MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programmes

BACHELOR of ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

SCHEME and SYLLABUS

(2025-26 Admitted Batch)

III AND IV SEMESTERS (SECOND YEAR)

Academic Year 2026-27

Vision of the institute

To be an institute of excellence in engineering education and research, Producing socially responsible professionals.

Mission of the institute

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional endeavors

Vision of The Department:

To emerge as department of high repute in Mechanical Engineering and allied fields through effective teaching, learning process and research activities, operating with a sense of professional and social responsibility.

Mission of The Department:

1. Empower students to scale high in their professional career through up skilling.
2. Effective association with higher institutes of learning, industry and research laboratories with emphasis on multi-disciplinary approach.
3. Encourage students to participate in sustainable projects.
4. Inculcate professional and ethical norms in all activities.

Program Educational Objectives:

PEO 1: Graduates will be able to apply engineering principles to develop products, processes or knowledge to solve mechanical and associated engineering problems for successful careers in mechanical engineering/higher education/research.

PEO 2: Graduates will acquire leadership qualities with strong communication skills along with professional and ethical values.

PEO 3: Graduates will be able to become entrepreneur / innovators to design and develop manufacturing systems and services to address social, technical and business challenges.

PROGRAM OUTCOMES (POs)

1. Engineering knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

3. **Design/Development of solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

4. **Conduct investigations of complex problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

5. **Engineering tool usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

6. **The engineer and the world**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

7. Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

8. **Individual and collaborative team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary settings.

9. **Communication**: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

10. **Project management and finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. **Life-long learning**: Recognize the need for, and have the preparation and ability for
i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES [PSOs]

PSO1:	Apply the knowledge of design engineering skills to manufacture an engineering mechanical system.
PSO2:	Model, simulate, analyze and optimize mechanical systems / processes through application of software.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE - 1 (To be conducted for 50 marks and reduced to 15 marks)	15
CIE – 2 (To be conducted for 50 marks and reduced to 15 marks)	15
Activities as decided by course faculty	20
SEE	50
Total	100

Scheme of Evaluation (Laboratory Courses)

Evaluation Type	**Marks**
Continuous internal Evaluation (CIE) in every lab session by the Course coordinator and Record writing (Rubrics to framed and evaluation to be made as per rubrics)	30
Laboratory CIE conducted by the Course Coordinator	20
SEE	**50**
Total	**100**

Examination	**Maximum Marks**	**Minimum marks to qualify**
CIE	**50**	**20**
SEE	**50**	**20**

MALNAD COLLEGE OF ENGINEERING, HASSAN
B.E. in Mechanical Engineering
2025 -26 Admitted Batch
(Effective from the academic year 2026-27)

III Semester B.E. Mechanical Engineering

Sl. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (Hours per Semester)						Examination Marks		
				Theory Lecture	Tutorial	Practical/Drawing	TW &SL	Total	Credits	CIE Marks	SEE Marks	Total Marks
				L	T	P	S	T	C			
1.	PCC	25ME301	Applied Statistics for Mechanical Engineering	28	28	0	48	90	3	50	50	100
2.	IPCC	25ME302	Material Science and Metallurgy	28	00	28	34	90	3	50	50	100
3.	PCC	25ME303	Basic Thermodynamics	42	00	0	48	90	3	50	50	100
4.	PCC	25ME304	Mechanics of Materials	42	00	0	48	90	3	50	50	100
5.	IPCC	25ME305	Manufacturing Technology –I	28	00	28	34	90	3	50	50	100
6.	PCCL	25ME306	Computer Aided Machine Drawing	28	00	28	34	90	3	50	50	100
7.	AEC	25ME307X	Ability Enhancement Course Lab	00	00	28	02	30	1	50	50	100
8.	SDC	25CP308	Community Project (Project Based Learning / Societal Project)	00	00	28	02	30	1	50	50	100
9.	AEC	-	Placement Training I	00	00	28	02	30	A	50	50	100
10.	NCMC	25NYP1	NSS / Yoga / PE	00	00	28	00	00	A	100	-	100
Total								**630**	**20**	**550**	**450**	**1000**

Ability Enhancement Course(Laboratory)			
25ME307A	Advanced Python Programming	25ME307B	Spreadsheet for Engineers

Course Title	Industrial Statistics		
Course Code	25ME301	LTPC	28-28-00-3
Exam	03 Hours	Hours / Week	3
SEE	50 Marks	Total hours	28L+28T+34ABL=90

Course Objective: To introduce the students to probability and statistics for Mechanical Engineering through an understanding of the descriptive statistics and probability to analyze distributions and relationship of real-time data.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)}**

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	apply statistical methods in analyzing, interpreting experimental data and find an appropriate distribution for analyzing data specific to an experiment.	1,2,3,5,8,9	-
2.	apply estimation and testing methods to make inference and modeling techniques for decision making.	1,2,3,5,8,9	-
3.	make appropriate decisions using statistical inference that is the central to experimental research.	1,2,3, 5,8,9	-
4.	use statistical methodology and tools in reliability engineering problems and time series analysis	1,2,3, 5,8,9	-

Course contents:

Module -1	10 Hrs.
Statistical Techniques: Statistics and data analysis; Measures of central tendency; Measure of Dispersion, Moments-Skewness-Kurtosis (Concepts only). Correlation and Regression - Rank Correlation; Curve Fitting of straight lines and second-degree parabola; Regression lines of y on x and x on y.	
Module- 2	**10 Hrs.**
Probability Distributions: Probability spaces, conditional probability, independent events, and Bayes' theorem, Binomial distribution; Poisson distributions; Normal distribution; Exponential distribution. **Introduction to Hypothesis Testing:** Testing of hypothesis: Null and Alternative hypothesis - Type I and Type II errors, Critical region - confidence interval - Level of significance, One tailed and Two tailed test. Large sample Tests: Test of significance - Large sample test for single mean, difference of means, single proportion, and difference of proportions.	
Module- 3	**12 Hrs.**
Small sample tests- Student's t-test, F-test- chi-square test- goodness of fit - independence of attributes. **Design of Experiments** - Analysis of variance - One Way-Two Way classifications.	
Module- 4	**10 Hrs.**
Reliability: Basic concepts- Hazard function-Reliabilities of series and parallel systems- System. Reliability - Maintainability-Preventive and repair maintenance- Availability. **Time Series Analysis**: Characteristics and Representation, Moving Averages, Exponential smoothening, Auto Regressive Processes.	
Text Book: 1. R. E. Walpole, R. H. Myers, S. L. Mayers, K. Ye, Probability and Statistics for engineers and scientists, 2012, 9th Edition, Pearson Education.	

Reference Books:

1. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 2016, 6th Edition, John Wiley & Sons.
2. E. Balagurusamy, Reliability Engineering, 2017, Tata McGraw Hill, Tenth reprint.
3. J. L. Devore, Probability and Statistics, 2012, 8th Edition, Brooks/Cole, Cengage Learning.
4. R. A. Johnson, Miller Freund's, Probability and Statistics for Engineers, 2011, 8th edition, Prentice Hall India.
5. Bilal M. Ayyub, Richard H. Mccuen, Probability, Statistics and Reliability for Engineers and Scientists, 2011, 3rd edition, CRC press.

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity1- Industrial Visit-Solve numerical problems using R-Program and Mini tab Software and present the report -10Marks 2) Details of activity2 – Case study on ANOVA and Reliability and present the report -10Marks	20
Total		**50**

Activities Mapped to Modules:

Module	Activity Description	Hours
1	Solve numerical problems on statistics and probability using Excel or R-Program	07
2	Solve numerical problems on one way and two-way ANOVA classification using Excel or R-Program or Minitab software.	07
3	Solve numerical problems on hypothesis testing using Excel or R-Program	07
4	Case study on reliability and time series models	07
	Total	**28hrs.**

Evaluation of Learning Process

Type of Evaluation	Hours
Test (1& 2) 3	3
Semester End Exam 3	3
Total	6

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**3**	**1**		**3**			**2**	**2**				
CO2	**2**	**3**	**2**		**3**			**2**	**2**				
CO3	**2**	**3**	**2**		**3**			**2**	**2**				
CO4	**2**	**3**	**1**		**3**			**2**	**2**				

Course Title	MATERIAL SCIENCE & ENGINEERING (LAB INTEGRATED)		
Course Code	25ME302	LTPC	28-0-28-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28P+34ABL=90

Course Objective: To introduce the students to Science and Engineering of Materials through an understanding of the relationship between Structure, Processing and Properties exhibited.
Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)}**

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to Pos	Mapping to PSOs
1.	Comprehend material behavior and its implications on the mechanical properties and performance of materials with a focus on crystal structure, imperfections, and diffusion.	1, 2	-
2.	interpret alloy systems, Iron-Carbon alloy system & isothermal transformation curves and to recommend suitable heat treatments for various steel types.	1, 2,3	-
3.	identify the composite materials and their production processes for various engineering application.	1	-

`

Course contents:

Module -1	07 Hrs.
Crystal Structure: Crystal imperfections – point, line, surface and volume imperfections. Electron defect, atomic diffusion: Phenomenon, Fick's laws of diffusion, factors affecting diffusion. **Deformation of Materials**: Plastic deformation in metals, Types of fracture brittle and ductile fracture, Creep stages of creep, Stress Strain diagram for ferrous and non-ferrous alloys. Fatigue, Types of fatigue loading with example, Mechanism of fatigue, fatigue properties, Fatigue testing and SN diagram.	
Module- 2	**07 Hrs.**
Solidification: Solubility and Solid Solutions, Conditions for unlimited solubility (Hume-Rothery rules), Gibb's phase rule, Construction of Equilibrium diagrams, Binary Equilibrium diagrams – Isomorphous, Eutectic and Partial Eutectic Systems, Development of Microstructures, Lever rule, Numerical examples, Iron – Carbon System: Equilibrium diagram.	
Module- 3	**07 Hrs.**
Heat Treatment of Metals: TTT diagram, Purpose of Heat Treatment, Classification of Heat treatment processes based on body or surface treatments, Study of Heat treatment Processes: Annealing, Normalizing, Hardening and Tempering. Surface Hardening methods like Carburizing, Cyaniding, Nitriding, Induction and flame hardening. Applications in mechanical engineering parts.	
Module- 4	**07 Hrs.**
Composite Materials: Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Numerical problems on determining properties of composites.	
Self-study component **Evaluated through Activities for 10 Marks** a) Introduction to Crystal Structure –Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures	

b) Properties, composition and uses of low, medium and high carbon steels, AISI – SAE and BIS Steel designations, Cast irons - Grey, White, malleable cast irons. Al, Mg, Copper & Titanium alloys. Composites – FRP & MMC
c) Heat treatment of nonferrous alloys

Text Books

1. Physical Metallurgy- Principles and Practice, V. Raghavan, PHI, 3rd Edition 2016, ISBN: IBN-978-81-203-5170-7.
2. Material Science and Engineering- An Introduction William D. Callister Jr. Wiley India Pvt. Ltd. 7th Edition, 2007, ISBN-13: 978-0-471-73696-7.

