MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programmes

BACHELOR of ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

SYLLABUS

III AND IV SEMESTERS

(SECOND YEAR)

(2023-24 Admitted Batch)

Academic Year 2024-25

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]:

Mechanical Engineering students shall be able to,

PO1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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)

	Portions for CIE	Mode of Evaluation	Weightage in Marks
CIE - 1	Syllabus to be decided by the course coordinators such that all the COs shall be covered.	Descriptive Test	**10**
CIE - 2		Descriptive Test	**10**
CIE - 3		Descriptive Test	**10**
Activity	Minimum of two activities to be conducted	Assignment / Case study/Practical/ Working model /Quiz	**20**
		Total	**50**

Examination		**Maximum marks**	**Minimum marks to be scored**	**Minimum Average marks to qualify**
CIE	**Tests**	**30**	**12 (> = 40%)**	**40 (> = 40%)**
	Activity	**20**	**08 (> = 40%)**	
SEE		**50**	**17.5 (> = 35%)**	

Scheme of Evaluation (Laboratory Courses)

Evaluation Type	**Evaluation modules**	**Marks**
Continuous internal Evaluation (CIE) in every lab session by the Course coordinator	Conduction of experiments	10
	Observation and tabulation of results	10
	Record writing	20
	Viva voce/Quiz	10
CIE		**50**
SEE		**50**

Note: The marks distribution to be made based on the rubrics for a particular laboratory course.

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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)**								
III 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	BSC	23MAME301	Mathematics for Mechanical Engineering	3	1	0	3	4
2	IPCC	23ME302	Material Science and Engineering	2	0	2	3	4
3	PCC	23ME303	Mechanics of Materials	3	1	0	3	4
4	IPCC	23ME304	Manufacturing Process	2	0	2	3	4
5	PCCL	23ME305	Computer Aided Machine Drawing	2	0	2	3	4
6	ESC	23ME306A	Electric and Hybrid Vehicle Technology	3	0	0	3	3
		23ME306B	Smart Materials & Systems					
7	AEC	23ME307	Advanced Python Programming	0	0	2	1	2
8	UHV	23SCR	Social Connect and Responsibility	0	0	2	1	2
9	MC	23NYP1	NSS/YOGA/PE	0	0	2	0	2
Total				**15**	**2**	**10**	**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

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Course Title	**Mathematics for Mechanical Engineering**		
Course Code	**23MAME301**	**L-T-P**	**(3-1-0) 3**
Exam	**3 Hrs.**	**Hours/Week**	**4**
SEE	**50 Marks**	**Total Hours**	**40L+13 T**

Course Objective: Students will be able to use appropriate data structures for solving problems.
Course outcomes: At the end of course, student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Utilise the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors.	1	-
2.	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyse the system of equations to compute the number of linearly independent Eigenvectors.	1,2	-
3.	Compute Laplace transform on simple functions, Fourier series of periodic functions, the orthogonal basis, QR factors of Matrices, and solve homogeneous differential equations using matrices	1	-
4.	Examine for adopting different techniques of integration so as to compute Fourier series, Laplace transform of a given function.	1,2	-
5.	Model the real-life problems/engineering application problems and solve the same.	1,2	-

MODULE – 1 **10 Hrs.**

Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions.

Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform

Self-Study--Unit impulse functions (Dirac – delta function). Application of Fourier series to Laplace equation.

MODULE – 2 **10 Hrs.**

Fourier Series: Periodic functions and their graphical representation, to find the function for standard graphs, to find Fourier series by change of interval method, to represent the experimental data as a Fourier series using the method - Practical harmonic analysis. application of Fourier series in engineering-To represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function.

