MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programmes

BACHELOR of ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

SCHEME and SYLLABUS

(2024-25 Admitted Batch)

III AND IV SEMESTERS (SECOND YEAR)

Academic Year 2025-26

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 upskilling.
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.

PEO 4: Graduates will be lifelong learners.

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, modelling, 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 modelling 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).

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	10
CIE - 2	10
CIE - 3	10
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	10
Record Writing	20
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
Academic Year 2025-26

Third Semester B.E. Mechanical Engineering

Sl. No.	Course Category	Course Code	Course Title	Teaching Hours/Week				Duration in hours
				Theory Lecture	Tutorial	Practical/ Drawing	Credits	
				L	T	P	C	
1	BSC	24ME301	Probability and Statistics for Mechanical Engineering	3	1	0	3	4
2	IPCC	24ME302	Material Science and Engineering	2	0	2	3	4
3	PCC	24ME303	Mechanics of Materials	3	1	0	3	4
4	IPCC	24ME304	Manufacturing Process	2	0	2	3	4
5	PCCL	24ME305	Computer Aided Machine Drawing	2	0	2	3	4
6	ESC	24ME306A	Electric and Hybrid Vehicle Technology	2	0	2	3	3
		24ME306B	Smart Materials & Systems					
7	UHV	24SCR	Social Connect and Responsibility	0	0	2	1	2
8	AEC	24ME307	Advanced Python Programming	0	0	2	1	2
9	MC	24NYP1	NSS/YOGA/PE	0	0	2	0	2
Total				**14**	**2**	**14**	**20**	**29**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End,**ESC**: Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course

Course Title	**Probability and Statistics for Mechanical Engineering**		
Course Code	**24ME301**	**LTPC**	**3-1-0-3**
Exam	**04 Hours**	**Hours / Week**	**4**
SEE	**50 Marks**	**Total hours**	**42L+14T+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	-
2.	apply estimation and testing methods to make inference and modeling techniques for decision making.	1,2,3	-
3.	make appropriate decisions using statistical inference that is the central to experimental research.	1,2,3	-
4.	use statistical methodology and tools in reliability engineering problems and time series analysis	1,2,3	

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. **Probability Distributions:** Probability spaces, conditional probability, independent events, and Bayes' theorem, Binomial distribution; Poisson distributions; Normal distribution; Exponential distribution.	
Module- 2	**10 Hrs.**
Hypothesis Testing-I: 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	**10 Hrs.**
Hypothesis Testing-II: 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.

CourseArticulationMatrix

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	1	14	14
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 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**

Activity-Based Learning (ABL - 28 Hours)

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.	08
3	Solve numerical problems on hypothesis testing using Excel or R-Program	07
4	Case study on reliability and time series models	06
	Total	**28hrs**

Evaluation of Learning Process (7Hours)

Type of Evaluation	Hours
Test(1,2and3)	3
Presentation	1
Semester End Exam	3
Total	7

Course Outcomes	Program Outcomes[POs]													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**3**	**1**											
CO2	**2**	**3**	**2**											
CO3	**2**	**3**	**2**											
CO4	**2**	**3**	**1**											

Course Title	**MATERIAL SCIENCE & ENGINEERING (LAB INTEGRATED)**		
Course Code	**24ME302**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**02+02**
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, 2	-

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Course contents:

Module -1	**8 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	**8 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	**8 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	**08 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**	**CO1**	1,4,7,9,10	**3**
2	Determine Compressive strength of Ferrous & Non -Ferrous materials.	**20**	**CO1**	1,4,7,9,10	**3**
3	Determine Bending strength of Ferrous & Non -Ferrous materials.	**20**	**CO1**	1,4,7,9,10	**3**
4	Determine impact strength of Ferrous & Non -Ferrous materials.	**20**	**CO1**	1,4,7,9,10	**3**
5	Determine hardness of Ferrous & Non -Ferrous materials.	**20**	**CO1**	1,4,7,9,10	**3**
6	Grain size calculation for a given Microstructure	**20**	**CO2**	1,4,7,9,10	**3**
7	Heat treating a given material and evaluation of mechanical properties.	**20**	**CO2**	1,4,7,9,10	**3**
	Average of 7 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	Three CIEs conducted for 20 marks each and reduced to 10 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**

CourseArticulationMatrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			1			2		2	2				
CO2	3	2	1				2		2	2				
CO3	3	2					2		2	2				

Course Title	**MECHANICS OF MATERIALS**		
Course Code	**24ME303**	**LTPC**	**3-1-0-3**
Exam	**03 Hours**	**Hours / Week**	**04**
SEE	**50 Marks**	**Total hours**	**42L+14P+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**
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 and to draw deflection curve	1, 2
3.	evaluate the elements under torsion, elastic stability of columns & struts.	2, 3

Module – I	
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. Self-study: Stress strain curves for materials like cast iron, rubber, glass etc. Review of engineering constants and properties of materials	**10 Hrs.**
Module – II	
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. Self-study: Identify the applicationns of SFD, BMD under practical cases for overhanging beams considering point load, UDL, UVL and Couple.	**10 Hrs.**
Module – III **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) **Deflection of Beams:** Introduction, Definitions of slope, deflection. Elastic curve - derivation of differential equation of deflection curve. Sign convention, slope and deflection standard loading using Macaulay's method, Problems on Cantilever and simply supported beams to point load and UDL. Self-study: Practical implications of deflection in beams.	**10 Hrs.**

Module – IV	
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. **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. **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. Self-study: Identify situations involving long and short column effect.	**10 Hrs.**

Activity 1: Laboratory visit and prepare a report.
Activity 2: Conduct a minute quiz on the respective topics in each module.