REFERENCE BOOKS:

1. Essentials of Material Science & Engineering, Donald Askeland&PradeepP.Phule, Thomson learning, Cengage Learning 6th Edition 2012 ISBN: 9788131516416
2. Principles of Material Science and Engineering, William F. Smith, McGraw–Hill International 3rd Edition 19960071147179, 9780071147170.
3. Material Science & Metallurgy for Engineers, 44th Edition, Dr. V.D.Kodgire&Sushil V Kodgire, Everest publishing house ISBN: 8186314008 (ISBN13: 9788186314005)

Exp NO.	EXPERIMENT NAME	Marks	COs	Pos	Level
1.	Determine Tensile strength of Ferrous & Non -Ferrous materials	**20**	**1**	1,4,8,9	**3**
2.	Determine Compressive strength of Ferrous & Non -Ferrous materials.	**20**	**1**	1,4,8,9	**3**
3.	Determine Bending strength of Ferrous & Non -Ferrous materials.	**20**	**1**	1,4,8,9	**3**
4.	Determine impact strength of Ferrous & Non -Ferrous materials.	**20**	**1**	1,4,8,9	**3**
5.	Determine hardness of Ferrous & Non -Ferrous materials.	**20**	**1**	1,4,8,9	**3**
6.	Grain size calculation for a given Microstructure	**20**	**2**	1,4,8,9	**3**
7.	Heat treating a given material and evaluation of mechanical properties.	**20**	**2**	1,4,8,9	**3**
8.	Determine Compressive strength of heat treated Ferrous & Non -Ferrous materials.	**20**	**1&2**	1,4,8,9	**3**
9.	Determine impact strength of heat treated Ferrous & Non -Ferrous materials.	**20**	**1 & 2**	1,4,8,9	**3**
10.	Determine hardness of heat treated Ferrous & Non -Ferrous materials.	**20**	**1 & 2**	1,4,8,9	**3**
	Average of 10 Experiments = 20 marks	**08 Hrs.**			

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	2	14	28
2	Practical	2	14	28
2	Student Study Hours – Self Learning	1	14	14
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	13
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 20 marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Lab	**Lab Component** Determine Tensile strength, Compressive strength, Bending strength, impact strength and hardness of Ferrous & Non -Ferrous materials	10
Lab CIE	Conduction of Lab CIE	05
ABL 2	Grain size calculation for a given Microstructure	05
Total		**50**

Evaluation of Learning Process (7 Hours)

ABL: Grain size calculation for a given Microstructure (13Hrs)		
Individual	Selecting Microscopic images from the published articles and have to mention basic details of materials methodology used	3
	Write-up of ASTM standard used	3
	Measure grain boundaries	3
	Compare with ASTM Std	3
	Results with conclusion	1
	Total	13

Type of Evaluation	Hours
Test (1, 2 and 3)	3
Lab CIE	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3			1				2	2				
CO2	3	2	1					2	2				
CO3	3							2	2				

Course Title	BASIC THERMODYNAMICS		
Course Code	25ME303	LTPC	28-28-0-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28T+34ABL=90

Course Objective:To equip the students with fundamental knowledge of basic principles, laws of thermodynamics, concept of energy and principles of entropy.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

COs	Statement	Pos	PSOs
1	describe basic concepts of thermodynamics and distinguish between work and heat.	1, 2,8,9	-
2	Assess thermodynamic applications using the first/second law of thermodynamics.	1, 2,8,9	-
3	apply the concepts of reversibility and entropy for analyzing thermodynamic systems.	1, 2,8,9	-
4	explain the importance of phase changes in pure substances, thermodynamic relations for ideal gases and real gases.	1, 2,8,9	-

COURSE CONTENTS:

Module –I	10 Hrs.
Fundamental Concepts & Definitions: Introduction, Microscopic and Macroscopic approaches. Thermodynamic system and the control volume, thermodynamic properties- intensive, extensive & specific properties, thermodynamic processes and cycles, thermodynamic equilibrium-definition, mechanical equilibrium, thermal equilibrium & chemical equilibrium, Zeroth law of thermodynamics, temperature measurement Concepts. **Work and Heat:** Mechanics definition of work and its limitations. Thermodynamic work, different forms of work, displacement work, expression for displacement work done in different processes through P-V diagrams. Heat-definition, comparison of work and heat, sign convention. Simple numerical Problems.	
Module –II	**10 Hrs.**
The First law of thermodynamics: Joule's experiment, equivalence of heat and work, statement of the first law, application of first law to non - cyclic processes. Energy- different forms of stored energy, energy as a property. First law as a rate equation. First law for a control volume, steady flow energy equation (SFEE), steady flow devices, PMMK-I. Limitations of first law of Thermodynamics. **The Second law of Thermodynamics:** Heat engine, source and sink, efficiency, heat pump and refrigerator, coefficient of performance. Statement of the second law, Kelvin –Planck and Clausius statements and their equivalence, PMMK–II. Carnot cycle, Carnot principles. Simple numerical Problems.	
Module –III	**12 Hrs.**
Reversibility : Reversible and irreversible processes, factors that make a process irreversible. Reversible heat engine, importance and superiority of a reversible heat engine. Carnot engine, internal and external reversibility, thermodynamic temperature scale. Clausius theorem, Inequality of Clausius. **Entropy**- definition, a property, change of entropy, entropy as a criterion of reversibility, principle	

of increase in entropy, calculation of entropy using Tds relations, entropy as a coordinate. Simple numerical Problems.

Module –IV	10 Hrs.

Pure substance : Definition, P-V and P-T diagram for a pure substance, two-property rule, triple and critical points, states of pure substance , P-V-T surfaces, T-s diagram and h-s diagram for a pure substance, quality or dryness fraction, steam tables, Mollier chart, Simple numerical Problems on calculation of steam properties.

Ideal & Real gases : Introduction, the equation of state for perfect gas, p-V-T surface of an ideal gas, internal energy and enthalpy of a perfect gas, specific heat capacities of an ideal gas, real gases, Vander Waal's equation, Virial equation of state, Beattie-Bridgeman equation, reduced properties, Law of corresponding states, compressibility chart.

Self- Study:

1. Compare and differentiate various forms of energy.
2. Apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components
3. Study how various heat engines work and prepare a report.
4. Construct thermodynamic temperature scale and write its significance.
5. Draw PVT surface for any two pure substances other than water and Carbon Dioxide and draw T-s diagram and h-s diagram.
6. Study how dryness fraction of steam is determined using throttling calorimeter, separating and throttling calorimeter.

Demonstrate with examples entropy is a measure of degradation of energy

Tutorials:

1.	Numerical problems on Temperature measurement
2.	Numerical problems on Temperature measurement
3.	Numerical problems on work and heat
4.	Numerical problems on work and heat
5.	Numerical problems on First law of thermodynamics
6.	Numerical problems on steady flow energy equation
7.	Numerical problems on Reversibility
8.	Numerical problems on Reversibility
9.	Numerical problems on Entropy
10.	Numerical problems on Entropy
11.	Numerical problems on **Pure substance**
12.	Numerical problems on Pure substance
13.	Numerical problems on Ideal & Real gases
14.	Numerical problems on Ideal & Real gases

TEXT BOOKS:

1. Yunus A Cengal& Michel A Boles, Thermodynamics – An Engineering Approach, TMH, 2011, ISBN: 007352932X, 9780073529325.
2. P.K. Nag, Basic and Applied Thermodynamics, TMH, 2010, 2nd Edition. ISBN-9780070151314

DATA HAND BOOK:

1. B. T. Nijaguna and B. S. Samaga, Thermodynamic Data Hand Book, Sudha Publications

REFERENCE BOOKS:

1. G.J. Van Wylen and Richard E.Sonntag, Fundamentals of classical thermodynamics, John Wiley and sons 2002. ISBN: 9780471829331
2. Spalding & Cole, Engineering Thermodynamics, Arnold 1973, 3rd Edition.
3. R. K. Rajput, Thermal Engineering, Laxmi Publications, New Delhi, 2006.
ISBN- 81-7008-073-8

Sl. No.	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	1	14	08
4	Tutorial Component	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	20
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**90**

Assessment Plan (for50marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1- To Demonstrate basic thermodynamics Concept and case studies, Prepare report and presentation- 10 Marks 2) Details of activity 2 – Preparing working model, Prepare report and presentation -10Marks	20
Total		**50**

Module	Activity Description	Hours
1	Demonstrate the understanding of basic thermodynamics concepts such as systems, forms of energy - work and heat, temperature.	4
2	To apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow.	4
3	Develop visual, physical, and mathematical models in support of thermodynamics problem design and analysis	4
4	ThermoVR: A Virtual Laboratory to Enhance Learning in Basic Thermodynamics	4
5	Case studies: Entropy changes in real life concepts, To study nature of any pure substance and extract P-V-T Graph	4
	Total	**20 Hrs.**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	-	-	-	-	2	2	-	-	-	-
CO2	2	3	-	-	-	-	-	2	2	-	-	-	-
CO3	2	3	-	-	-	-	-	2	2	-	-	-	-
CO4	2	3	-	-	-	-	-	2	2	-	-	-	-

Course Title		MECHANICS OF MATERIALS	
Course Code	25ME304	LTPC	28-28-0-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28T+34ABL=90

Course Objective: Impart basic knowledge on response of materials for physical structures under static load.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	explain the basic concepts and principles of stress analysis on members subjected to uniaxial and biaxial load	1, 2, 9	-
2.	evaluate the beams subjected to various stresses	2, 3	-
3.	evaluate the elements under torsion, elastic stability of columns and struts	2, 3	-

COURSE CONTENTS:

Module – I	10 Hrs.
Simple Stress and Strain: Introduction. Properties of material, Concept of Stress and Strain, Hook's Law, Stress Strain Diagram for structural steel and Non-ferrous materials. Poisson's Ratio & principles of superposition, Total elongation of tapering bars of circular section. Problems on deformations of member, Composite section.	
Module – II	**12 Hrs.**
Volumetric Strain and Thermal Stresses: Volumetric strain, Expression for Volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses including compound bars. **Bending Moment and Shear Force in Beams:** Introduction, Types of beams loadings and supports. Shearing force in beam. Bending moment, Sign convention. Relationship between loading shear force and bending moment. Expression for shear and bending moment equations, SFD and BMD with salient values for cantilever beams considering point load, UDL, UVL and Couple. SFD and BMD with salient values for simply supported beam considering point load, UDL, UVL and Couple.	
Module – III	**10 Hrs.**
Bending Stress and Shear Stress in Beams: Introduction, Bending stress in beam. Assumptions in simple bending theory. Pure bending derivation of Flexure equation. Modulus of rupture, Section modulus, Flexural rigidity. Assumptions in theory of shear stresses in beams, Shear stress diagram for solid rectangular section and circular section. (No numerical on shear stresses)**Thin and Thick Cylinders**: Introduction. Thin and thick cylinders subjected to pressure. Hoop stresses and longitudinal stresses. Problems on change in length, diameter and volume. Lame's equations: Problems on thick cylinder.	
Module – IV	**10 Hrs.**
Torsion of Circular Shafts: Introduction. Pure torsion- General torsion equation. Strength and stiffness, Torsional rigidity, Torsional flexibility and polar modulus. Power transmitted by solid shaft. Power transmitted by hollow shaft. **Elastic stability of columns:** Introduction. Euler's theory on columns. Effective length, slenderness ratio. Short and long columns, Radius of gyration, Buckling load. Assumptions, derivations of Euler's Buckling load for different end conditions. Limitations of Euler's theory.	

TEXTBOOKS:

1. James G.Gere,*Mechanics of Materials,*9th Edition, 2017.Thomson Publishers.ISBN-13-978-9355737.
2. S.Ramamrutham, R. Narayanan, *Strength of Materials*, Dhanphatrai publishing Co.Ltd.2003.ISBN-818743354X, 978818743354.

REFERENCE BOOKS:

1. Egor.P. Popov, *Engineering Mechanics of solids*, Pearson education India, 2nd edition, 1998. ISBN-8120321073, 9788120321076
2. B.C. Punmia, Ashok Jain, Arun Jain, *Strength of Materials*, Laxmi publications, 2002. ISBN-13,9788131804285
3. Ferdinand Beer & Russell Jhonstan, *Mechanics of Materials*, TMH 3rd Edition, 2003. ISBN – 0070535108, 9780070535107
4. R.K. Bansal, *Strength of Materials*, Laxmi Publications, Revised edition 2010. ISBN - 8131808149, 9788131808146

Tutorial Component (TC)

1. Numerical on varying cross-section bars
2. Numerical on bars with varying load
3. Numerical on composite bar
4. Numerical on member subjected to thermal stresses
5. Numerical on member subjected to volumetric strain
6. Numerical on SFD and BMD in beams
7. Numerical on SFD and BMD in beams
8. Numerical on varying cross-section bars
9. Numerical on bars with varying load
10. Numerical on composite bar
11. Numerical on bending stresses in beams
12. Numerical on thincylinder
13. Numerical on thick cylinder
14. Numerical on torsion of shaft

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial component	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50 marks each and reduced to 15 Marks	**30**
Details of Activity	Details of activities to be conducted Details of activity1-Laboratory visit and prepare a report-10 Marks Details of activity2 – quiz-10 Marks	**20**
Total		**50**

Activities Mapped to Modules:

Module	Activity Description	Hours
1 (Group activity)	Selection of material and preparation for lab	4
	Visit to lab prepare standard test specimen	4
	Interaction and observations at lab	4
	Preparation of report (formatting, calculation, editing)	4
	Report presentation and discussion	4
1,2,3,4(Quiz)	Practice and preparation for the quiz	4
	Conduction and evaluation of quiz on each module	4
Total		**28**

Evaluation of Learning Process

Type of Evaluation	Hours
Test (1, 2 and 3) 3	3
Semester End Exam 3	3
Total	6

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3						**1**	1				
CO2		3											
CO3		3	2										

Course Title	MANUFACTURINGTECHNOLOGY - I(Lab Integrated)		
Course Code	25ME305	LTPC	28-0-28-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28P+34ABL=90

Course objectives:

To provide students with comprehensive knowledge and practical skills in various manufacturing processes.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	explain the principles, operations and procedures required for various manufacturing processes	1, 2	-
2.	describe the principles, operations, and capabilities of different types of joining and forming processes	1, 2	-
3.	identify and select appropriate processes for moulding, joining, and forming processes for a given application	2, 3, 8	-

COURSE CONTENTS:

Module – I	07 Hrs.
Molding Elements: Steps involved in moulding,moulding materials, pattern types and allowances, core-making procedure. Molding techniques include CO_2 molding, shell molding, investment casting, and die casting. **Melting furnaces:** Classification, electric arc furnace, induction furnace, cupola furnace construction& operations, calculations on air requirements for cupola.	
Module – II	**06Hrs**
Welding Processes: Principle of welding. Classification of welding processes, principles, operation, and applications of TIGW, MIGW, friction welding, and laser beam welding processes. Resistance Welding: Principles, operation, and applications of spot welding. Formation of different zones during fusion welding and welding defects. **Soldering and brazing:** Principles, operation and applications of soldering and brazing.	
Module – III	**07 Hrs.**
Principles of metal forming: Classification of metal forming processes, Forging - Forging operations, open and closed die forging, forging defects. Rolling: Principle of rolling, roll stand arrangements and defects in rolled products. **Sheet metal forming:** Shearing, drawing, blanking, bending, spinning, stretch forming, embossing, and coining.	
Module – IV	**06 Hrs.**
Powder Metallurgy:Introduction, Steps involved in powder metallurgy, production of metallic powder, processing methods - mixing and blending, compacting, sintering, and other secondary operations. **Processing of plastics**:Plastic materials - thermoplastic and thermosetting materials. Plastic processing methods: Compression molding, transfer molding, injection molding, extrusion molding, blow molding, and thermoforming.	

