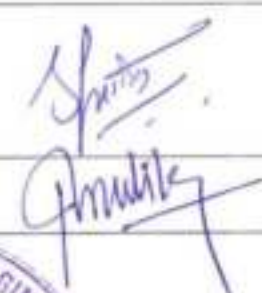|	**Introduction to Sustainability**	
Unit 1	Definition of sustainability: Environmental, Social, and Economic aspects, Global environmental challenges: Climate change, resource depletion, pollution, Importance of sustainability in engineering, Role of sustainability in modern technologies and industrial practices	3
	Sustainability in Mechanical Engineering	
Unit 2	Sustainable manufacturing processes, Explore various sustainable manufacturing processes, such as:Additive manufacturing (3D printing), Lean manufacturing&Green machining, Discuss their benefits in reducing energy consumption, material waste, and environmental impact	2
	Life Cycle Assessment (LCA) Overview	
Unit 3	Study the Life Cycle Assessment (LCA) methodology, its stages (from raw material extraction to disposal), and its application in evaluating the environmental impact of products.	2
	Renewable Energy in Mechanical Systems	
Unit 4	Introduction to renewable energy sources: Solar (Thermal and photovoltaic cell), Wind, Hydro, Mechanical applications of renewable energy systems, Importance of sustainable energy solutions in mechanical engineering	3
	Sustainable Design	
Unit 5	Key principles of sustainable design in mechanical systems, Energy-efficient design strategies, Use of renewable materials in mechanical design, Introduction of tools for sustainable design.	2
	Energy-Efficient Systems	
Unit 6	Renewable energy applications in mechanical engineering, Design and implementation of energy-efficient systems	2

Practical: -Six assignments/quizzes/presentations, etc. based on the above topics.

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3						3							1	
CO2	2	2					2							2	
CO3	2	2					2							1	
CO4	1	1					3							3	
CO5	1	1					1							1	
CO6	1						1							1	

References:

Text Books	
1	"Environmental Studies" K. R. Nambiar
2	"Renewable Energy Engineering" by G. D. Rai
3	"Toyota Production System" Ravi Phadke, Nilesh Kate
4	"Product design and Manufacturing" A.K.Chitale
Reference Books	
1	Sustainable Energy by Jeffersons W. Tester, Elisabeth M. Drake
2	Sustainable Design and Manufacturing" by A. J. A. Barron and B. D. Sheppard
3	Mechanical Engineering Design" by J. E. Shigley
Video Link	
1	https://youtu.be/VNgtajZVAKE?list=PL3MO67NH2XxL8WmVnN3j2wX8v5THwi0sw
2	https://youtu.be/CsqECIHQBCI?list=PLx3rZEiwFTIO_2_STJGSsq9Mya7kjQVCy
3	https://youtu.be/VNgtajZVAKE
4	https://youtu.be/mh51mAUexK4?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk

Sr. No.	Description	Signature
1	Name of the faculty: Prof. S.S. Patil	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME401L ANALYSIS OF MECHANICAL ELEMENTS LAB

		Evaluation Scheme:	
Practicals	: 2 hrs. /week	**ISA**	: 25 Marks
Credits	: 1		

Course Objectives: The objective of the course is to

1. apply the basic concepts related to tensile, compressive and shear stresses in engineering components and evaluate the stress- strain

2. Calculate force and bending moment in beams, deflection in beams, buckling in columns using fundamental equations.

3. Estimate distribution of bending stresses and shear stresses

Course Outcomes:

Cos	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Understand the concept of stresses and strains.	Understand
CO2	Draw shear force and bending moment diagram under different loading conditions.	Create
CO3	Determine torque, bending stresses, shear stresses and principle stresses in beams.	Evaluate
CO4	Evaluate deflection in beams and buckling load in column due to application of different loading.	Evaluate

Description:

Analysis of Mechanical Elements is a fundamental subject needed primarily for the students of Mechanical sciences. As the engineering design of different components, structures etc. used in practice are done using different kinds of materials, it is essential to understand the basic behavior of such materials. Analysis of Mechanical Elements, also known as mechanics of materials, is focused on analyzing stresses and deflections in materials under load.

Prerequisites:	1:	Knowledge of Basic Mechanical Engineering
	2:	Knowledge of applied mechanics

Practicals: For this course numerical based assignments are offered during practical hours.