Tutorials:

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 deflection of beams
13. Numerical on torsion of shaft
14. Numerical on thin and thick cylinder
15. Numerical on column's

Text Books:

1. James G.Gere, Mechanics of Materials, 5th Edition, 2004.Thomson Publishers. ISBN-0534417930
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

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	-	-	-
4	Tutorial component	1	14	14
5	Activity Based Learning (ABL1 & ABL2)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**90**

1. Laboratory visit and prepare a report (Group Activity)

Description: Students conduct tests on ferrous or non-ferrous materials and study its mechanical properties (tensile/compressive).

ABL1 (18 Hours): Laboratory Visit	**Hours**
Selection of material and preparation for lab	2
Visit to lab prepare standard test specimen	6
Interaction and observations at lab	3
Preparation of report (formatting, calculation, editing)	3
Report presentation and discussion	4
Total	**18**

2. Conduct quiz on the respective topics in each module

Description: Course faculty to conduct quiz on each module and take the average marks.

ABL2 (10 Hours): quiz	**Hours**
Practice and preparation for the quiz	8
Conduction and evaluation of quiz on each module	2
Total	**10**

CourseArticulationMatrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3							1					
CO2	2	3												
CO3		3	2											

Course Title	**MANUFACTURING PROCESS**		
Course Code	**24ME304**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**2+2**
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.	**26**

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	Three CIEs conducted for 20 marks each and reduced to 10 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**

Integrated Lab Component (28 Hours)

Activity Based Learning (26Hours)

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

CourseArticulationMatrix

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				

MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belgaum)

Course Title	COMPUTER AIDED MACHINE DRAWING		
Course Code	24ME305	LTPC	2-0-2-3
Exam	03 Hours	Hours / Week	04
SEE	50 Marks	Total hours	28L+28P+34ABL=90

Course Objective: Engineers must be able to convey ideas into a form which is communicated to the shop floor in a graphic language which is correct, clear and accurate so that they are self-explanatory and cannot be misinterpreted. This course aims at imparting comprehensive knowledge of both the principles of Machine Drawing and conventional practice of drafting as per ISO/BIS specifications.

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, 8, 10,12**	1
2.	select appropriate standard components available off-the –shelf and draw the assembly/orthographic/sectional views as per ISO/BIS standards	**5, 8, 10,12**	1
3.	create assembly drawings adopting ISO/BIS standards and communicate effectively among design/manufacturing/inspection personnel	**5, 8, 9, 10, 12**	1

Course contents:

	Part – A
1.	ISO and BIS Conventions in Machine Drawing. Dimensioning– Exercises on dimensioning practices. Introduction to intersection curves. Conic sections, Involutes, and cycloids. Conversion of pictorial views into orthographic projections of machine parts, Sections of Machine parts in simple positions.
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, Machine and cap screws. Stud bolt. Locking arrangements, Foundation bolts.
3.	**Permanent Fasteners: Riveted joints:** Simple joints, Rivet heads, Welded joints
4.	**Temporary Fasteners:** Keys, Cotter Joint and Knuckle joint**.** **Shaft Couplings:** Muff coupling, Split muff coupling, Flange couplings (Solid and Protected types), Pin type flexible coupling, Universal coupling, Oldham 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.	**Tool head of a shaper**

10.	**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	1	14	14
2	Integrated Lab Component	2	14	28
3	Student Study Hours - Self Learning	1	14	14
3	Activity Based Learning (ABL1)	-	-	27
4	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	One CIE conducted for 100 marks and reduced to 20 marks	20
Activity Details	Submission of printouts of computer-solved problems	30
Total		**50**

Activity Based Learning (27Hours)

ABL1(XX Hours) : Activity 1 details		**Hours**
1.	Computer-solved problems printouts of **Conversion of Isometric to orthographic views and sections of Machine parts in simple positions**	4
2.	Computer-solved problems printouts of **Threaded Fasteners**	4
3.	Computer-solved problems printout of **Permanent Fasteners: Riveted joints**	4
4.	Computer-solved problems printout of **Temporary Fasteners, Shaft Couplings**	6
5.	Computer-solved problems printout of **assemblies of Bearings, Screw jack, Simple Eccentric, Lathe tail stock, Tool head of a shaper , Machine swivel vice**	9
Total		27

Evaluation of Learning Process (7Hours)

Type of Evaluation	**Hours**
Test	3
Submission of printouts	1
Semester End Exam	3
Total	**7**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	2	-	3	-	3	3	-
CO2	-	-	-	-	3	-	-	2	-	3	-	3	3	-
CO3	-	-	-	-	3	-	-	2	-	3	-	3	3	-

Course Title	**ELECTRIC AND HYBRID VEHICLE TECHNOLOGY**		
Course Code	**24ME306A**	**LTPC**	**3-0-0-3**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**42L+48ABL=90**

Course Objective: To equip students with fundamental knowledge of the concept of electric vehicles, motors & drives for electric vehicles, concept of hybrid vehicles and fuel cell for electric vehicles.

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

Outcomes (POs)} upon completion of the course, students shall be able to:

	CourseOutcomes	**POs**
	describe about working principle of electric vehicles.	1,2
2.	explain the construction and working principle of various motors used in electric vehicles.	1, 2
#	describe the different types and working principle of hybrid vehicles.	1,2
1.	illustrate the various types and working principle of fuel cells.	1,2

Course Contents:

Module– 1	**10 Hrs.**
Introduction to Electric Vehicles: Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.	
Module – 2	**10 Hrs.**
Electric Vehicle Motors: Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.	
Module-3	**10 Hrs.**
Hybrid Vehicles: Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls.	
Module-4	**10 Hrs.**
Fuel Cells for Electric vehicles: Fuel cell – Introduction, Technologies & Types, Obstacles. Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics – Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle – System, Components, maintenance.	

TEXTBOOKS:

1. Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.
2. Jack Erjavec and Jeff Arias, "Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles", Cengage Learning Pvt. Ltd., New Delhi, 2007
3. MehrdadEhsani, YiminGao, sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.