Lab components	Hours
➢ Welding of different types of joints using electric Arc welding (lap joint, Butt joint, Tee -joint) ➢ Use of foundry tools and equipments, preparation of moulds using two boxes. ➢ Preparation of sheet metal models and soldering the joints. ➢ Demonstration of forging model involving upsetting, drawing, and bending operations.	**28**

Marks Distribution –COs and POs with defined Blooms Taxonomy

Module (Lab Activity)	Experiment Name	Marks	CO	PO	Level
1	Moulding Practice (Minimum three models) (Average marks for three models)	5	3	PO1, PO3, PO8	3
2	Welding Practice (Minimum three models) (Average marks for three models)	5	3	PO1, PO3, PO8	3
3	Sheet metal models and soldering (Minimum three models) (Average marks for three models)	5	3	PO1, PO2, PO3, PO8	3
4	Lab CIE (Conducted for 20 marks and then reduced to 5 Marks)	5	3	PO1, PO2, PO3 PO8, PO9	3

TEXTBOOK:

1. P. N. Rao, "Manufacturing Technology – Foundry, Forming and Welding", TMH, 3rd Edition, 20011. ISBN: 10: 0-07-008798-9.

REFERENCE:

1. SeropeKalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, 4th Ed. 2006. ISBN: 81-7758- 170-8.
2. Phillip F. Ostwald and Jairo Munoz, "Manufacturing Processes and Systems", Wiley India, 9th Edition, 2009. ISBN: 978-81- 265-1894-4.

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	02	14	28
2	Integrated Lab Component	02	14	28
3	Evaluation of Learning Process	-	-	06
4	Activity Based Learning (ABL)	-	-	28
Total Learning Hours/Semester				90

Proposed Assessment Plan (for 20 marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Lab	**Lab Component-** Preparation mold cavity, Mold preparation, Manual metal arc welding, weld using Spot welding machine, Simple models using sheet metal operations.	10
Lab CIE	Conduction of Lab CIE	05
ABL	Make the engineering parts with given specifications using 3D printing techniques	05
Total		**50**

Activity Based Learning (28 Hours)

ABL (28Hours): Students engage in a hands-on exploration of Making models		Hours
1	Make the engineering parts with given specifications using 3D printing techniques	10
2	Identify suitable manufacturing processes for producing components with different materials	08
3	Demonstrate metal forming operations for shaping materials	10
Total		28

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2	3	1											
CO3	3	2	2					2	2				

Course Title	COMPUTER AIDED MACHINE DRAWING		
Course Code	25ME306	LTPC	28-0-28-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28P+34ABL=90

Course Objective: To develop the ability to interpret and create accurate engineering drawings using computer-aided design tools, while applying standard drawing conventions, dimensioning practices, and principles of machine component design for effective communication in engineering and manufacturing environments.

Course Outcomes (COs){with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	read an Engineering drawing and convert it to orthographic/sectional views as per ISO/BIS standards.	5, 7, 8, 9, 11	1
2.	Apply the knowledge of machine drawing to create detailed part and assembly drawings of standard fasteners and representing them through orthographic and sectional views in accordance with ISO/BIS standards.	5, 7,8, 9, 11	1
3.	Create assembly drawings of machine components by producing orthographic and sectional views for effective communication of design intent among design, manufacturing, and inspection personnel in accordance with ISO/BIS standards.	5, 7, 8, 9, 11	1

Course contents:

	Part – A
1.	ISO and BIS Conventions in Machine Drawing. Dimensioning– Exercises on dimensioning practices. Conversion of pictorial views into orthographic projections of machine parts, Sections of Machine parts in simple positions. **Self-study component:** Introduction to intersection curves, Conic sections, Involutes, and cycloids.
2.	**Threaded Fasteners:** Thread Forms -ISO metric (internal & external). Square, acme and Buttress threads. Bolts, Nuts & Screws: Hexagonal headed & square headed bolts with corresponding nuts, Locking arrangements, Foundation bolts. **Self- study component:** Machine and cap screws, Stud bolt.
3.	**Permanent Fasteners: Riveted joints:** Simple joints, Rivet heads, Single riveted Lap & Butt Joints (Chain & zig zag), Double riveted lap & Butt joints (Chain & zig zag) **Self-study component**: Various types of welded joints, symbols.
4.	**Temporary Fasteners:** **Joints:** Keys, Cotter Joint and Knuckle joint**.** **Shaft Couplings:** Flanged couplings (Solid and Protected types), Universal coupling, Oldham coupling. Introduction to pipe joints. **Self-study component:** Split muff coupling, Pin type flexible coupling, Muff coupling, Pipe joints-C.I. Flange type, socket and spigot type, Union joint, expansion joint.

	Part – B (Assemblies)
5.	Bearings: Plummer Block, Footstep bearing
6.	Screw jack
7.	Simple Eccentric
8.	Lathe tail stock
9.	**Self-study component** :Tool head of a shaper
10.	**Self-study component** : Machine swivel vice

Scheme of Evaluation
CIE – 50 Marks [Activity + Class work = 30 Marks + CIE test =20 Marks] The question paper shall contain two parts and there shall be questions from **Part – A for a** maximum of **50 Marks** and from**Part – B** for a maximum of **50 Marks.** i. Two Questions **each of 10 marks** for a total mark of **20** shall be set **from 1, 2,** and **3**. ii. One Question **for 30marks** shall be set **from 4**. iii. One Question for total marks of **50** shall be set **from 5 to 10**. **Note:** The duration of examination (SEE) is 3 hrs. for 100 marks
TEXT BOOK 1. Machine Drawing – K.L. Narayana, P. Kannaiah,K. Venkata Reddy, 2006, 3rd Edition, New Age International. ISBN (13): 978-81-224-2518-5. **REFERENCES** 1. Machine Drawing – N. Sidheshwar, P. Kannaiah, V.V.S. Sastry, McGraw Hill Edition 48th ISBN 10: 007460337X/ ISBN 13: 9780074603376 2. Machine Drawing by *N.D. Bhatt* and V.M. Panchal, 48th edition (2013); Charotar Publishing House Pvt. Ltd., ISBN: 978-93-80358-69-7 3. Machine Drawing by *K. R. Gopalkrishna*,2014, Publisher. Subhas Stores, *ISBN*: 4567142527

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	2	14	28
2	Integrated Lab Component	2	14	28
3	Student Study Hours - Self Learning	-	-	08
3	Activity Based Learning (ABL1)	-	-	20
4	Evaluation of Learning Process	-	-	06
	Total Learning Hours/Semester			**90**

Activity Based Learning (20Hours)

ABL1(XX Hours): Activity 1 details		Hours
1.	**Group activity- ISO/BIS Compliance Check:** Review drawings and identify errors in dimensioning and standards.	4
2	**Group activity**- Exploded View Creation: Develop exploded assemblies of couplings or joints.	4
3	**Group activity:T**eams dissemble and assemble machine parts and draw the part and assembly drawings using CAD tools.	6
4	**Group activity:**Create 3D model of different components and assemble it and convert 3D model into 2D orthographic and sectional viewsusing CAD tool.	6
	Total	20

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	One CIE conducted for 100 marks and reduced to 20 marks	20
Individual Activity 1	Submission of printouts of computer-solved problems	10
Group activity 1	**ISO/BIS Compliance Check:** Review drawings and identify errors in dimensioning and standards.	05
Group activity 2	Exploded View Creation: Develop exploded assemblies of couplings or joints.	05
Group activity 3	**T**eams dissemble and assemble machine parts and draw the part and assembly drawings using CAD tools.	05
Group activity 4	Draw 3D model of and assemble it and convert a 3D model into 2D orthographic and sectional viewsusing CAD tool.	05
	Total	**50**

Evaluation of Learning Process (6 Hours)

Type of Evaluation	Hours
Test	2
Evaluation of activity	1
Semester End Exam	3
Total	**6**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	3	-	2	-	3	-	3	3	-
CO2	-	-	-	-	3	-	2	2	3	-	3	3	-
CO3	-	-	-	-	3	-	2	2	3	-	3	3	-

Course Title	ADVANCED PYTHON PROGRAMMING		
Course Code	25ME307A	LTPC	0-0-28-1
Exam	03 Hours	Hours / Week	02
SEE	50 Marks	Total hours	28P+02ABL=30

Course Objective:
To bring awareness on importance of python and applications of python in solving engineering problems

Course Outcomes (COs) {with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	Statement	POs
1	develop the ability to utilize libraries like Numpy, Matplotlib, Pandas etc. used in scientific computation	5
2	apply python programming skills to analyze and solve engineering problem	2, 5

Course Contents:

Part A

1. Numpy Library - Working with Arrays/Matrices
2. Pandas Library – Pandas series and Pandas DataFrame
3. Plotting the data with Matplotlib Library
    - Matplotlib: Figure and Axes
    - Subplots with Matplotlib
    - Grid Specs - Plot Layouts
    - Contour Plots
    - Surface Plots
    - Polar Plots

Part B

4. Programs on Mechanics
    - Analysis of Projectile Motion
    - Analysis of Beams - Shear force and Bending Moment Diagrams
    - Programs on Mechanical Vibration - Analyse the simple spring mass system with python.
5. Programs on Thermal System
    - Analyse the diesel cycle with python Program.

SEE Scheme:

One Question from Part A	15
One Question from Part B	25
Viva Voce	10

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	-	-	-
2	Practical	2	14	28
2	Student Study Hours – Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	-
4	Activity Based Learning **(ABL)**	-	-	02
Total Learning Hours / Semester				**30**

Activity Based Learning (02 Hours)

ABL: Import mechanical/thermal experimental data from CSV and clean/process it using Pandas. **(02Hrs)**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	-	3	-	-	-
CO2	-	2	-	-	3	-	-	-	-	3	-	-	-

Course Title	SPREADSHEET FOR ENGINEERS		
Course Code	25ME307B	LTPC	0-0-28-1
Exam	03Hours	Hours/ Week	01
SEE	50 Marks	Total hours	28P + 02ABL = 30

Course Objective: To enable students to effectively use spreadsheet tools (Excel) for engineering computations, data analysis, visualization, and problem-solving through practical applications.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon successful completion of this course, the student shall be able to:

#	Course Outcomes	Mapping to Pos	Mapping to PSOs
1.	Apply spreadsheet tools to perform engineering computations, data visualization, and analysis.	1, 2, 5	1
2.	Use advanced functions, regression, and optimization techniques to solve engineering problems using spreadsheets.	2, 3, 5	2
3.	Develop VBA-based programs to automate engineering computations using macros and user-defined functions.	3, 5, 10	2

Course Contents:

Sl. No.	Experiments
1.	**Charting:** Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, create a combination chart
2.	**Functions:** Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using The CONVERT Function to Convert Units
3.	**Conditional Functions:** Logical Expressions, Boolean Functions, IF Function, Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions.
4.	**Regression Analysis:** Trendline, Slope and Intercept, Interpolation and Forecast, The LINEST Function,Multilinear Regression, Polynomial Fit Functions, Residuals Plot, Slope and Tangent, Analysis ToolPack.
5.	**Iterative Solutions Using Excel:** Using Goal Seek in Excel, Using The Solver To Find Roots, Finding Multiple Roots, Optimization Using The Solver, Minimization Analysis, NonLinear Regression Analysis.
6.	**Matrix Operations Using Excel:** Adding Two Matrices, Multiplying a Matrix by a Scalar, Multiplying Two Matrices, Transposing a Matrix, Inverting a Matrix and Solving System of Linear Equations.
7.	**VBA User-Defined Functions (UDF):** The Visual Basic Editor (VBE), The IF Structure, The Select Case Structure, The For Next Structure, The Do Loop Structure, Declaring Variables and Data Types, An Array Function The Excel Object Model, For Each Next Structure.
8.	**VBA Subroutines or Macros:** Recording a Macro, Codinga Macro Finding Roots by Bisection, Using Arrays, Addinga Control and Creating User Forms.
	Demonstration Experiments
9.	**Numerical Integration Using Excel:** The Rectangle Rule, The Trapezoid Rule, The Simpson's Rule, Creating a User-Defined Function Using the Simpson's Rule.
10.	**Differential Equations:** Euler's Method, Modified Euler's Method, The Runge Kutta Method, Solving a Second Order Differential Equation.