Number	Tutorial Topic	Hrs.
1	Assignment on stresses and strains.	2
2	Assignment on principal stresses (both analytical and graphical).	2
3	Assignment on shear force diagram & bending moment diagram.	2
4	Assignment on bending stresses and shear stresses in beams.	2
5	Assignment on deflection of beams.	2
6	Assignment on torsion & Column	2

Mapping of POs & COs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	If applicable		
													PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 2	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 3	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 4	3	3	3	2	--	--	--	--	--	--	--	--	2	--	--

References:

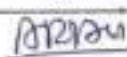|	Text Books
1	"Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3	"Strength of Materials", Khurmi Gupta, S. Chand Publication.
4	"Strength of Materials", R.K. Rajput, S. Chad Publication.
5	"Mechanics of structure", S.BJunnerkar,Charotar Publication House.
6	"Strength of Materials", S. S. Bhavikatti, Vikas Publication House.
7	"Strength of Materials", Timoshenko and Young, CBS Publication.
8	"Mechanics of Materials", S. S. Ratan, Tata McGraw Hill Publication, 2009.

Reference Books

1	"Strength of Materials", Beer and Johnson, CBS Publication.
2	"Strength of Materials", G.H. Rider, Mac Millan India Ltd.
3	"Strength of Materials", Nag and Chanda, Willey India Publication.
4	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
5	"Strength of Materials", Den Hartong, McGraw Hill Publication.
6	"Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi.

Web Links/ Video Lectures:

1. https://nptel.ac.in/courses/112/107/112107146/

2. https://nptel.ac.in/courses/112/106/112106141/

Sr. No.	Description	Signature
1	Name of Faculty Prof. A. R. Koli, Prof. V. N. Mane	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

Practicals	: 2 hrs/ week	**Examination Scheme**	
Credits	: 1	ISA	: 25 Marks
		POE	: 25Marks

Course Objectives: The objective of the course is to

The course aims to:

1. Provide the students with basic knowledge of mechanism and its application in mechanical engineering through the experiments and table top working models.

2. Know the significance of velocity and acceleration diagram in application of mechanism.

3. Introduce the role of power transmission device (belt drive) in mechanism.

4. Study the fundamental theory of friction and its analysis in different Mechanisms and machines.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the concept of machines, mechanisms and related terminologies.	Understand
CO2	Analyse the power transmitting elements used in different machines and select the appropriate machines and mechanisms as per requirement.	Analyze
CO3	Analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.	Analyze
CO4	Draw velocity and acceleration diagrams graphically and analytically.	Create

Description:

The effectiveness of mechanical machines depends upon mechanism used for transmission of motion in different components. Engineer can deal with these machines only if he has fundamental knowledge of mechanisms. Theory of Machine subject is introduced in syllabus to get the students acquainted with mechanism which is used in machine to transmit power from a source to its various parts as well as to transform motion from one form in to another form. It includes kinematics and kinetics of mechanism, design of cam and follower , theory of governor etc.

Prerequisites:	1:	Applied mechanics
	2:	Basic Mathematics
	3:	Basic Mechanical Engineering

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)	2	Understand
2	One A3 size sheet of Velocity problems by relative velocity method. (Minimum 4 problems)	2	Analyze & Create
3	One A3 size sheet of Acceleration problems (including Coriollis component) by relative acceleration method. (Minimum 4 problems)	2	Analyze & Create
4	One A3 size sheet of Velocity problems by Klien's construction and Instantaneous center method. (Minimum 4 problems)	2	Analyze & Create
5	Verification of ratio of angular velocities of shafts connected by Hooks joint.	2	Analyze
6	One A3 size sheet of Problems on cam profile. (Minimum 4 problems)	2	Analyze & Create
7	Experiment on Governor characteristics for Porter governor.	2	Analyze
8	Experiment on belt drives	2	Understand
9	Experiment on Cam Profile	2	Understand
10	Experiment on Dynamometer	2	Understand

Mapping of POs & COs:

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

References:

	TextBooks
1	"Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
2	"Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition.
3	"Theory of Machines", V.P. Singh, DhanpatRai and Sons.
	ReferenceBooks
1	"Theory of Machines and Mechanism", Shigley, McGraw Hill, New York
2	"Theory of Machines", Abdullah Shariff, McGraw Hill, New Delhi.
3	"Theory of Machines", Thomas Bevan, CBS Publisher