REFERENCESBOOKS:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Hybrid, Electric & Fuel-Cell Vehicles Jack Erjavec, Delmar, Cengage Learning.
5. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.

E-Books / Web References:

www.wiley.com/go/electricvehicle2e

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	-	-	-
4	Tutorial component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	42
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**90**

1. Indicative Experiments and prepare a report (Group Activity)

ABL1 (18 Hours): Indicative Experiments	**Hours**
Performance study of Lithium-ion battery for Electric Vehicle	5
Performance study of battery and motor cooling system in Electric Vehicle	5
Performance study on regenerative braking for PMSM motor	5
Fault diagnosis of battery using BMS in electric and hybrid vehicle.	5
Development of Energy Management system for SI engine with electric vehicle motor	5
Performance map development for SI engine to operate in hybrid mode	5
Report presentation and discussion	4
Total	**34**

2. Conduct quiz on the respective topics in each module

Description: Course faculty to conduct quiz on each module and take the average marks.

ABL2 (10 Hours): quiz	**Hours**
Practice and preparation for the quiz	6
Conduction and evaluation of quiz on each module	2

Total	**08**

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	1												
CO3	3	1												
CO4	3	1												

Course Title	**SMART MATERIALS AND SYSTEMS**		
Course Code	**24ME306B**	**LTPC**	**3-0-0-3**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**42L+48ABL=90**

Course objectives:

Students will learn how to analyze, create, and implement smart structures and materials, fluid-based systems, vibration control techniques, and biomimetics in engineering 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**
1	comprehend the principles and applications of smart structures	1, 2	-
2	explain the characteristics and applications of electro-rheological and magneto-rheological fluids	1, 2	-
3	acquire expertise in vibration control techniques, structure control, and biomimetics	1, 2	-

COURSE CONTENTS:

Module – I	**08 Hrs.**
Introduction: Closed-loop and Open-loop Smart Structures. Applications of Smart structures, Piezoelectric properties. Inchworm Linear motor, Shape memory alloys, Shape memory effect-Application, Processing, and Characteristics. **Shape Memory Alloys:** Introduction, Phenomenology, Influence of stress on characteristic temperatures, Modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators.	
Module – II	**08 Hrs.**
Electro rheological and Magneto rheological Fluids: Mechanisms and Properties, Characteristics, Fluid composition, and behaviour, Discovery and Early developments, Summary of material properties. Applications of ER and MR fluids (Clutches, Dampers, others). **Fibre Optics:** Introduction, Physical Phenomenon, Characteristics, Fibre optic strain sensors, Twisted and Braided Fibre Optic sensors, Optical fibres as load bearing elements, Crack detection applications, Integration of Fibre optic sensors and shape memory elements.	
Module – III	**08 Hrs.**
Vibration Absorbers: Introduction, Parallel Damped Vibration Absorber, Analysis, Gyroscopic Vibration absorbers, analysis & experimental setup and observations, Active Vibration absorbers. Control of Structures: Introduction, Structures as control plants, Modelling structures for control, Control strategies and Limitations. **Biomimetics:** Characteristics of Natural Structures. Fiber-reinforced: organic matrix natural composites, Natural creamers, Mollusks. Biomimetic sensing, Challenges, and opportunities.	
Module – IV	**07 Hrs**
Piezoelectric Sensing and Actuation: Introduction, Cantilever Piezoelectric actuator model, Properties of Piezoelectric materials, Applications. Magnetic Actuation: Concepts and Principles, Magnetization and Nomenclatures, Fabrication and case studies, Comparison of major sensing and actuation methods. **Case Studies:** MEMS Magnetic actuators, BP sensors, Microphone, Acceleration sensors, Gyro, MEMS Product development: Performance, Accuracy, Repeatability, Reliability, Managing cost, Market uncertainties, Investment, and competition.	

Self-learning components
➢ **Online Resources and Tutorials:** Recommend course-related online lessons or demos. Students can use virtual labs or simulations to interact with smart materials or fluid-based systems. ➢ **Case Studies and Real-World Applications:** Give students case studies or real-world application scenarios to use their understanding of smart structures, electro- and magneto-rheological fluids, vibration control, structural control, and biomimetics. Material selection, system design, and performance optimization are considered when students solve practical engineering challenges.

TEXTBOOK:

1. "Smart Structures –Analysis and Design", A. V. Srinivasan, Cambridge University Press, New York, 2001, (ISBN:0521650267).
2. "Smart Materials and Structures", M. V. Gandhi and B. S. Thompson Chapmen & Hall, London, 1992 (ISBN:0412370107).
3. "Foundation of MEMS, by Chang Liu. Pearson Education. (ISBN:9788131764756).

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)	-	-	28
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**90**

1. Case Studies and prepare a report (Group Activity)

ABL1 (20 Hours): Case Studies	**Hours**
High-band width, low strain smart sensors	5
Smart actuators	5
Smart composites	5
Advances in smart structures & materials	5
Total	**20**

2. Conduct quiz on the respective topics in each module

Description: Course faculty to conduct quiz on each module and take the average marks.

ABL2 (10 Hours): quiz	**Hours**
Practice and preparation for the quiz	6
Conduction and evaluation of quiz on each module	2
Total	**08**

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	1												
CO3	3	1												
CO4	3	1												

Course Title	**ADVANCED PYTHON PROGRAMMING**		
Course Code	**24ME307**	**LTPC**	**0-0-2-1**
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	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	3	-	-	-	-

Course Title	**SOCIAL CONNECT & RESPONSIBILITY**		
Course Code	**24SCR**	**L-T-P**	**(0-0-2)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
CIE	**100 Marks**	**Total Hours**	**28P+02ABL=30**

Course Objective:

Provideaformalplatformforstudentstocommunicateandconnectwiththeirsurroundings and create responsibleconnectionwithsociety.