Suggested Learning Resources:

- Excel Resources - 600+ Self Study Guides, Articles & Tools (wallstreetmojo.com)
- https://www.ictlounge.com/html/year_7/esafety_part7.htm
- McFedriesPaulMicrosoft Excel 2019 Formulas And Functions Microsoft Press, U.S, 2019 Edition

SEE Scheme:

Sl. No.	Question	Marks
1	Group A (Experiments 1 to 5)	15
2	Group B (Experiments 6 to 8)	25
3	Viva Voce	10

Teaching-Learning-Evaluation Scheme:

Sl. No.	Teaching and learning method	No. of hours/ week	No. of weeks	Hours/ semester
1.	Classroom teaching & learning	-	-	-
2.	Practical	2	14	28
3.	Student study hours - self learning	-	-	-
4.	Tutorial component	-	-	-
5.	Activity BasedLearning (ABL)	2	1	2
6.	Evaluation of learning process	-	-	-
			Total learning hours/ semester	**30**

Proposed Assessment Plan (for 50 Marks of CIE):

Tool	Remarks	Marks
Continuous Internal Evaluation (CIE)	Evaluation in each lab session based on execution, accuracy, and understanding	20
Record Writing	Maintenance and timely submission of lab record	10
Activity-Based Learning (ABL)	Problem-solving activity using spreadsheet tools	10
Internal Test / Viva	Test/ viva conduction	10
	Total	**50**

Evaluation of Learning Process (06 Hours):

Type of Evaluation	Hours
CIEs	03
Semester End Examination (SEE)	03
Total	**06**

COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	3	-
CO2	-	3	2	-	3	-	-	-	-	-	-	-	3
CO3	-	2	3	-	3	-	-	-	-	2	-	-	3

Course Title	National Service Scheme (NSS)		
Course Code	25NYP1	(L-T-P) C	(0-0-2)
Exam	-	Hours/Week	2
SEE	-	Total Hours	24

Course Outcomes: At the end of the course, the student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the importance of his / her responsibilities towards society	6	-
2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	3, 6	-
3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	3, 6	-
4	Implement government or self-driven projects effectively in the field.	11	-
5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.	11	-

MODULE - 1	8 Hrs.
Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing	

MODULE - 2	8Hrs.
Waste management– Public, Private and Govt. organization, 5 R's.	

MODULE - 3	8 Hrs.
Setting of the information imparting club for women leading to contribution in social and economic issues.	

Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Yoga - I			
Course Code	**25YOG1**	**CIE**	**100 Marks**
Course Type	**NCMC**		
Total Hours	**2 hrs/week**		

Course Objectives

The objectives of this course are to:

1. Introduce students to the origin, history, philosophy, and fundamental concepts of Yoga.
2. Familiarize students with the different schools of Yoga, its aims, objectives, and the importance of prayer in Yogic practice.
3. Develop awareness of the rules, regulations, and safety precautions to be followed during Yogic practices.
4. Enable students to learn and practice Suryanamaskara and selected Yogasanas with proper techniques for improving physical and mental well-being.
5. Promote a healthy life style by encouraging regular Yogic practice, correcting misconceptions about Yoga, and fostering positive health, self-discipline, and overall wellness.

Introduction of Yoga: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, Prayer : importance of prayer

Brief introduction of yogic practices for common man to promote positive health, Rules and regulations: Rules to be followed during yogic practices by practitioner

Suryanamaskara: Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2rounds, Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non yogic practices

Different types of Asanas: Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana, Sitting 1.Padmasana, 2.Vajrasana, Standing 1.Vrikshana, 2.Trikonasana, Proneline1.Bhujangasana, 2.Shalabhasana, Supineline

1.Utthitadvipadasana, 2.Ardhahalasana

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.
2. Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.
3. Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.
4. Analyze the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga.
5. Adopt Yoga as a regular life style practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.

Suggested Learning Resources: (Text Book / Reference Book /Manuals):

Text books:

1. George Feuerstein: the yoga Tradition (its history, literature, philosophy and practice)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind (Orient paper Backs: Vision Books Pvt.Ltd..1982.
3. B.K.Slyenkar: Light on the Yoga sutras of Patanjali (Haper Collins Publications India Pvt.Ltd.New Delhi.)
4. Science of Divinity and Realization of Self Vethathiri Publication,(6-11)WCSC,Erode

Reference books/Manuals:

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited. ISBN:9781909141209,978190914209
2. Basavaraddi IV: Yoga in School Health, MDNIY NewDelhi. 2009
3. Dr.HR.Nagendra: Yoga Research and application (Vivekanda Kendra Yoga Prakashana Bengalore)
4. Dr.Shirley Telles: Glimpses of Human Body (Vivekanda KendraYoga Prakashana Bengalore).

Web links and Video Lectures (e-Resources):

Search by topics to get the videos

Assessment Structure:

This course is having only **Continuous Internal Assessment** (CIE) marks of 100.

Weightage	Marks
Attendance to all the sessions	20 Marks
Practical sessions on Yoga and Its Benefits	40 Marks
Two Assignments	40 Marks
Total Marks	100

A student shall obtain a minimum of 40% marks or 40 marks out of 100 to qualify in the course.

PHYSICAL EDUCATION (SPORTS & ATHLETICS)–I						
Course Code	**:**	25PE1		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	15 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state/national/international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I: Orientation **4 Hours**

A. Lifestyle
B. Health &Wellness
C. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **4 Hours**

A. Warming up (Free Hand exercises)
B. Strength–Push-up/Pull-ups
C. Speed– 30Mtr Dash

Module III: Specific games (Any one to be selected by the student) **16 Hours**

1. Kabaddi–Handtouch,Toe Touch,Thigh Hold, Anklehold and Bonus.
2. Kho-Kho– Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Scheme and Assessment for auditing the course and Grades:

Sl.No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes/Assignment–2,eachof 20marks	40
3.	Final presentation/exhibition/Participation In competitions/practical on specific tasks assigned to the students	40
	Total	**100**

Course Title	Community Project / Societal Project		
Course Code	25SCR	(L-T-P)C	(0-0-2)1
Exam	3 Hrs.	Hours/Week	2
CIE + SEE	50 marks + 50 Marks	Total Hours	30

Course Objective: Rapid urbanization, population growth, environmental concerns, energy demand, water scarcity, waste management, transportation issues and rural development challenges have created practical problems affecting communities and public welfare. This course aims to integrate technical knowledge, field exposure and societal engagement so that students identify real community issues, frame problem statements and attempt appropriate, feasible and sustainable engineering responses within the scope of a one-semester project.

Course Outcomes: At the end of the course, the student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Identify and analyze societal problems through field interaction and technical assessment.	1,2,3,4,6,9	-
2	Develop skills in project planning, field survey, data collection, implementation, documentation and reporting.	1,2,3,4,5,8,9,10	-
3	Formulate feasible engineering problem statements and solutions considering practical constraints and sustainability aspects.	1,2,3,5,6,7, 10	-
4	Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.	6, 7	-
5	Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.	2,3,4,5,8,9, 11	-
6	Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.	6,8,9,10,11	-

Restrictions and professional conduct:

Community / Societal Projects shall remain **academic, socially responsible, technically focused, and politically neutra**l. Students and faculty shall maintain professionalism, ethical conduct, public respect and institutional integrity while interacting with communities, public groups, organizations and stakeholders. Students and faculty shall avoid the following during project execution:

- Association with political party activities, campaigns or propaganda.
- Participation in activities that may disturb communal harmony, public order or institutional reputation.
- Use of the project platform for personal, political, ideological or commercial promotion.
- Disrespectful, discriminatory or unethical interaction with community members or stakeholders.

Projects must also recognize constraints related to cost, resources, environment and safety, and stakeholder behavior/cooperation/acceptance when planning and implementing activities.

SET OF PROJECT ACTIVITIES (TW/SL = 30 HOURS)

Methods for Project Identification:

Students may identify the project topic using one or more of the following methods:

- Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.
- Review of issues highlighted in print and electronic media, and social networks (WhatsApp, Facebook, X, Instagram, etc.).
- After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

Sl.No	Project Title	Measurable Engineering Outcome	Mapped POs	SDGs
1.	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2.	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3.	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
4.	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5.	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6.	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7.	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction.	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8.	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9.	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10.	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11

11.	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12.	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13.	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14.	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15.	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16.	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17.	Youth mentoring programmes	Deliver a structured mentoring activity and measure participation, engagement, and skill/awareness improvement.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
18.	Adult education	Conduct learner-needs assessment, prepare instructional content, and measure improvement in basic literacy or numeracy indicators.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
19.	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12
20.	Human rights awareness with legal systems	Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.	PO6, PO7, PO8, PO9, PO10	SDG 5, SDG 10, SDG 16
21.	House tax collection through digital media	Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.	PO2, PO3, PO4, PO5, PO10, PO11	SDG 9, SDG 11, SDG 16
22.	Use of application / application program	Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.	PO1, PO3, PO4, PO5, PO9, PO10	SDG 9, SDG 11, SDG 17
23.	Creation of Panchayat library	Plan the library model, catalogue resources, and measure usage, accessibility, or participation outcomes.	PO6, PO8, PO9, PO10, PO11 SDG 4,	SDG 10, SDG 11, SDG 17

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher
1	Community Engagement and Social Innovation	Phadke, N. D.	1st	Oxford University Press, New Delhi.
2	Project-Based Learning in Engineering Education	Garg, N. R.	1st	Pearson India Education Services, Noida.
3	Service Learning and Community Projects.	Gupta, A. and P. Singh.	1st	McGraw-Hill Education (India), New Delhi.
4	Practical Guide to Community Development Projects	Wilson, G.	2nd	Routledge, London.

Reference Books:

1. NPTEL courses on Project-Based Learning and Social Innovation.
2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: https://sdgs.un.org
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

Web links and Video Lectures (e-Resources):

1. NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
2. NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
3. Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): https://vlab.co.in
4. Geological Survey of India (GSI) – Maps, reports, and publications: https://www.gsi.gov.in
5. YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
6. American Society of Civil Engineers (ASCE) – Geotechnical resources and standards Teaching-Learning Process

Week / Phase	Teaching-Learning Activity	Faculty Role	Student Activity	Output / Evidence
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record

4	Problem statement and objective formulation	Review and refine problem statement	Prepare problem statement, scope, and objectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Work plan / Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

Assessment structure:

A. Continuous Internal Evaluation (CIE) – 50 marks

• Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.

• CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totaling 50 marks:

B. Semester End Examination (SEE) – 50 marks

• The SEE shall be conducted batch-wise by a committee of : one faculty from the same department and one from a different department.