Video Link:

1. https://archive.nptel.ac.in/courses/112/106/112106270/#.
2. https://nptel.ac.in/courses/112105268

Sr. No.	Description	Signature
1	Name of Faculty Dr. Lingaraju.S.V , Prof A-M.Patil	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UGPCC-ME410LP MANUFACTURING PROCESSES LAB

Practicals: 2 hrs./week
Credits: 1

Course Objectives: The objective of the course is to
1. Acquire skills in the basic sand casting process.
2. Understand the pattern making process.
3. Perform Sand Testing.
4. Study Lathe Machine, Drilling Machine, Milling Machine.
5. Study and perform the various machining operations.

CourseOutcomes:

COs	At the end of successful completion of the course, the student will be able to:	Bloom's Taxonomy
CO1	Describe the importance of casting processes in manufacturing.	Understand
CO2	Design and develop the pattern.	Apply Create
CO3	Evaluate the properties of molding sand.	Apply
CO4	Demonstrate the components and accessories of various Machine tools.	Understand
CO5	Perform various machining operations to prepare Job using plain turning, facing, taper turning, threading, knurling, grooving, Centre drilling.	Apply Create

Description:

Most mechanical manufacturing industries are dealing with casting processes. Students should have hands-on experience related to this technology to make them skilled with the industrial environment. To emphasize this objective, a manufacturing lab is introduced to the mechanical engineering course which contains basic knowledge of casting process, sand testing and machine tools and operations.

Prerequisites:	1:	Basic Mechanical Engineering, Machine Drawing Interpretation, Use of workshop equipment, Safety measures.

Sr. No	Practical/Experiment/TutorialTopic	Hrs.	Bloom's Taxonomy
1	Study of Patterns–Types, Materials used, Pattern Allowances and preparation of pattern for solid casting.	4hrs	Knowledge Apply Create
2	**Testing of Greensand** To find Size and Grain fineness number of molding sand. To calculate Hardness (mold/core) and Green Compressive strength of molding sand To find Permeability, Moisture percentage and Clay content of given sand.	4hrs	Knowledge Apply

3	Demonstration of Lathe machine to understand constructional details, various mechanisms, accessories and attachments.	2hrs	Knowledge Understand
4	Reading the component Drawing, selecting and preparing operation sequence. Manufacturing of component on lathe Machine.This Job consists of operations such as turning, facing, grooving, Taper turning, Threading, Knurling, center drilling.	12hrs	Apply Create
5	Visit to a Foundry to study patterns and different types of Machine tools.	2hrs	Knowledge

Mapping of Pos & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	3	3	--	2	--	--	--	--	--	--	--	--	--	3
CO3	2	3	1	3	2	--	--	--	--	--	--	--	--	--	2
CO4	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	3	3	3	2	2	--	--	--	--	--	--	--	--	--	3

Text Books	
1	Manufacturing Technology - Foundry, Forming and Welding, Vol. I, P. N. Rao, Tata McGraw-Hill, New Delhi, 3rd edition, 2009.
2	A Textbook of Production Technology (Manufacturing Processes) P.C.Sharma,S. Chandand Company Pvt. Ltd, New Delhi. 7th Edition, 2010.
3	Production technology, R.K.Jain, Khanna Publishers,Delhi,15th Edition,2000.
4	P. L. Jain, Principles Of Foundry Technology-II, Tata McGraw-Hill, NewDelhi, 2nd Edition,2006
5	Elements of Workshop Technology vol. III,S.K.Hajra-Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt.Ltd,New Delhi,13th Edition,2012

Reference Books	
1	Principles of metal casting, Haine and Rosenthal, Tata McGraw-Hill Book, New Delhi.
2	Workshop TechnologyVol. 1, W. A. J. Chapman , CBS Publishing and Distributors, New Delhi
3	O.P.Khanna, Foundry technology, Khanna Publishers, NewDelhi
4	"Production Technology",P.C.Sharma, S.Chand Publication, 11thEdition.