Self-Study-- Half range series method. Applications of Fourier transforms/ fast Fourier transforms in

computer science engineering.	
MODULE -3	**10 Hrs.**
Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of non homogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method. Linearly dependent and independent vectors. Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the image of some points is given**. Applications** of solution of system of equations to balance the chemical equations. **Self-Study**-- Traffic flow problem, to find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.	
MODULE -4	**10 Hrs.**
Linear Algebra: Eigen values and Eigenvectors, properties, Illustrative examples, Applications-Stretching of an elastic membrane, to determine the growth of a population model. Role of Eigen values, eigenvectors in determining natural frequency Rayleigh power method to find the highest Eigen value. Diagonalization and powers of 3X3 matrices when Eigen values are already given. Gram Schmidt process, QR-factorization, symmetric matrices and quadratic forms, Matrix method to solve homogeneous differential equations of order 2, degree 1. **Self-Study**--Stability analysis of differential equations which governs the dynamical systems using the concept of Eigen value, eigenvectors. Applications of system of equations, Eigen value, eigenvectors, linear transformation in computer science. Application of Eigen value Eigen vectors in data compression, Signature testing, Face recognition. Google page ranking**.**	
TUTORIAL: **1.** Need to study in rank of a matrix -L3 **2.** Examples on rank of a matrix and consistency -L3 **3.** Importance of solution of system of equation in application problems traffic flow –L4 **4.** Examples on Eigen values and Eigen vectors and diagonalization -L3 **5.** A report on role of Eigen values and Eigen vector in engineering –L4 **6.** To fit a Fourier series to the experimental data –L4 **7.** Examples on Fourier series (change of interval method)-L4 **8.** Examples on Laplace transform of periodic functions -L3 **9.** Examples on Laplace transform of unit step- function -L3 **10.** Examples on Laplace transform of initial value problem -L3 **11.** A report the application of Fourier series in engineering –L4 **12.** A report the application of Laplace transforms in engineering –L4 **13.** Importance of solution of system of equation in application problems chemical reaction-L4	
ACTIVITIES: 1. To represent saw tooth periodic motion of a follower operated by a Cam which rotates uniformly, in the form of Fourier series. 2. Application of Fourier series to Laplace equation, heat conduction.	

3. Fourier series representation for the excitation described by the wave form,
4. Role of Eigen values, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).
5. Lenovo input output method – application to balance the economy of a Country.
6. Applications of factorization of matrices-Google recommendation.
7. Jordan canonical form when minimal polynomial and characteristic polynomial is given and its application in Engineering.
8. Diagonalize a matrix and determining the principal stresses.
9. Application of Laplace transformation.
10. Application of Eigen value and Eigen vectors in data compression, Signature testing, Face recognition. Google page ranking.
11. Least square solution of system of equations- a matrix approach
12. Unit impulse functions (Dirac – delta function)- application.

Note

1. Theorems and properties without proof. Applicable to all the Modules.

2. Self-study part is not included for Semester End Examination.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Linear algebra by David c lay, 3rd edition, Pearson education, 2002.

Reference Books:

1. R K Jain and S R K Iyengar, Advanced engineering mathematics by Narosa publishers, 2nd edition, 2005.
2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.

Web links

- http://nptel.ac.in/courses.phd?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicerath.org/

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Course Articulation Matrix

Course Outcomes	Program Outcomes [POs]													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-												
CO2	3	2												
CO3	3	-												
CO4	3	2												
CO5	3	2												

MALNAD COLLEGE OF ENGINEERING, HASSAN
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Course Title	MATERIAL SCIENCE & ENGINEERING (LAB INTEGRATED)		
Course Code	23ME302	LTPC	2-0-2-3
Exam	03 Hours	Hours / Week	02+02
SEE	50 Marks	Total hours	26+26

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.	

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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 & Pradeep P.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.**			

Course Articulation Matrix

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				

MALNAD COLLEGE OF ENGINEERING, HASSAN
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Course Title	MECHANICS OF MATERIALS		
Course Code	23ME303	LTPC	3-1-0-3
Exam	03 Hours	Hours / Week	04
SEE	50 Marks	Total hours	40