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

#	Course Outcomes	Mapping to PO's
1	Describe societal challenges and build solutions to alleviate these complex social problemsthrough immersion, design&technology.	3,5,6
2	Communicateandconnectwiththeirsurroundings.	7,12

MODULE – 1

Plantation and adoption of a tree: Plantation of a tree that will be adopted by a group of students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE – 2

Heritage walks and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.

MODULE -3

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

MODULE -4

Water Conservation: knowing the presentpractices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **FoodWalk**City'sculinarypractices,food lore,andindigenousmaterialsoftheregionused in cooking.

Course Conduction

A total of 15-20 hours engagement per semester is required for the course. Students will be divided into teams and each team will be handled by two **faculty mentors**. Faculty mentors will design the activities for evaluation.

Guideline forAssessment Process:

ContinuousInternalEvaluation (CIE)

After completion of the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed andlearnedinthesocialconnectperiod.Thereportshouldbe signedbythementor.Thereportshallbeevaluateddon't hebasisof /orotherrelevant criteriapertainingto the activitycompleted.

- Dairy recording the details of activity conducted
- Planningand scheduling hesocialconnect
- Information/Data collected during the social connect
- Analysisoftheinformation/dataandreportwriting

Consideringallabove pointsallottingthemarksasmentionedbelow

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactory andfail	<=39

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: Plantation of tree and social gathering activity**(02Hrs)**

Course Articulation Matrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	2	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	3	-	-

IV SemesterAcademic Year 2024-25

MALNAD COLLEGE OF ENGINEERING, HASSAN **B.E. in Mechanical Engineering** **Scheme of Teaching and Examinations2023** **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **(Effective from the academic year 2023-24)**								
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	PCC	24ME401	Engineering Thermodynamics	4	1	0	4	5
2	IPCC	24ME402	Machining Science (Tradition &Non-Traditional)	2	0	2	3	4
3	PCC	24ME403	Theory of Machines	4	1	0	4	5
4	IPCC	24ME404	Measurements Science& Metrology	2	0	2	3	4
5	PCCL	24ME405	Energy Conversion Laboratory	0	0	2	1	2
6	ESC	24ME406A	Micro Electromechanical Systems	3	0	0	3	3
		24ME406B	Robotics and Automation					
7	BSC	24ME407	Biology For Engineers	2	0	0	2	2
8	AEC	24ME408	Introduction to AI & ML	0	0	2	1	2
9	UHV	24UHV	Universal Human Values	1	0	0	1	1
10	MC	24NYP2	NSS/YOGA/PE	0	0	2	0	2
Total				**18**	**2**	**08**	**22**	**30**

Course Title	**ENGINEERING THERMODYNAMICS**		
Course Code	**24ME401**	**LTPC**	**4-1-0-4**
Exam	**03 Hours**	**Hours / Week**	**05**
SEE	**50 Marks**	**Total hours**	**52L+14T+54ABL=120**

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**
1	describe basic concepts of thermodynamics, assess thermodynamic applications using the first/second law of thermodynamics, concepts of entropy and thermodynamic relations for analyzing thermodynamic systems	1, 2	-
2	apply the thermodynamic principles to evaluate the performance improvement of gas-power and vapour power cycles.	2,3,7	-
3	analyze the refrigeration systems and air-conditioning systems to carry out calculations on system performance.	2,3,7	-

COURSE CONTENTS:

Module –I	**13 Hrs.**
Basic Concepts in Thermodynamics: Basic concepts of Thermodynamics, Thermodynamic processes and cycles, Thermodynamic equilibrium (mechanical thermal & chemical equilibrium), Zeroth law of thermodynamics, Thermodynamic work, Expression for displacement work done in different processes through P-V diagrams. Heat-definition, comparison of work and heat, sign convention- Numerical Problems. **First Law of Thermodynamics:** Energy balance for closed systems - steady flow energy equation (SFEE) - First law applied to steady – flow engineering devices - PMMK-I - Numerical Problems. **Self-Learning Component**: Introduction, Microscopic and Macroscopic approaches. Thermodynamic system and properties, Mechanics definition of work and its limitations.	
Module –II	**13 Hrs.**
Second Law of Thermodynamics: - Limitations of first law of Thermodynamics, Cyclic heat Engine, Energy Reservoirs, Reversed Heat Engine, Kelvin-Planck and Clausius statements and its equivalence- Refrigerators, Heat Pump–COP - Perpetual Motion Machines (PMMK-II) Carnot cycle, Carnot's Theorem -– Numerical Problems. **Entropy& Thermodynamic relations** - Entropy Definition-Point function, Clausius theorem, Clausius inequality, Principle of increase in entropy- Calculation of Change in entropy for different processes through T-S diagrams, Numerical Problems. **Self-Learning Component**: Joule's Experiment-Equivalence of heat and work–COP	
Module –III	**12 Hrs.**
Gas power cycles: Air standard assumptions - Otto cycle - Diesel and Dual cycles - Comparison of Otto, Diesel and Dual combustion cycles – Numerical Problems. **Vapour power cycles**:Rankine cycle - Effects of pressure and temperature on Rankine cycle performance- Rankine cycle with Reheat and regeneration– Numerical Problems. **Self-Learning Component**: Carnot cycle and its drawbacks- Closed and open gas turbine cycles- Characteristics of an Ideal working fluid in Vapour power cycles.	

Module –IV	12 Hrs.

Refrigeration: Introduction to refrigeration -Refrigerator and heat pump- - Analysis vapour compression refrigeration system- Pressure–Enthalpy diagram- Methods to improve the performance – Numerical Problems. **Air-conditioning**: Introduction- Properties of atmospheric air- Psychometric properties- Psychometric chart- Psychometric processes and their representation on Psychometric chart- Types of air conditioning systems – Numerical Problems.