CIE and SEE Rubrics

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry/community	8	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation & feasibility	10	Problem statement is precise; approach is sound, innovative and clearly feasible.	Problem statement adequate; approach feasible with minor gaps.	Problem statement partial; approach feasibility is marginal.	Problem statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	8	Thorough stakeholder engagement; data collection is comprehensive; analysis is well-interpreted.	Good engagement; data analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/analysis.
Project documentation; Clarity, organization & problem-solving demonstrated	10	Documentation is complete, well-organized, analytical, and shows strong problem-solving.	Documentation complete and clear with some analytical content.	Documentation on basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving.
Communication & Presentation skills	6	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses.	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	8	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

2025 Admitted Batch
IV Semester Academic Year 2026-27

IV Semester B.E. Mechanical Engineering								
Sl. No.	**Course Category Course Code**		**Course Title**	**Teaching Hours/Week**				
				Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Credits**	**Duration in hours**
				L	**T**	**P**	**C**	
1.	HMSC	25ME401	Management & Entrepreneurship	3	0	0	3	3
2.	PCC	25ME402	Fluid Mechanics & Machinery	2	0	2	3	4
3.	IPCC	25ME403	Manufacturing Technology –II	3	0	2	3	5
4.	IPCC	25ME404	Applied Thermodynamics	3	0	0	4	3
5.	IPCC	25ME405	Measurement Science& Metrology	2	0	2	3	4
6.	PCC	25ME406	Kinematics of Machines	3	0	0	3	3
7.	AEC	25ME407	Ability Enhancement Course Lab	0	0	2	1	2
8.	SDC	25EP408	Environmental Science Project	0	0	2	1	2
9.	BSC	25ME409	Biology for Engineers	0	2	0	1	2
10.	AEC	--	Placement training-II	0	0	2	A	2
11.	NCMC	25NYP2	NSS / YOGA / PE	0	0	2	A	2
Total				**15**	**3**	**14**	**22**	**32**

Ability Enhancement Course(Laboratory)	
25ME407A	Data Visualization and Analysis using Tableau and Power BI
25ME407B	PLC and Automation
25ME407C	AI For Mechanical Engineering& Prompt Engineering

Course Title	MANAGEMENT AND ENTREPRENEURSHIP		
Course Code	25ME401	LTPC	42-0-0-3
Exam	3 Hours	Hours / Week	03 Hours
SEE	50 Marks	Total hours	42L+48ABL=90

Course objective:

To develop proficiency for making rational decisions regarding problems likely to be encountered in professional practice, by applying management concepts and entrepreneurial skills

Course Outcomes (COs) with mapping shown against the Program Outcomes (POs) Upon

successful completion of this course, the student shall be able to:

#	Course Outcomes	Mapping to POs	pping to PSOs
1	explain the basic concepts of management and entrepreneurship	1,7, 8, 9, 10	-
2	apply the conceptual knowledge of management and entrepreneurship to make rational decisions in professional practice	1, 7, 8, 9, 10	-
3	utilize the initiatives by government and private institutions to boost entrepreneurial spirit	1, 9, 10	-

Course Contents:

Module–I	10 Hrs.
Management: Introduction, Management functions, levels of management, Roles of a manager, Managerial skills, and Managerial effectiveness. **Planning:** Nature, importance and purpose of planning process, types of plans (meaning only), Steps in planning & planning premises.	
Module–II	**11 Hrs.**
Organizing: Characteristics of an organization, types of organization, Process of organizing, Span of management, Departmentalization, Committees, Authority, Responsibility, Centralization and Decentralization. **Staffing:** Recruitment, Selection. **Directing:** Requirements of effective direction, Motivation: Maslow's need –hierarchy theory, Herzber's Two-factor theory, Leadership styles. **Coordination:** meaning, importance and techniques. **Controlling:** Meaning, steps in controlling, essentials of a sound control system.	
Module–III	**11 Hrs.**
Entrepreneurship: Introduction, steps in entrepreneurship, role of entrepreneurs in economic development, entrepreneurship in India, corporate entrepreneurship, entrepreneurial competencies, capacity building for entrepreneurs, myths about entrepreneurship, environmental factors affecting entrepreneurial growth, creating a favorable environment for entrepreneurship.	

Module–IV	10 Hrs.
MSME: Role and importance, concepts and definitions, government policy initiatives for MSME, schemes for MSME, role of clusters in promoting MSME, problems in MSME sector, impact of liberalization, privatization and globalization of MSME sector, effect of WTO/GATT. Institutions supporting business enterprises: Central, state level and other institutions.	

Self-Study Component:

Case Study: Study real companies (manufacturing or startup-based) and analyze:

- Organizational structure
- Production/operations management
- Leadership style
- Financial and marketing strategies
- Entrepreneurial journey and challenges

Mini Business Plan Development

Create a startup idea and prepare:

- Problem statement
- Product/service idea
- Market analysis
- Cost estimation
- Revenue model
- SWOT analysis
- Risk assessment

Industry Visit / Virtual Study

Visit a local manufacturing unit or MSME and observe:

- Plant layout
- Inventory management
- Quality control
- HR practices
- Safety measures

Entrepreneur Interview Project

Interview a local entrepreneur or business owner and study:

- How they started
- Funding challenges
- Workforce management
- Growth strategy
- Failures and lessons learned

Text Book:

1. Principles of Management, P C Tripathi, P N Reddy & Ashish Bajpai, Tata McGraw Hill, Seventh Edition, 2021. ISBN:9789354600630
2. Entrepreneurship development and small business enterprises, Poornima M Charantimath, Pearson, Fourth Edition, 2025. ISBN: 978-9367138014

References:

1. Industrial Engineering and Management – Kaushik Kumar & Divya Zindani, Dreamtech Press, 2020, ISBN-978-9389633191
2. Entrepreneurship- Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, 11th Edition, ISBN: 9789390113309
3. Industrial Engineering and Organization Management - O.P. Khanna, Dhanpat Rai Publications, 2020
4. https://www.msme.gov.in/

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	1	14	14
4	Tutorial component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	26
6	Evaluation of Learning Process	-	-	08
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Activity Details	Students can choose any two activities listed in the self-study component, and then prepare and present a report on the chosen activities. Each activity carries 10 marks.	20
Total		**50**

Activities Mapped to Modules:

Module	Activity Description	Hours
1 & 2	Case Study: Study real companies (manufacturing or startup-based) and analyze	6
3 & 4	Mini Business Plan Development	6
1 & 2	Industry Visit / Virtual Study	7
3 & 4	Entrepreneur Interview Project	7
	Total	**26**

Evaluation of Learning Process (08 Hours)

Type of Evaluation	Hours
Test (1, 2 and 3)	03
Presentation & Report Evaluation	02
Semester End Exam	03
Total	**08**

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]											PSO's	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1							2	2	3	3			
2							2	2	3	3			
3									3	3			

Course Title	Fluid Mechanics & Machinery		
Course Code	25ME402	LTPC	28-28-0-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28T+48ABL=90

Course Objective: To impart the students with fundamental knowledge of fluid properties, concept of fluid flow &basics principles of hydraulic pumps and turbines.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	demonstrate the significance of fluid properties and laws of fluid statics to engineering systems.	1, 2,3,8,9	-
2.	apply the knowledge of fluid Kinematics and fluid dynamics while addressing problems of mechanical engineering.	1, 2,3,8,9	-
3.	analyse the viscous flow through pipes and determine various losses	1, 2,3,8,9	-
4.	analyse the performance of hydraulic pumps and turbines	1, 2,3 ,8,9	-

COURSE CONTENTS:

Module –I	10Hrs.
Fluid Statics: Definition of fluid, Concept of continuum, Fluid properties, Rheological classification, Pascal's Law and Hydrostatic pressure and its measurement –Manometer and its types, related numerical problems. **Buoyancy**: Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid. Buoyancy, Condition of Equilibrium for Submerged and Floating Bodies, Centre of Buoyancy, related numerical problems.	
Module –II	**12Hrs.**
Fluid Kinematics: Description of fluid motion – Lagrangian and Eulerian approach, Types of Flow-steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates, related numerical problems. **Laminar and Turbulent flow:** Flow through circular pipe, between parallel plates, Fully-developed laminar flow, Hagen Poiseuille equation. Turbulent flow, related numerical problems.	
Module –III	**10Hrs.**
Fluid Dynamics: Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem– venturimeter, orificemeter, Pitot tube, rectangular and triangular notch, related numerical problems. **Flow Through Pipes:** Loss of head due to friction in pipes, Darcy–Weisbach equation, Major and minor losses, pipes in series and parallel, related numerical problems.	

Module –IV	10Hrs.

Hydraulic Machines: Introduction - Centrifugal pumps – Work done - Head developed - Pump output and Efficiencies - priming - minimum starting speed - performance of multistage pumps - Cavitation - methods of prevention - Pump characteristics – Classification of hydraulic turbines - Pelton wheel - Francis turbine - Kaplan and Propeller turbines - Specific speed - Theory of draft tube - Governing - Performance characteristics - Selection of turbines related numerical problems**.**

Self-study:

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Concept of continuum, types of fluids etc, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, Absolute, gauge, atmospheric and vacuum pressures pressure measurement by simple, differential manometers and mechanical gauges.

TEXT BOOKS:

1. Som S K, Gautam Biswas, Chakraborty S, Introduction to Fluid Mechanics and Fluid Machines, 2017, McGraw Hill.
2. Fox and McDonald, Introduction to Fluid Mechanics, 2020, 10th Edition, Wiley

REFERENCE BOOKS:

1. Yunus A. Cengel and John. M. Cimbala, Fluid Mechanics: Fundamentals and Applications, 2019, 4th Edition, McGraw Hill.
2. A text book of Fluid Mechanics and Hydraulic Machines, Dr. R K Bansal, Laxmi publishers
3. Frank M White., (2016), Fluid Mechanics, 8thEdition , McGraw-Hill

Web links and Video Lectures (e-Resources):

- Nptel.ac.in
- VTU, E- learning
- MOOCS
- Open courseware

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Industrial visits
- Working Model
- Virtual Laboratory
- Course Seminar
- Term Project
- Think-Pair-Share Activity

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial component	2	28	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Activity Details	Details of activities to be conducted • Details of activity1- Industrial to understand practically the various losses and to prepare report and presentation - 10Marks • Details of activity2 – Preparing working model, Prepare report and presentation -10Marks	20
Total		**50**

Activities Mapped to Modules:

Module	Activity Description	Hours
1	Determine the viscosity of oil using Red wood viscometer and Say-bolt viscometer.	3
1	Measurement of pressure using different Manometers for high and low pressure measurements (manometers using different manometric fluids).	3
3	Working principle of different flow meters and their calibration (orifice plate, venture meter, turbine, Rota meter, electromagnetic flow meter)	5
3	Determination of head loss in pipes and pipe fittings having different diameters, different materials and different roughness	6
3	Reynolds apparatus to measure critical Reynolds number for pipe flows	5
3	Effect of change in cross section and application of the Bernoulli equation	3
3	Working principle of different flow meters for open channel and their calibration	2
	Total	**28hrs**

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]											PSO's	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	1					2	3				
2	3	3	2					2	3				
3	3	3	2					2	3				
4	3	3	2					2	3				

Course Title	Manufacturing Technology - II (Lab Integrated)		
Course Code	25ME403	LTPC	28-0-28-3
Exam	03Hours	Hours/ Week	03
SEE	50 Marks	Total hours	28L+28P+34ABL = 90

Course Objective: To impart knowledge of machining principles, processes, and process planning, and to develop skills in analyzing and performing machining operations for practical applications.

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon successful completion of this course, the student shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain and apply machining principles, tool geometry, and metal cutting mechanics	1, 2	1
2.	Analyze and evaluate tool wear, tool life, cutting fluids, and finishing processes	2, 3, 4	1
3.	Compare and select appropriate advanced and hybrid machining processes for applications	2, 3, 5	2
4.	Perform machining operations, prepare process sheets, and design basic jigs & fixtures	3, 5, 9, 10	1

Course Contents:

Module – 1	07 Hrs.
Introduction to Machining Processes: Subtractive manufacturing processes and classifications. Principles of machining- Introduction, orthogonal and oblique machining, basic tool angles of single point cutting tool, mechanism of chip formation, types of chips. **Mechanics of metal cutting:** Cutting ratio, shear angle and its significance, Merchant's circle diagram, and Ernst- Merchant theory on orthogonal machining. Numerical examples on Merchant's circle diagram.	
Module – 2	**07 Hrs.**
Machining temperature and its control: Heat sources in machining, Cutting Fluids: Characteristics of cutting fluids, types, and applying methods of cutting fluids. Tool wear and tool life: Modes of tool failure, the effect of cutting parameters on tool life, tool life criteria, Taylor's tool life equation, and problems on tool life evaluation. **Finishing Process:** Importance of surface finishing processes, Grinding, Honing, Polishing, and Lapping.	
Module – 3	**07 Hrs.**
Advanced Machining Process: Importance and classification of the advanced machining process. Process principal, process parameters, and application of Abrasive Jet Machining (AJW), Water Jet Machining (WJM), Ultrasonic Machining (USM), Wire Electrical Discharge Machining (WEDM), Electro Chemical Machining (ECM), Electron Beam Machining (EBM), and Plasma Arc Machining (PAM).	
Module - 4	**07 Hrs.**

Hybrid Machining Process: Importance of hybrid machining process, Process principal, process parameters, and application of Electrochemical Discharge Machining (ECDM), Ultrasonic Assisted Electric Discharge Machining (UAEDM), Electrochemical Discharge Grinding (EDG), Powder Assisted Electric Discharge Machining (PAEDM).
Jigs and Fixtures: Importance of jigs and fixtures, the difference between jigs and fixtures, and types of jigs and fixtures.