Sr. No.	Description	Signature
1	Name of Faculty: Prof.S.M.Gidaveer	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

23UG-ME411A AUDIT COURSE (ENVIRONMENT STUDIES)

Lectures: 2 hrs / week

Credit Point : 2

Examination Scheme

ISA   : 50 Marks

Course Objectives: The objective of the course is
The syllabus of Environment ethics and sustainability provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. The students of Engineering undergoing this course would develop a better understanding of human relationships, perceptions and policies towards the environment and focus on design and technology for improving environmental quality. Their exposure to subjects like understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management and the effects of global climate change, shall help the students to bring a systems approach to the analysis of environmental problems.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to:	Bloom's Taxonomy
CO1	**Acquire** knowledge of fundamental environmental concepts including ecological concepts.	Understand
CO2	**Identify** the environmental problems such as various pollutions, waste disposal and their solutions.	Understand
CO3	**Recognize** the ethical responsibility of engineers towards environmental stewardship. .	Apply
CO4	**Realize** various environmental changes like global warming, etc and its impact on society.	Apply

Description:

The Study of Environment is playing important and crucial role for sustainable development of society, particularly to address industrial pollution, living standards and climate change issues. This course covers essential theory of environment processes and infrastructure for the supply of water, the disposal of waste, and the control of pollution of all kinds.

Prerequisites:	1	Understanding of Basic sciences
	2	Understanding of environmental sciences.

Sr. No	Lecture/Practical/Experiment/Tutorial Topic	Hrs.
1	**Ecology:** Ecosystem, Ecological Pyramids, Food chain, food web, Ecological succession. **Natural Resources and Associated Problems**: Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources Role of individuals in conservation of natural resources.	4 Hrs
2	**Pollution** **Water pollution**: causes, effects, control, drinking water quality standards, Arsenic, lead, cadmium, chromium, fluoride contamination & its effects, water treatment, wastewater treatment. **Air pollution**: Causes, effects, control, Air pollution controlling equipments, Air quality standards, National air quality index, vehicular emission, alternative fuels, indoor air pollution, Thermal inversions, Photochemical Smog and Acid Precipitation **Noise pollution**: Causes, effects, control, noise standards recommended by CPCB, **Environmental Protection Act:** Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act and International and National efforts for Environmental Protection.	10 Hrs
3	**Waste management:** Solid waste management, biomedical waste management, E waste, plastic waste management, Hazardous waste management, carbon footprint, Recycling of waste, Role of Central Pollution Control Board (CPCB),State Pollution Control Board, Role of NGO's	4 Hrs
4	**Social Issues and Environment:** Global Warming, Ozone layer depletion, urban problems related to energy, Alternative energy sources, Evolution of Sustainable development: timeline, Evolution of green movements in India, **Disaster management**: Flood, Earthquakes, Cyclones, Landslides, Draught, Tsunami etc., Swachh Bharat Mission, Role of Information technology in Environment and human health.	6 Hrs
5	**Project Work:** Visit to Local Polluted site – Urban/Rural/Industrial/Agricultural Or Study of simple Ecosystems –Ponds, River, Hill slopes Or Preparation of small models or device to resolve the environment problem/issue **Project work shall be based on study / observation / analysis made on environmental issues and report should be submitted in hard copy.**	---

Mapping of POs & COs:

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

References:

Text Books	
1	Agarwal K.C. ,2001 "Environmental Biology", Nidi publication ltd., Bikaner
2	D.K.Asthana, Meera Asthana, A Textbook of Environmental Studies, S. Chand Publication Revised edition, 2006.
3	S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co ltd., Delhi, Second revised edition, 2009.

Reference Books	
1	Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter- relationships Wm C Brown Publishers 1989
2	Francois Ramade Ecology of Natural resources, John wiley & Sons, 2009
3	Robert Leo Smith, Ecology and field biology, Harper Collins Publishers, 1998
4	Gilbert M. Masters, Introduction to Environmental Engineering & Science, Prentice Hall International Inc. Second Edition

Sr. No.	Description	Signature
1	Name of Faculty R.G. Kshirsagar	
2	Syllabus Structure and Content of Course Verified	
3	Approval of Board of Studies Chairman	

Member Secretary
Board of Studies

Chairman
Board of Studies
Chairman
Board of Studies
MECHANICAL ENGG. DEPT.
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Academic Dean
T.K.I.E.T., Warananagar
Dean, Academic
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Seal of Institute