Self-Learning Component: Simple Vapour compression refrigeration &Vapour absorption refrigeration system-working principle- applications, methods of refrigeration.

TEXTBOOKS:

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 HANDBOOK:

1. B. T. Nijaguna and B. S. Samaga, Thermodynamic Data Handbook, Sudha Publications, 2001. ISBN 1234002388

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. T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologiest, Pearson Education, Fifth Edition. ISBN- 9788177582383
4. 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	4	14	56
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	1	14	14
5	Activity Based Learning (ABL1 & ABL2)	-	-	44
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**120**

AssessmentPlan(for50marks ofCIE):

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 activity1- Demonstrate basic thermodynamics concept-10Marks 4) Details of activity2 – Preparing working model-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.	8
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.	8
3	Develop visual, physical, and mathematical models in support of thermodynamics problem design and analysis	10
4	ThermoVR: A Virtual Laboratory to Enhance Learning in Engineering Thermodynamics	8
5	Case studies: Food processing and preservation, freezing and drying, cold storage, refrigerated containers and trucks.	10
	Total	**44 hrs**

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	-	-	1	-	-	-	-	-	-	-
CO3	-	3	2	-	-	-	1	-	-	-	-	-	-	-

Course Title	**MACHINING SCIENCE (Lab Integrated)**		
Course Code	**23ME404**	**(L-T-P) C**	**(2-0-2) 3**
CIE	**50**	**Hours/Week**	**2+2**
SEE	**50**	**Total Hours**	**28L +28P+ 36ABL = 90**

Course Objective: To impart a comprehensive understanding of machining science and its practical applications.

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	explain and apply the principles of machining processes, including chip formation, metal cutting mechanics, and temperature control	1, 2,8, 9,10	-
2	describe the parameters affecting tool wear, tool life, and surface finishing processes	1, 2, 9,10	-
3	explain the principle, process parameters and applications of various advanced machining and hybrid machining processes	1,2, 9,10	-

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	**06 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	**06 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	**06 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.

Lab Component

- Facing and countersinking, turning, taper turning, thread cutting, grooving, chamfering, and boring operations on the lathe.
- Machining rectangular, triangular &dovetail slots on the shaping machine. Face milling, milling keyways using end mill cutters, and gear cutting.

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Manufacturing Technology – Foundry, Forming and Welding",	P. N. Rao,	3rd	TMH	2008
2	Machining and Machine Tools	A.B. Chattopadhyay,	2nd	Wiley India Pvt. Ltd	2012

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	"Manufacturing Technology – Metal cutting and machine tools",	P. N. Rao	2nd	TMH	2009
2.	**"Modern machining process"**	Pandey and Shan	-	TATA McGraw Hill	2000

E Books and online course materials:

1. https://dokumen.pub/qdownload/manufacturing-science-2nbsped-8176710633-9788176710633.html

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=nRaEaRTaoMA
2. https://www.youtube.com/watch?v=UpoCvGW5XvM
3. https://www.youtube.com/watch?v=wbLItIE-78E
4. https://www.youtube.com/watch?v=G5eJZcY_R3g

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	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Lab	**Lab Component** Facing and countersinking, turning, taper turning, thread cutting, grooving, chamfering, and boring operations on the lathe. Machining rectangular, triangular &dovetail slots on the shaping machine. Face milling, milling keyways using end mill cutters, and gear cutting.	10
Lab CIE	**Conduction of Lab CIE**	05
ABL	**Report on Review of 5 Machining Research Articles**	05
Total		**50**

Activity Based Learning (28 Hours)

ABL : Review of 5 Machining Research Articles **(28Hrs)**		
Writing a **review** report on selected topic	Writing a critical review focusing on **industrial relevance, innovations, and sustainability**.	6
	Clear, concise summaries with critical insights for each paper.	6
	Strong comparison of methods, results, and innovations.	6
	Identifies research gaps, limitations, and future scope effectively.	5
	Well-organized, plagiarism-free, proper citations & references.	4
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 Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	2	2				
CO2	3	2							2	2				
CO3	3	1							2	2				

Course Title	**THEORY OF MACHINES**		
Course Code	**24ME403**	**LTPC**	**4-1-0-4**
Exam	**03 Hours**	**Hours / Week**	**05**
SEE	**50 Marks**	**Total hours**	**52L+14T+54ABL=120**

Course Objective: Carryout motion analysis of linkages using graphical and analytical techniques and to determine static and dynamic forces on machine elements

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.	analyze various mechanisms through degrees of freedom and carry out graphical and analytical analysis of static and dynamic forces on mechanisms and machines	1, 2,5	-
2.	resolve the balancing problems of medium and high-speed machinery	1,2,5	-
3.	analyze types of motion profiles and generate cam profile and velocity ratio of gear trains	1,2	-
4.	draw turning moment diagrams of mechanisms and analyze characteristics of flywheels andgovernors	1,2	-

COURSE CONTENTS:

Module-I	**13 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. **Static Force Analysis:** Introduction, Static equilibrium, Equilibrium of two and three force members. Member with two forces and torque, Free-body diagrams, Static force analysis of simple mechanisms.	
Module-II	**13 Hrs.**
Dynamic Force Analysis: Inertia force, inertia torque, Determination of inertia force- engine mechanism, Engine force analysis. **Balancing of Rotating Masses:** Static Balancing, Dynamic Balancing of rotating masses-effect of single rotating mass, effect of two rotating masses not in the same plane of rotation; several masses rotating in a single and different transverse plane, Graphical and analytical methods.	
Module- III	**12 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 and roller follower. **Gears and Gear Trains:** Introduction, Problems on Epicyclic gear trains by tabular method	
Module- IV	**12 Hrs.**
Fly wheel: Engine output torque, turning moment diagrams of I.C. Engines and multi cylinder Engine, Fluctuation of Energy, Fly wheel design for I.C. Engine and size for punching press. **Governors**: Principle of Governors, Types, force analysis of Porter, Proell and Hartnell governors, Controlling force, stability, sensitiveness, effort and power of governors, governor characteristics.	