List of Experiments

- Facing, turning, taper turning, thread cutting, grooving, chamfering, boring operations on lathe
- Machining rectangular, triangular & dovetail slots on shaping machine
- Milling operations: face milling, keyway cutting, gear cutting
- Preparation and execution of process sheets for selected machining components

TEXTBOOKS:

1. Workshop technology, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt ltd 2004
2. Machining and Machine Tools, AB Chattopadhyay, 2nd Edition, Wiley India Pvt. Ltd 2012
3. Mechanical Metallurgy, George E. Dieter, McGraw-Hill, Third edition

REFERENCE BOOKS:

1. Manufacturing Technology – Metal cutting and machine tools, P. N. Rao, 2nd Edition, TMH 2009
2. Modern machining process, Pandey and Shan, TATA McGraw Hill, 2000
3. Design of Jigs, Fixtures and Press Tools, K. Venkataraman, Ane Books Pvt Ltd, 2016
4. Production Technology, HMT, Tata McGraw-Hill, 2001.

E-Books and online course materials:

https://referenceglobe.com/CollegeLibrary/library_books/20180120071811Fundamentals-of-Machining-and-Machine-Tools-Boothryd.pdf

Online Courses (MOOC):

- https://nptel.ac.in/courses/112105126

Teaching-Learning-Evaluation Scheme:

Sl. No.	Teaching and learning method	No. of hours/ week	No. of weeks	Hours/ semester
1.	Classroom teaching & learning	2	14	28
2.	Integrated lab component	2	14	28
3.	Student study hours - self learning	-	-	-
4.	Tutorial component	-	-	-
5.	Learning Activity Based (ABL1 & ABL2)	-	-	28
6.	Evaluation of learning process			06
			Total learning hours/ semester	**90**

Proposed Assessment Plan (for 50 Marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20marks each and reduced to 10 marks	30
Activity Details	Continuous assessment of lab experiments, records, and execution	10
	Conduction of Lab CIE	05
	Assessment based on assignments, case studies, mini project/presentation	05
	Total	**50**

Activity Based Learning (ABL – 28Hours):

Activities mapped to modules:

Module	Activity Description	Hours
1.	**Numerical & Concept-Based Activity:** • Solving problems on Merchant's circle diagram, cutting forces, and shear angle • Demonstration/video analysis of chip formation (orthogonal vs oblique cutting) • Assignment on tool geometry and chip types	07
2.	**Case Study & Analysis:** • Case study on tool wear and tool failure in machining industries • Numerical problems on Taylor's Tool Life Equation • Analysis of cutting fluids and their performance in different machining conditions	07
3.	**Advanced Machining Study:** • Comparative study of advanced machining processes • Video-based learning/ virtual lab demonstration • Report preparation on selection of suitable AMP for given application	07
4.	**Mini Project / Application-Based Activity:** • Study/design of jigs and fixtures for a given component • Preparation of process sheet for a given component (sequence of operations, cutting parameters, tooling selection) • Implementation of process sheet in lab and performance analysis • Presentation/report submission	07

Evaluation of Learning Process (06 Hours):

Type of Evaluation	Hours
CIEs (1, 2, and 3)	03
Semester End Examination (SEE)	03
Total	**06**

COURSE ATRICULATION MATRIX

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	-	-	-	-	-	-	-	2	1
CO3	1	2	3	-	2	-	-	-	-	-	-	-	2
CO4	-	2	3	1	2	-	-	-	2	2	-	3	-

Course Title	APPLIED THERMODYNAMICS		
Course Code	25ME404	LTPC	28-28-28-4
Exam	03 Hours	Hours / Week	04
SEE	50 Marks	Total hours	28L+28T+28P+36ABL=120 Hrs.

Prerequisites: Basic Thermodynamics (25ME305)

Course Objective: To impart students with thermodynamic principles that governs the behavior in evaluation of various thermodynamic systems and their applications

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}

Upon completion of the course, students shall be able to:

COs	Statement	Pos	PSOs
5.	apply the thermodynamic principles to evaluate for improving the performance of gas-power cycles	1, 2,3,8,9	-
6.	analyze the performance of vapour power cycles and steam nozzles.	1, 2,3,8,9	-
7.	analyze the refrigeration systems and air-conditioning systems in order to carry out calculations on system performance.	1, 2,3,8,9	-
8.	analyze air compressorsfor their performance & use the combustion principlesto predict products of combustion	1, 2,3,8,9	-

COURSE CONTENTS:

Module –I	10 Hrs.
Gas Power Cycles : Air-standard Cycles **;** Assumptions made, Carnot ,Otto , Diesel and Dual combustion cycle , representation of these cycles on T-s and P-V diagrams, efficiencies , mean effective pressure and work ratio, comparison of Otto , Diesel and Dual combustion cycles. **Gas turbine cycles:** Closed and open gas turbine cycles**,** analysis of Simple open and closed gas turbine (Brayton) cycle, Methods to improve the performance; gas turbine cycles with regeneration, inter-cooling and reheating. Simple numerical Problems.	
Module –II	**12 Hrs.**
Vapour power cycles: Carnot cycle and its drawbacks, Rankine cycle, Analysis of Rankine cycle and comparison of these cycles on T-s and h-s diagrams, Effects of pressure and temperature on Rankine cycle performance. Practical Rankine cycle, Rankine cycle with Reheat and regeneration. Characteristics of an Ideal working fluid in Vapour power cycles. **Steam nozzles:** Types of Nozzles, Nozzle shapes, critical pressure ratio, maximum mass flow, nozzle efficiency. Simple numerical Problems	
Module –III	**10 Hrs.**
Refrigeration:Introduction to refrigeration, applications, methods of refrigeration, refrigerator and heat pump, COP, Simple Vapour compression refrigeration system and its analysis, pressure – enthalpy diagram, methods to improve the performance, Vapour absorption refrigeration system-working principle. Air-conditioning-Introduction, **Air-conditioning**: Properties of atmospheric air, Psychometric properties, Psychometric chart, Psychometric processes and their representation on Psychometric chart, types of air conditioning systems. Simple numerical Problems.	

Module –IV	10 Hrs.

Reciprocating compressors : Reciprocating compressor- single stage air compressor with and without clearance, work done, volumetric efficiency, disadvantages of single stage compressor, necessity of multistaging, advantages, effect of inter-cooling, Optimum pressure ratio, minimum work for compression.

Combustion Thermodynamics: Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. Dissociation and equilibrium, emissions

Self study:

1 Visit nearby service station and Study commercially available two wheelers with four stroke engines and prepare a comparison chart.
2 Study and prepare a report on regenerative cycle with feed water heating system used in steam power plants.
3 Study jet propulsion and prepare a report on turbojet and the turbo prop.
4 Study commercially available 3 fluid vapour absorption system with applications and prepare a report.
5 Prepare a report on working of vertex tube, steam jet and sound way of refrigeration.
6 List the steam turbine power plants of India and compare them based on different parameters.
7 Prepare a report on working of a cycle pump.

Study the window air conditioner and prepare a report

Tutorials:

1.	Numerical problems on Otto cycle
2.	Numerical problems on Diesel cycle
3.	Numerical problems on Dual combustion cycle
4.	Numerical problems on Gas turbine cycles
5.	Numerical problems on Gas turbine cycles
6.	Numerical problems on Vapour power cycles
7.	Numerical problems on Vapour power cycles
8.	Numerical problems on Steam nozzles
9.	Numerical problems on Refrigeration
10.	Numerical problems on Refrigeration
11.	Numerical problems on Air-conditioning
12.	Numerical problems on Air-conditioning
13.	Numerical problems on Reciprocating compressors
14.	Numerical problems on Combustion Thermodynamics

TEXT BOOKS:

1. P.K. Nag , Basic and Applied Thermodynamics, Tata McGraw Hill pub. Co., 2002. ISBN- 089-116-626-2
2. Yunus A Cengal& Michael A Boles, Thermodynamics – An Engineering Approach, Tata McGraw Hill pub. Co., 2002. ISBN: 139780073305370

DATA HAND BOOK:

B. T. Nijaguna and B. S. Samaga, Thermodynamic Data Hand Book, Sudha Publications, 2001. ISBN 1234002388

REFERENCE BOOKS:

1. T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologiest,

Pearson Education, Fifth Edition. ISBN- 9788177582383
2. Gorden Rogers and Yon Mayhew, Engineering Thermodynamics, Pearson Education, Fourth Edition. ISBN – 987-81-317-0206-2
3. R. K. Rajput, Thermal Engineering, Laxmi Publications, New Delhi, 2006.
ISBN- 81-7008-073-8

Exp. NO.	EXPERIMENT NAME	Marks	COs	POs	Level
1	Determination of Flash and Fire point of Lubricating oil using open cup apparatus.	**10**	**CO4**	1,2, 3,8,9	**3**
2	Determination of Flash and Fire point of Lubricating oil using closed cup apparatus.	**10**	**CO4**	1,2, 3,8,9	**3**
3	Determination of C.V. of solid fuels.	**10**	**CO4**	1,2, 3,8,9	**3**
4	Determination of Viscosity of Lubricating oil using Redwood viscometer.	**10**	**CO4**	1,2, 3,8,9	**3**
5	Determination of Viscosity of Lubricating oil using Saybolt viscometer.	**10**	**CO4**	1,2, 3,8,9	**3**
6	Valve Timing/Port opening diagram of an I.C.	**10**	**CO4**	1,2, 3,8,9	**3**
7	Determination of areas of Regular & irregular shapes using Planimeter	**10**	**CO4**	1,2, 3,8,9	**3**
8	Performance Tests on I.C. engines, calculations and heat balance sheet for 4-stroke Engine	**10**	**CO4**	1,2, 3,8,9	**3**
9	Performance Tests on I.C. engines, calculations and heat balance sheet for 4-stroke petrol engine.	**10**	**CO4**	1,2, 3,8,9	**3**

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	2	14	28
2	Integrated Lab Component	2	14	28
3	Student Study Hours – Self Learning	1	14	14
4	Tutorial Component	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	14
6	Evaluation of Learning Process	-	-	08
Total Learning Hours/Semester				**120**

Assessment Plan (for50marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity1- Industrial visit to cold storages, Refrigerator repairing unit, Prepare report and presentation - 10Marks 2) Details of activity2 – Preparing working model, Prepare report and presentation -10Marks	20
Total		**50**

Module	Activity Description	Hours
1	To Demonstrate gas power cycles using virtual lab	2
2	To Demonstrate Methods to improve the efficiencies of gas turbine and Rankine cycle	3
3	To Visit nearby cold storages, Refrigerator repairing unit- to study the performance & Improving the losses-Prepare report and presentation	3
4	To Demonstrate single & Multistage air compressor using virtual lab and Calculate various efficiencies	3
5	To Visit chemistry laboratory to perform the flue gas apparatus & Carryout the combustion reaction using exhaust gas analysis	3
	Total	**14 hrs**

Course Articulation Matrix

Course Out comes													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	-	-	-	-	2	2	-	-	-	-
CO2	2	3	3	-	-	-	-	2	2	-	-	-	-
CO3	2	3	3	-	-	-	-	2	2	-	-	-	-
CO4	2	3	3	-	-	-	-	2	2	-	-	-	-

Course Title	MEASUREMENT SCIENCE AND METROLOGY (Lab Integrated)		
Course Code	25ME405	LTPC	28-0-28-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28P+34ABL=90

Course objectives:

To impart knowledge of measurement techniques and systems used in general and engineering practices.