TEXTBOOKS:

1. R.S. Khurmi, *Theory of Machines*, S Chand; 14th edition,2020. ISBN-812192524X.
2. Rattan S.S., *Theory of Machines*, TMH, Third Edition, 2011. ISBN-13:978-0-07-0144774.

REFERENCE BOOKS:

1. Hamilton H. Mabie and Fred W. Ocvirk, *Mechanisms and Dynamics of Machinery*, John Wiley & Sons. ISBN-0471802379.
2. Shigley. J. V. and Uickers, J. *Theory of Machines & Mechanisms* TMH, 6th Edition, 2003. ISBN-04718-0237-9, ISBN-019515598X.
3. DR. JagadeeshLal, *Theory of Mechanisms and Machines*, Metropolitan Book Co. Pvt. Ltd, 2005. ISBN: 8120000749.

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	2	14	28
5	Activity Based Learning (ABL1 & ABL2)	-	-	30
6	Evaluation of Learning Process	-	-	06
Total Learning Hours / Semester				**120**

AssessmentPlan(for50marks ofCIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 5) Details of activity1-Mechanism Model Making-10Marks 6) Details of activity2 – Preparing working model-10Marks	20
Total		**50**

Module	Activity Description	Hours
1	Mechanism Model Making (Group Activity): Students build working models of mechanisms (e.g., four-bar chain, slider-crank, Geneva mechanism) using cardboard, wood, or 3D-printed parts.	6
2	Mechanism Simulation using Software: Students model a mechanism and simulate its motion to observe velocities and accelerations of links. **Tools:** Use software like Working Model, Autodesk Fusion 360, Solid Works Motion, or MATLAB Simscape.	6

3	Cams and Followers: Design a cam in AutoCAD/SolidWorks for a specified displacement diagram (e.g., rise-return-dwell).	6
4	.Model Construction & Working Principle: Build a Watt Governor or Porter Governor to visualize centrifugal force-based speed control	6
5	Balancing of Rotating Masses:Use a balancing machine or simulated setup where rotors with uneven mass distribution are balanced by adding/removing weights	6
	Total	**30hrs**

Evaluation of Learning Process (6 Hours)

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

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**			**1**									
CO2	3	**2**			**1**									
CO3	3	**2**												
CO4	3	**2**												

Course Title	**MEASUREMENT SCIENCE AND METROLOGY (Lab Integrated)**		
Course Code	**24ME404**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**02+02**
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, 12	-

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's 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 Verniercalliper, 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, 12th edt., 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	Three CIEs were conducted for 20 marks each and reduced to 10 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**

CourseArticulationMatrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**													
CO2	**2**	**3**												
CO3	**2**	**3**						**2**				**1**		

Course Title	**ENERGY CONVERSION LABORATORY**		
Course Code	**24ME405**	**LTPC**	**0-0-2-1**
Exam	**03 Hours**	**Hours / Week**	**02**
SEE	**50 Marks**	**Total hours**	**28P+02ABL=30**

Prerequisites: Basic & Applied thermodynamics, Fluid mechanics

Course objectives: To provide students with the necessary skills to conduct experiments, collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures to understand characteristics of different fuels, energy conversion and performance of I.C. Engines.

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.	Evaluate characteristic properties of fuels and oils using suitable tests and suggests their importance in real life situation.	1, 2,8,9	-
2.	Determine areas of regular/irregular surfaces using Planimeter, observe and draw valve timing diagram for both SI and CI engines.	1, 2,8,9	-
3.	Evaluate the performance of IC engines.	2,7, 8,9	-

Course Contents:

PART – A

1. Determination of Flash and Fire point of Lubricating oil using open cup and closed cup apparatus.
2. Determination of C.V. of solid fuels.
3. Determination of Viscosity of Lubricating oil using Redwood &Sayboltviscometer.
4. Valve Timing/Port opening diagram of an I.C. engine
5. Determination of areas of Regular & irregular shapes using Planimeter

PART – B

6. Performance Tests on I.C. engines, calculations and heat balance sheet for
   a) 4-stroke Engine.
7. Performance Tests on I.C. engines, calculations and heat balance sheet for
   b) 4-stroke petrol engine.
8. Performance Tests on I.C. engines, calculations and heat balance sheet for
   c) Two stroke petrol engine.

SEE Scheme:

1.	One experiment from either 1 to 5	15 Marks
2.	Any one performance test either from6, 7 or 8	25 Marks
3.	Viva Voce	10 Marks
	Total:	50 Marks

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**

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Activity Based Learning (02 Hours)

ABL: Compare the properties of different fuels by performing flash point, fire point, viscosity and calorific value tests and find out which is suitable for the better performance of the given engine. **(02Hrs)**

CourseArticulationMatrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**						**1**	**1**					
CO2	**3**	**3**						**1**	**1**					
CO3	**3**	**3**					**2**	**1**	**1**					

Course Title	**MICRO ELECTROMECHANICAL SYSTEMS**		
Course Code	**24ME406A**	**LTPC**	**3-0-0-3**
Exam	**03Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

Course Objective: To study various MEMS fabrication technologies and applications of various Micro sensors and Micro actuators.

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

#	Course Outcomes	Mapping to Pos
1	explain the micromachining techniques for specific MEMS fabrication process	1,5
2	explain the working principles of micro sensors, actuators, motors, valves, pumps, and fluidics used in Microsystems	1, 5
3	explain the applications of Thermal Sensors and Actuators and recent developments in micro-optical systems	1,5,12

Course Contents:

Module – 1	**10 Hrs.**
Introduction: Background and Introduction, Production Engineering, Precision and Ultra-Precision Engineering, Integrated circuits, Micro electromechanical systems.M**icro Machining:** Introduction, Photolithography, structural and sacrificial materials, other lithography methods, thin film deposition, impurity doping, etching, problems with bulb micromachining, surface micromachining, wafer bonding.	
Module – 2	**10 Hrs.**
Mechanical Sensors and Actuators: System on A Chip, Passive Electronic and Mechanical Systems, Principles of Sensing and Actuation, Beam and Cantilever, Micro plates, Capacitive effects, piezo electric materials as sensing and actuating elements, Shear mode piezo actuator, griping piezo actuator, inchworm technology.	
Module – 3	**10 Hrs.**
Thermal Sensors and Actuators: Introduction, micro machined thermo couple probe, thermal flow sensors, micro plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys, U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator,	
Module – 4	**10Hrs.**
Review on properties of light, light modulators, beam splitter, micro lens, micro mirrors Digital micro mirror device, light detectors, grating light valve, optical switch, wave guide and tuning	
SELF STUDY: 1. Magnetic Sensors and Actuators 2. Application of MEMS in Automotive Industry. 3. Micro Fluidic, Chemical and Bio-Medical Micro Systems	
TEXT BOOK: **1.** NitaigourPremch and Mahalik, Micro – Electromechanical Systems, Tata McGraw Hill Publishing Company Ltd 2007. ISBN:13-938-0-07-063445-9	

REFERENCE BOOKS:

1. Tai-Ran Hsu, MEMS and Microsystems- Design, Manufacture and Nanoscale Engineering, John Wiley & Sons, INC. 2008. ISBN: 978-0-470-08301-7.

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	42
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**90**

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity1- Seminar and present the report -10Marks 2) Details of activity2 – Case study and present the report-10 marks	20
Total		**50**

Module	Activity Description	Hours
1	**Seminar Topic:**Scaling laws in miniaturization, Materials for MEMS, MEMS fabrication process and micro manufacturing, Micro sensors and Micro-actuators, Microfluidics.	21
2	**Case Studies**: Application of MEMS devices for – Smart home, visually impaired, surgery, Brain sensors, Self-driving car, Wearable sensors, pollution monitoring and other emerging areas/products; Modelling and analysis of MEMs devices.	21
	Total	**42 hrs**

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				2									
CO2	3				2									
CO3	3				2							1		

Course Title	**ROBOTICS AND AUTOMATION**		
Course Code	**24ME406B**	**LTPC**	**3-0-0-3**
Exam	**03Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**42L+48ABL=90**

Course Objectives: To make students apply the principles and strategies of Robotics and Automation tools while creating a new facility or upgrading the conventional systems to automated systems.

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	interpret the fundamental principles and tools of Robotics and Automation systems.	1, 2	-
2	Apply the concepts of Robotics and Automation while upgrading the manufacturing system facilities of an automated production system.	3, 5	2

Course Contents:

Module - 1	**10 Hrs.**
Introduction: Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations, Types of Drive Systems, Wrist & Gripper Subassemblies, Robot Controls, Robot Applications in Manufacturing.	
Module - 2	**10Hrs.**
Robot Sensing & Vision: Introduction to Various Sensors and their Classification, Use of sensors, Machine Vision System: Sensing, Digitizing, Image Processing and Analysis, Application of Machine Vision System. **Robot teaching & industrial Applications:** Various Teaching Methods, Motion Interpolation, Robot Language Structure, WAIT, SIGNAL & DELAY Commands, Branching, Motion commands, End effector and Sensor commands, Typical Programming Examples such as Palletizing.	
Module – 3	**10 Hrs.**
Introduction to Automation: Production System Facilities, Automation in Production Systems: Types of Automation, Computerized Manufacturing Support Systems, and Reasons for automating a production system, Automation Principles and Strategies, Levels of Automation. Basic Elements of an Automated System, Advanced Automation Functions.	
Module – 4	**10 Hrs.**
Automated Manufacturing Systems: Manufacturing System, Components of Manufacturing System, The 10 principles of Material handling, AGVs, Automated storage system, Types of automated assembly system, Flexible Manufacturing System, Elements of FMS, Computer Aided Process Planning, Advanced Manufacturing Planning, introduction to Programmable Logic controller.	

TEXTBOOKS:

1) Groover, Weiss, Nagel "**Industrial Robotics**", McGraw Hill International, ISBN 10: 1259006212
2) Mikell.P. Groover, "**Automation, Production Systems and Computer Integrated Manufacturing**", Fourth Edition, Pearson Education, Limited, 2015. ISBN: 1292076119, 9781292076119.

REFERENCE BOOKS:

1) Fu, Lee and Gonzalez, "Robotics, control vision and intelligence", McGraw Hill International, ISBN – 8131518124
2) StamatiosManesis&George Nikolakopoulos, "Introduction to Industrial Automation", CRC Press, 2018, ISBN: 978-1-4987-0540-0
3) John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", Fifth Edition, Pearson, 2015, ISBN-13 978-9332555129

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	42
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**90**

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 activity1- Hands on session on the operation of Pick Place robot with simple teach pendent / lead through program / PLC programming and present the report -10Marks 4) Details of activity2 – Visiting the au*tomation laboratory to learn the concepts of automation applied in various industry* and present the report-10 marks	20
Total		**50**

Module	Activity Description	Hours
1	Hands on session on operation of Six-Axis articulated robot for different operation using teach pendant	8
2	Learn and Practice the PLC programming for simple pick and place operation of the robot	16
3	Understand working principle of various sensors, actuators and controllers used in industrial automation	8
4	Hands on experiences on different automation experimental setup	10
	Total	**42 hrs**

COURSE ATRICULATION MATRIX

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	1	-	-	-	-	-	-	-	-	1

Course Title	**BIOLOGY FOR ENGINEERS**		
Course Code	**24ME407**	**L-T-P-C**	**2-0-0-2**
Exam	**3Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**28L+32ABL=60**

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	1,3,12	
2.	Relate the basic principles of engineering mechanics to human body	1,3,12	
3.	Explain the mechanical characteristics of various parts inhuman body	1,3,12	
4.	Describe the importance of different biomaterials and the properties	1,3,12	

MODULE-1	**3Hrs**

Introduction toHumanAnatomy: Overviewofhumananatomy,Structuralorganizationofthehuman body cardiovascularsystem,endocrinesystem,digestivesystem,respiratorysystem,excretorysystem,lymphatics ystem,nervoussystem,muscular system and skeletal system.