Course Outcomes (COs){with mapping shown against the **Program Outcomes (POs)}**

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	apply appropriate principles and procedures for the measurement of different physical quantities	1	-
2.	apply the principles of metrology in the design of gauges	1, 2	-
3.	identify and demonstrate appropriate measurement systems for different applications	1, 2, 8,	-

Module –I	07 Hrs.
Measurements: Methods of measurements, generalized measurement system, performance characteristics of measurement systems. Errors in measurements. Transducers: Classification, types, and their functions. **Measurement of strain:** Introduction, principle of strain gauges, types, gauge orientation, Wheatstone bridge circuit and bridge configurations.	
Module –II	**06 Hrs.**
Force measurements-proving ring, load cell, etc. **Torque measurement**: Mechanical and electrical dynamometers. **Pressure measurements:** Methods of measuring pressure - use of elastic members, measurement of low pressure- McLeod gauge, thermal conductivity gauges. **Temperature measurements**: Classification of temperature measuring devices, resistance thermometer – principle and operation, thermocouple- laws and materials used, and pyrometers.	
Module – III	**06 Hrs.**
Metrology: Standards of measurement, slip gauges, building of slip gauges. **Limits, fits and tolerances:** Principles of interchangeability and selective assembly, tolerances, limits of size, types of fits, ISO system of limits and fits.	
Module –IV	**07 Hrs.**
Design of gauges: Types and classification of gauges, hole basis system and shaft basis system. Design of gauges (Taylor's Principles) with numerical examples.	
Lab components: ➢ Calibration of Load cell, LVDT, Determination of young's modulus for a given material in bending using strain gauges, Speed measurement using stroboscope. ➢ Calibration of Pressure gauge and Calibration of thermocouple. ➢ Measurement of angle by Sine center, Measurement of gear tooth elements using gear tooth Verniercaliper, Roundness testing and Mechanical comparators. Activity on Plug and ring gauges.	

TEXT BOOK:

1. Thomas G. Beckwith, Roy D. Marangoni& John H. Lienhard V, **"**Mechanical Measurements", Pearson education Inc. 5th edition, 2004. ISBN: 0201569477.
2. R.K. Jain, **"**Engineering Metrology" – Khanna Publishers, 20th edition, 2008. ISBN: 81-7409-153-8.

REFERENCE BOOKS:

1. Anand K. Bewoor and Vinay A. Kulkarni, **"**Metrology and Measurements", TMH, 2009. ISBN:978-0-07-014000-4
2. A.K. Sawhney and PuneethSawhney, **"**Mechanical Measurements and instrumentation", DhanpatRai& Sons, 12thedt., 2013.

(Lab Activity)	Experiment Name	Marks	COs	POs	Level
1	i) Calibration of Load cellandLVDT(Average Marks) ii) Determination of young's modulus for a given material in bending using strain gauges, iii) Speed measurement using stroboscope.	5	3	1,2,8,9	3
2	iv) Calibration of Pressure gauge, v) Calibration of thermocouple.(Average Marks)	5	3	1,2,8,9	3
3	vi) Measurement of angle by Sine center, Measurement of gear tooth elements using gear tooth verniercalliper vii) Roundness testing, Mechanical comparators (Average Marks)	5	3	1,2,8,9	3
4	viii) Plug and ring gauges	5	3	1,2,8,9	3
	Average of All activity = 20 marks	**26 Hrs.**			

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	2	14	28
2	Practical	2	14	28
2	Student Study Hours – Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	07
4	Activity Based Learning **(ABL)**	-	-	27
Total Learning Hours / Semester				**90**

Assessment Plan (for 20 marks of CIE):

Tool	Remarks	Marks
CIE	Two CIEs conducted for 50marks each and reduced to 15 marks	30
Lab	**Lab Component** ➢ Calibration of LVDT, thermo couple, pressure gauge, and Load cell. ➢ Measurement of angle by Sine center, ➢ Measurement of gear tooth elements using gear tooth vernier caliper ➢ Roundness testing, Mechanical comparators	10
Lab CIE	**Conduction of Lab CIE**	05
ABL	1. Students should select any two automobile components from the nearest workshop or services center, and all minor and critical dimensions should be measured using available measuring instruments in the lab. 2. Draw a 2D drawing of a measured automobile component, highlighting its dimensions using proper notations on an A4 sheet.	05
Total		**50**

Activity Based Learning (27 Hours)

ABL 1: Determination of dimensions of selected automobile components (20 Hrs)		
4–5 students per group	Selecting an automobile component.	5
	Cleaning and study of component application	5
	Taking the dimensions of two components using instruments	5
	Chart preparations	5
ABL 2 : Draw a 2D drawing **(07Hrs)**		
Individual	Draw a 2D drawing of a measured automobile component, highlighting its dimensions using proper notations on an A4 sheet.	7
Total		**27**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test (1, 2 and 3)	3
Lab CIE	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**3**							**2**	**2**				
CO2	**2**	**3**						**2**	**2**				
CO3	**2**	**3**						**2**	**2**				

Course Title	KINEMATICS OF MACHINES		
Course Code	ME406	LTPC	28-28-0-3
Exam	03 Hours	Hours / Week	03
SEE	50 Marks	Total hours	28L+28T+28 ABL=90

Course Objective:
Carryout motion analysis of linkages using graphical and analytical techniques

Course Outcomes (COs) {with mapping shown against the **Program Outcomes (POs)**}
Upon completion of the course, students shall be able to:

COs	Statement	POs
1.	explain the principles of kinematic pairs, mechanisms, inversions, and machine elements, and analyze the kinematic behavior of planar mechanisms.	1, 2,5,8,9
2.	determine the position, velocity, and acceleration of mechanisms, and design cam profiles using graphical, analytical, and modern engineering tools.	1,2,3,5,8,9
3.	analyze gears and gear trains for motion transmission, and apply simulation and AI-assisted engineering tools to evaluate and optimize mechanism performance.	1,2,3,5,8,9

Course contents:

Module -1	10 Hrs.
Definitions: Introduction to Link, Kinematic Pairs, Degrees of freedom. Kinematic chain, Mechanism, Inversion, Machine, Grubler's criterion. **Linkages:** Four bar chain and its inversions, Single slider chain and its inversions, Double slider chain and its inversions, Kinematic chain with three lower pairs, Quick return motion mechanisms, Straight line mechanisms, Pantograph, Intermittent motion mechanisms, Toggle mechanism, Ackerman steering gear mechanism, Hooke's Joint.**Introduction to AI-assisted mechanism synthesis and optimization**; **AI applications in robotic linkage design using simulation tools.**	
Module- 2	**10 Hrs.**
Velocity analysis: Determination of velocity by instantaneous center method and relative velocity method, Problems. **Acceleration analysis:** Determination of acceleration, Coriolis component of acceleration, Problems. Klein's constructions for slider crank mechanism. Velocity and acceleration analysis using loop closure equation.	
Module- 3	**10 Hrs.**
Cams: Types of cams, Types of followers, Displacement - constant velocity, Simple Harmonic Motion, Uniform Acceleration & Retardation Motion, Cycloidal motion. Cam with knife edge follower, roller follower (in-line, offset), flat faced follower and oscillating follower. Problems on drawing cam profiles.**AI-assisted cam profile optimization for improved follower motion and reduced vibration**.	
Module- 4	**10 Hrs.**
Gears: Law of gearing, Definitions, Terminology of gears, Characteristics of involute action, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute & cycloidal teeth. Basics of Bevel, Helical, Spiral, Worm, Rack and Pinion, central distance, Efficiency. Problems. **AI applications in gear fault diagnosis and predictive maintenance** **Gear Trains:**Simple and Compound gear trains, Epicyclic gear trains. Problems on gear trains by tabular method. Differentials.	

Self- Study Component:

1. Demonstrate the following Mechanisms using **The Virtual Lab**
   (http://www.vlab.co.in/broad-area-mechanical-engineering)
   - Position analysis of Slider crank mechanism
   - Velocity analysis of Slider crank mechanism
   - Acceleration analysis of Slider crank mechanism
   - Position analysis of Elliptical Trammel
   - Hart Straight Line Mechanism
   - Peaucellier Straight Line Mechanism
   - Elliptical Cam Mechanism
   - Eccentric Cam Mechanism
   - Tchebichev Straight Line Mechanism
   - Whitworth Mechanism
   - Crank and Slotted Mechanism
   - Universal Joint
2. CAM Module and Gear profile module generation using **MechAnalyser** (**MechAnalyzer** is a 3D model based open source software developed by IIT Delhi).
   (http://www.roboanalyzer.com/mechanalyzer.html)
3. Visit the college workshop and list the different kinematic mechanisms used in machines and automobiles.

Tutorials

1. **Basics of Kinematics** – Links, kinematic pairs, chains, mechanisms, DOF (Gruebler's criterion).
2. **Mechanisms and Inversions** – Four-bar, slider-crank, quick return, straight-line, toggle, steering gear, Hooke's joint.
3. **Velocity & Acceleration Analysis** – IC method, relative velocity, acceleration, Coriolis acceleration, Klein's construction.
4. **Cam Mechanisms** – Motion curves and cam profile construction.
5. **Gears & Gear Trains** – Gear terminology, involute gears, interference, simple, compound, and epicyclic gear trains.
6. **Virtual Lab & Applications** – Mechanism demonstrations, MechAnalyzer exercises, and identification of mechanisms in workshop machines and automobiles.

Text Book

1. Bevan, T., *The Theory of Machines*, 3rd Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2018. ISBN: 9789387964389
2. Rattan, S. S., *Theory of Machines*, 5th Edition, McGraw Hill Education, New Delhi, 2019. ISBN-13: 9789353166281.

Reference Books:

1. **Singh, S.**, *Theory of Machines: Kinematics and Dynamics*, 3rd Edition, Pearson India Education Services Pvt. Ltd., New Delhi, 2019. ISBN: **9789353944315**.
2. **Ambekar, A. G.**, *Mechanism and Machine Theory*, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2019. ISBN: **9789389347548**.

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3) Details of activity 1- Mechanism Identification and Analysis/ **AI-assisted mechanism synthesis and optimization** -10Marks 4) Details of activity 2 –Virtual Lab / MechAnalyzer/ **AI applications in robot linkage design / and predictive maintenance of gear systems**.-10Marks	20

Activities Mapped to Modules:

Module	Activity Description	Hours
1	AI-assisted mechanism synthesis and optimization of a four-bar or slider-crank mechanism using MechAnalyzer/AI tools.	7
2	Velocity and acceleration analysis of a slider-crank mechanism using Virtual Lab and comparison with analytical results.	7
3	Cam profile generation and optimization using MechAnalyzer/CAD tools.	7
4	AI-based case study on robot linkage design and predictive maintenance of gear systems.	7
	Total	**28**

Evaluation of Learning Process (7Hours)

Type of Evaluation	Hours
CIE	3 Hrs
Semester End Examination (SEE)	3Hrs
Total	06

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			3			2	2				
CO2	3	3	2		2			2	2				
CO3	3	3	2		3			2	2				

Course Title	Data Visualization and Analysis using Tableau and Power BI (Ability Enhancement Course Lab)		
Course Code	25ME407A	LTPC	0-0-28-1
Exam	03Hours	Hours / Week	01
SEE	50 Marks	Total hours	28P+02ABL=30

Course Objective:

To provide hands-on experience in preparing, analyzing, and visualizing datasets using Power BI or Tableau for generating business insights through interactive dashboards and reports.

Course Outcomes (COs) {with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	Statement	POs
1	Apply data preparation and transformation techniques using visualization tools	2,5,10
2	Create interactive dashboards and visual reports for real-world business datasets.	2,5,10

Course Contents:

List of Experiments
1. Load and clean a dataset using built-in data preparation tools
2. Create bar charts, column charts, and line graphs for sales or revenue data
3. Design interactive dashboards with filters and slicers
4. Use calculated fields and DAX expressions (Power BI) or Table Calculations (Tableau)
5. Build KPI indicators and trend lines for business metrics
6. Create heatmaps and geographical maps for region-wise analysis
7. Implement drill-down and drill-through functionality
8. Perform time-series analysis using date hierarchies
9. Combine multiple datasets using joins and relationships
10. Create pie charts, tree maps, and donut charts for category-wise breakdown
11. Apply conditional formatting and data labels for insights
12. Use bookmarks and buttons to build guided dashboards (Power BI only)
13. Publish dashboards to the Power BI service or Tableau Public
14. Build a mini-project: visualize a complete case study (e.g., sales, HR, finance)

TEXTBOOKS:

1. Flach, Peter. Machine learning: the art and science of algorithms that make sense of data. Cambridge University Press, 2012.