MODULE-2	**4Hrs**

SkeletalSystem: Structuralcompositionofbone,MechanicalPropertiesofbones,StressandStrain,Bending Moment 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.Overviewofskele tal,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. CRCPress.
2. ParkJB.Biomaterialsscienceandengineering. SpringerScience&BusinessMedia;2012Dec.6.

Reference books:

1. Vaccari, D.A.,Strom,P.F.,&Alleman,J.E.(2005).Environmentalbiologyforengineersandscientists.JohnWile y & 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	2	14	28
2	Integrated Lab Component	-	-	-
3	Student Study Hours – Self Learning	-	-	-
4	Tutorial Component	-	-	-
5	Activity Based Learning (ABL1 & ABL2)	-	-	26
6	Evaluation of Learning Process	-	-	06
Total Learning Hours/Semester				**60**

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.	8
2	Stress & Strain Analysis of Bone Models to understand the mechanical behaviour of bones under load and design safe mechanical structural elements.	16
3	Design of a Biomechanical Pulley System to understand mechanical principles (levers, pulleys, inclined planes) to biological systems.	8
4	Material Selection for an Artificial Joints to understand material selection for biomechanical applications and understand bioengineering principles.	10
	Total	**42 hrs**

CourseArticulationMatrix

Course Out comes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3		1								2		
CO2	3		1								2		
CO3	3		1								2		
CO4	3		1								2		

Course Title	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**		
Course Code	**24ME408**	**LTPC**	**0-0-2-1**
Exam	**03Hours**	**Hours / Week**	**02**
SEE	**50 Marks**	**Total hours**	**28P+02ABL=30**

Course Objective:
To provide insights about fundamentals of Artificial Intelligence & Machine Learning

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	describe variety of artificial intelligence and machine learning concepts, applications, data modeling& evaluation techniques	2, 5

Course Contents:

Module – 1	**04 Hrs.**
Introduction to Artificial Intelligence: What is Intelligence? What is Artificial Intelligence (AI)?, Areas within artificial intelligence ,Challenges and opportunities for artificial intelligence,	
Module – 2	**02 Hrs.**
Applications of artificial intelligence in Mechanical Engineering.	
Module – 3	**03 Hrs.**
Introduction to Machine learning: Human learning and its types, Machine learning and its types, Applications, tools and issues in machine learning, Activities in machine learning, exploring structure of data, Data quality and Preprocessing, Supervised Learning and Unsupervised Learning.	
Module – 4	**04 Hrs.**
Modeling and Evaluation: Introduction, selecting a model, training a model, model representation and interpretability, Evaluating performance of a model.	

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	PO12	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	-	-	-	-	-	-

Course Title	**UNIVERSAL HUMAN VALUES**		
Course Code	**24UHV**	**L-T-P**	**(0-0-2)1**
CIE	**50 marks**	**Hours/Week**	**2 Hrs.**
SEE	**50 marks**	**Total Hours**	**28P+02ABL=30**

Course Objective: The course aims at the development of the value of education by the right understanding through the process of self-exploration (about themselves), family, society and nature/existence. Strengthening of self-reflection by development of commitment and courage to act are presented as the prime focus throughout the course towards qualitative transformation in the life of the student.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs
1.	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also, they are able to note that the natural acceptance (intention) is always for living in harmony.	6, 7, 8, 9, 12
2.	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	6, 7, 8, 9, 12
3.	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.	6, 7, 8, 9, 12

Course Contents

Module - 1	**8 Hrs.**

Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

MODULE – 2	**6 Hrs.**

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.

MODULE-3	**8Hrs**

Harmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.

Whole existence as Coexistence: Understanding the harmony in Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

MODULE-4	**6 Hrs.**

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Self-Learning Activities-

1. Sharing about Oneself and Exploring Natural Acceptance
2. Exploring Harmony of Self with the Body
3. Exploring the Feeling of Respect
4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence
5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

Textbook and Teachers Manual-

1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's for a Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books-

1. JeevanVidya:EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak,1999.
2. HumanValues, A.N.Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-JCKumarappa
8. Bharat Mein Angreji Raj–PanditSunderlal.
9. Redis covering India-by Dharampal
10. Hind Swarajor Indian Home Rule-by Mohandas K. Gandhi.
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-RomainRolland (English)
13. Gandhi-RomainRolland (English)

Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	1	3	2	-	-	1	-	-
CO2	-	-	-	-	-	2	1	3	2	-	-	1	-	-
CO3	-	-	-	-	-	2	1	3	2	-	-	1	-	-

Evaluation:

Continuous Internal Evaluation (CIE)

Two CIEs will be conducted for 20 marks each.

For the activity component students should form a team of 3 to 4 members each. A group activity should be assigned to each team based on the modules covered in the course. Students should show the progress in this activity as a preliminary phase for SEE.

CIE	Schedule	Assessment Method	Marks	Duration (Min.)
CIE I	At the end of 8 weeks	Objective Questions	20	60
CIE II	At the end of 11 weeks	Objective Questions	20	60
Activity	After CIE 2	Presentation/Role Play/Prototype development	10	-

Semester End Examination

SEE will be conducted for 50 marks in practical mode based on the assigned activity which may be a presentation/ prototype development/any other activity.