REFERENCES:

1. Artificial Intelligence: AI is Nearby, Emerging Library Technologies © 2018 Elsevier Ltd. All rights reserved.

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	-	-	-
2	Practical	2	14	28
2	Student Study Hours – Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	-
4	Activity Based Learning **(ABL)**	-	-	02
Total Learning Hours / Semester				**30**

Activity Based Learning (02 Hours)

ABL: Compare raw vs. preprocessed data in terms of model performance.
Prepare a table comparing supervised vs. unsupervised algorithms with examples. (02Hrs)

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	-	2	-	-	-
CO2	2	-	-	-	3	-	-	-	-	2	-	-	-

Course Title	PLC AND AUTOMATION (Ability Enhancement Course Lab)		
Course Code	25ME407B	LTPC	0-0-28-1
Exam	3 Hours	Hours / Week	01
SEE	50 Marks	Total hours	28P+02ABL=30

Course Objective:

To provide students with hands-on experience in designing, programming, and troubleshooting industrial automation systems using Programmable Logic Controllers (PLCs).

Course Outcomes:

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	develop and implement ladder logic programs sheet metal forming operations using PLC	1, 5, 8	2
2	interface and operate various industrial sensors and actuators for automated processes	1,5, 8	2
3	program a six-axis articulated Robot for different application.	1, 5, 8	2

`

Exp NO.	EXPERIMENT NAME	Cos	Pos	Level
1.	Developtheladderdiagramforcylinderforward-reverseoperationandexecute it using PLC.	**1, 2**	**1, 5, 8**	**3**
2.	Develop the ladder diagram for performing V-bending operation on sheet metal and execute it using PLC.	**1, 2**	**1, 5, 8**	**3**
3.	Develop the ladder diagram for performing shearing operation on sheet metal and execute it using PLC.	**1, 2**	**1, 5, 8**	**3**
4.	Develop the ladder diagram for performing edge bending operation on sheet metal and execute it using PLC.	**1, 2**	**1, 5, 8**	**3**
5.	Develop the ladder diagram for level control and execute it using PLC.	**1, 2**	**1, 5, 8**	**3**
6.	Develop the ladder diagram for bottle filling process and execute it using PLC.	**1, 2**	**1, 5, 8**	**3**
7.	Develop PLC programs using virtuallab plat form and simulate.	**1,2**	**1, 5, 8**	**3**
8.	Programming of six axis articulated Robot for pick and place operation.	**3**	**1, 5, 8**	**3**
9.	Programming the Robot to generate Arcs, Spline and Circle.	**3**	**1, 5, 8**	**3**
10.	Develop Robot programs using virtuallabpl at form and simulate.	**2, 3**	**1, 5, 8**	**3**

Scheme of Evaluation

Evaluation Type	Evaluation modules	Marks
Continuous internal Evaluation (CIE)in every lab session by the Course coordinator	Conductionofexperimentsfrom1to 10	30
	Record writing	20
	CIE	**50**
Semester End Examination		
1.Oneexperimentfrom 1 to4		20
2.Oneexperimentfrom 5, 6, 8 & 9		20
3.Viva-Voce		10
	SEE	**50**

Teaching -Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	-	-	-
2	Practical	2	14	28
2	Student Study Hours– Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	-
4	Activity Based Learning **(ABL)**	-	-	02
Total Learning Hours/ Semester				**30**

Activity Based Learning (02 Hours)
Develop ladder diagram for various industrial applications.

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3				3			2					3
CO2	3				3			2					3
CO3	3				3			2					3

Course Title	AI For Mechanical Engineering & Prompt Engineering		
Course Code	25ME407C	LTPC	0-0-2-1
Exam	03 Hours	Hours / Week	02
SEE	50 Marks	Total hours	30

Course Objective:

To bring awareness on importance of Artificial Intelligence and applications of Arduino in solving engineering problems

Course Outcomes (COs) {with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	Statement	POs
1	develop the ability to utilize libraries of Arduino used in scientific computation	5
2	apply Arduino Programming skills to analyze and solve engineering problems	2, 5

Course Contents:

Part A

1. AI Driven Thermal Monitoring System.
2. Smart Industrial Noise Classification System.
3. Intelligent Obstacle Avoidance System.
4. Predictive Maintenance of Motors.
5. AI Driven Smart Fan.
6. AI Driven Sorting System.

Part B

7. Human Following Robot.
8. AI Driven Facial Recognition Attendance System.

SEE Scheme:

One Question from Part A	15
One Question from Part B	25
Viva Voce	10

Teaching - Learning – Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	-	-	-
2	Practical	2	14	28
2	Student Study Hours – Self Learning	-	-	-
3	Evaluation of Learning Process	-	-	-
4	Activity Based Learning **(ABL)**	-	-	02
Total Learning Hours / Semester				**30**

Activity Based Learning (02 Hours)

ABL: Import real world data from different industrial domains and develop models for the same. **(02Hrs)**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-	-

Course Title	BIOLOGY FOR ENGINEERS		
Course Code	25ME409	L-T-P-C	14-0-0-1
Exam	3Hrs.	Hours/Week	01
SEE	50 Marks	Total Hours	14L+16ABL=30

Course objective

Realization of relation between Natural Engineering and man- made Engineering.

Course Outcomes: At the end of the course, student will be able:

#	Course Outcomes	Mapping to POs	Mappingt oPSOs
1.	Explain the structure and functions of various organ systems in humanBody in an engineering perspective	1,3	
2.	Relate the basic principles of engineering mechanics to human body	1,3	
3.	Explain the mechanical characteristics of various parts inhuman body	1,3	
4.	Describe the importance of different biomaterials and the properties	1,3	

MODULE-1	3Hrs

Introduction toHumanAnatomy: Overviewofhumananatomy,Structuralorganizationofthehumanbody cardiovascularsystem,endocrinesystem,digestivesystem,respiratorysystem,excretorysystem,lymphaticsyste m,nervoussystem,muscular system and skeletal system.

MODULE-2	4Hrs

SkeletalSystem: Structuralcompositionofbone,MechanicalPropertiesofbones,StressandStrain,BendingMom ent and torsional Loads, Area Moment of Inertia, Joints of human body and Degrees of Freedom

MODULE-3	4Hrs

MODULE – 3: Human Body as a Mechanical System – spine as levers, tendon as pulleys, teeth as wedges,MusculoSkeletalsystemaswheelandaxle,jointsasscrews,feetasinclinedplanes.Overviewofskeletal, muscular, cardiovascular, respiratory, nervous, digestive, urinary, endocrine, lymphatic, reproductive and integumentary system, Measuring mechanical strength of cells–osmolarity and elasticity of biological membranes

MODULE-4	3Hrs

MODULE – 4: Biomaterials: Definition, characteristics, examples, classification – metals, polymers, ceramics and composites, factors important for biomaterial science. Bio engineering (production of artificial limbs, joints andotherpartsofbody21sNano Biomolecules and its various types; Principles and Application of Biosensor; Basics of Biochips–Biofertilizer –Bioinformatics–Biofuel.

Textbooks:

1. Johnson, A.T. (2018). Biology for engineers. CRC Press.
2. ParkJB.Biomaterialsscience and engineering. SpringerScience&BusinessMedia;2012Dec.6.

Reference books:

1. Vaccari, D.A.,Strom,P.F.,&Alleman,J.E.(2005).Environmentalbiologyforengineersandscientists.JohnWiley &

Sons.
2. Netter,F.(2019).Atlas of Human Anatomy(7thed.).Philadelphia, PA: Saunders.
3. Tamura,R.,Yoshida,K.,&Toda,M.(2019).Currentunderstandingoflymphaticvesselsinthecentralnervoussystem.NeurosurgicalReview,43(4), 1055–1064.https://doi.org/10.1007/s10143.

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	1	14	14
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	10
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**30**

Tool	Remarks	Marks
CIE	Two CIEs conducted for 20marks each	40
Activity Details	Details of activities to be conducted- Seminar Presentation and report writing	10
Total		**50**

Module	Activity Description	Hours
1	Mechanical modeling of the Human Arm to learn how anatomy functions as a system of levers and actuators.	2
2	Stress & Strain Analysis of Bone Models to understand the mechanical behaviour of bones under load and design safe mechanical structural elements.	2
3	Design of a Biomechanical Pulley System to understand mechanical principles (levers, pulleys, inclined planes) to biological systems.	2
4	Material Selection for an Artificial Joints to understand material selection for biomechanical applications and understand bioengineering principles.	4
	Total	**10hrs**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3		1										
CO2	3		1										
CO3	3		1										
CO4	3		1										

Course Title	National Service Scheme (NSS)		
Course Code	25NYP2	(L-T-P) C	(0-0-28) 0
Exam	-	Hours/Week	01
SEE	-	Total Hours	14

Course Out Comes: At the end of the course, the student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the importance of his / her responsibilities towards society	6	-
2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	3, 6	-
3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	3, 6	-
4	Implement government or self-driven projects effectively in the field.	11	-
5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.	11	-

MODULE –1	8Hrs.

Water conservation techniques – Role of different stakeholders– Implementation.

MODULE –2	8Hrs.

Preparing an actionable business proposal for enhancing the village income and approach for implementation.

MODULE –3	8Hrs.

Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Yoga - II			
Course Code	25YOG2	**CIE**	100 Marks
Course Type	NCMC		
Total Hours	2 hrs/week		

Course Objectives

The objectives of this course are to:

1. Introduce students to the origin, history, philosophy, and fundamental concepts of Yoga.
2. Familiarize students with the different schools of Yoga, its aims, objectives, and the importance of prayer in Yogic practice.
3. Develop awareness of the rules, regulations, and safety precautions to be followed during Yogic practices.
4. Enable students to learn and practice Suryanamaskara and selected Yogasanas with proper techniques for improving physical and mental well-being.
5. Promote a healthy life style by encouraging regular Yogic practice, correcting misconceptions about Yoga, and fostering positive health, self-discipline, and overall wellness.

Patanjali's Ashtanga Yoga: Patanjali's Ashtanga Yoga, its need and importance. Yama: Ahimsa, satya, asteya, brahmacharya, aparigraha, Niyama : shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan, Suryanamaskar 12 count 4 rounds. Different types of Asanas: Sitting 1. Sukhasana, 2.Paschimottanasana, Standing1. Ardhakati Chakrasana, 2.ParshvaChakrasana, Prone line 1. Dhanurasana Supine line 1. Halasana, 2. Karna Peedasana

Kapalabhati: Meaning, importance and benefits of Kapalabhati. 40strokes/min3 rounds Pranayama–1. Suryanuloma–Viloma, 2.Chandranuloma-Viloma, 3-Suryabhedana, 4-Chandra Bhedana, 2.Nadishodhana, 3-BhramariPranayama, Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.
2. Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.
3. Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.
4. Analyze the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga.
5. Adopt Yoga as a regular life style practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.

Suggested Learning Resources: (Text Book /Reference Book/Manuals):

Text books:

5. George Feuerstein: the yoga Tradition (its history, literature, philosophy and practice)
6. Sri Ananda: The complete Book of yoga Harmony of Body and Mind (Orient paper Backs: Vision Books Pvt.Ltd..1982.
7. B.K.Slyenkar: Light on the Yoga sutras of Patanjali (Haper Collins Publications India Pvt.Ltd.New Delhi.)
8. Science of Divinity and Realization of Self Vethathiri Publication,(6-11)WCSC,Erode

Reference books/Manuals:

5. Principles and Practice of Yoga in Health Care,Publisher:Handspring Publishing Limited. ISBN:9781909141209,978190914209
6. BasavaraddiIV: Yoga in School Health, MDNIY NewDelhi. 2009
7. Dr.HR.Nagendra: Yoga Research and application (Vivekanda Kendra Yoga Prakashana Bengalore)
8. Dr.Shirley Telles: Glimpses of Human Body (Vivekanda KendraYoga Prakashana Bengalore).

Web links and Video Lectures (e-Resources):

Search by topics to get the videos

Assessment Structure:

This course is having only **Continuous Internal Assessment** (CIE) marks of 100.

Weightage	**Marks**
Attendance to all the sessions	20Marks
Practical sessions on Yoga and Its Benefits	40Marks
Two Assignments	40Marks
Total Marks	100

A student shall obtain a minimum of 40% marks or 40 marks out of 100 to qualify in the course.

PHYSICAL EDUCATION (SPORTS & ATHLETICS)– II						
Course Code	**:**	25PE2		**CIE**	**:**	**100 Marks**
Course Type	**:**	NCMC				
Total Hours	**:**	15 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

Module I: Ethics and Moral Values **4 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

Module II : Specific Games (Any one to be selected by the student) **16 Hours**

A. Volleyball –Attack, Block, Service, Upper Hand Pass and Lowerhand Pass.
B. Athletics (Track Events) –Any event as per availability of Ground.

Module III : Role of organisation and administration **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl.No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes/Assignment–2,eachof 20marks	40
3.	Final presentation/exhibition/Participation in competitions/ practical on specific tasks assigned to the students	40
	Total	**100**