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 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	8 Hrs.
Simple Stress and Strain: Introduction. Properties of material, Concept of Stress and Strain, Hook's Law, Stress Strain Diagram for structural steel and Non-ferrous materials. Poisson's Ratio & principles of superposition, Total elongation of tapering bars of circular section. Problems on deformations of member, Composite section. **Self-study:** Stress strain curves for materials like cast iron, rubber, glass etc. Review of engineering constants and properties of materials	
Module – II	**12 Hrs.**
Volumetric Strain and Thermal Stresses: Volumetric strain, Expression for Volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses including compound bars. **Bending Moment and Shear Force in Beams:** Introduction, Types of beams loadings and supports. Shearing force in beam. Bending moment, Sign convention. Relationship between loading shear force and bending moment. Expression for shear and bending moment equations, SFD and BMD with salient values for cantilever beams considering point load, UDL, UVL and Couple. SFD and BMD with salient values for simply supported beam considering point load, UDL, UVL and Couple. **Self-study:** Identify the applicationns of SFD, BMD under practical cases for overhanging beams considering point load, UDL, UVL and Couple.	
Module – III	**10 Hrs.**
Bending Stress and Shear Stress in Beams: Introduction, Bending stress in beam. Assumptions in simple bending theory. Pure bending derivation of Flexure equation. Modulus of rupture, Section modulus, Flexural rigidity. Assumptions in theory of shear stresses in beams, Shear stress diagram for solid rectangular section and circular section. (No numerical on shear stresses) **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.	
Module – IV	**10 Hrs.**
Torsion of Circular Shafts: Introduction. Pure torsion- General torsion equation. Strength and stiffness, Torsional rigidity, Torsional flexibility and polar modulus. Power transmitted by solid shaft. Power transmitted by hollow shaft. **Elastic stability of columns:** Introduction. Euler's theory on columns. Effective length, slenderness ratio. Short and long columns, Radius of gyration, Buckling load. Assumptions, derivations of	

Euler's Buckling load for different end conditions. Limitations of Euler's theory. **Self-study:** Identify situations involving long and short column effect.
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

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							1					
CO2	2	3												
CO3		3	2											

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Course Title	**MANUFACTURING PROCESS (Lab Integrated)**		
Course Code	**23ME304**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**2+2**
SEE	**50 Marks**	**Total hours**	**26 + 26**

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, welding, and forming processes for a given application	2, 3, 8	-

COURSE CONTENTS:

Module – I	**07 Hrs.**
Molding Elements: Patterns-pattern allowances and types of patterns, 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, operation, and charge calculations.	
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. Resistance Welding: Principles, operation, and applications of spot welding. Formation of different zones during fusion welding and welding defects.	
Module – III	**07 Hrs.**
Principles of metal forming: Classification of metal forming processes, Forging - Forging operations, open and closed die forging, forging defects. Numerical on forging load. Rolling: Principle of rolling, roll passes & roll pass sequence, and defects in rolled products. Extrusion: Principle, direct and indirect extrusion.	
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 other equipment, preparation of molds using two boxes. Use of split and match plate patterns and cores ➢ Preparation of one 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 of three models)	5	3	PO1, PO3 PO8	3
2	Forging Practice (Minimum three models) (Average marks of three models)	5	3	PO1, PO2, PO3 PO8, PO9	3
3	Welding Practice (Minimum three models) (Average marks of three models)	5	3	PO1, 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.

Course Articulation Matrix

Course Outcomes	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	1	2						2	2				

MALNAD COLLEGE OF ENGINEERING, HASSAN
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Course Title	**COMPUTER AIDED MACHINE DRAWING**		
Course Code	**23ME305**	**LTPC**	**2-0-2-3**
Exam	**04 Hours**	**Hours / Week**	**03+03**
SEE	**50 Marks**	**Total hours**	**26+26**

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 [Assignments – 10 Marks **+** 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 **60 Marks** and from **Part – B** for a maximum of **40 Marks.** i. Three Questions **each of 10 marks** for a total mark of **30** shall be set **from 1, 2,** and **3**. ii. Two Questions **each of 15 marks** for a total mark of **30** shall be set **from 4**. iii. Questions for total marks of **40** shall be set **from 5 to 10**. **Note:** The duration of examination (SEE) is 4 hrs. for 100 marks	
Text Book – Machine Drawing – N. Sidheshwar, P. Kannaiah, V.V.S. Sastry, McGraw Hill Edition 48th Reprint 2014.	

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	-

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

Course Title	**ELECTRIC AND HYBRID VEHICLE TECHNOLOGY**		
Course Code	**23ME306A**	**LTPC**	**3-0-0-3**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

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:

#	**Course Outcomes**	**POs**
1.	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
3.	describe the different types and working principle of hybrid vehicles.	1,2
4.	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. Mehrdad Ehsani, Yimin Gao, 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

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	1												
CO2	3	1												
CO3	3	1												
CO4	3	1												

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

Course Title	**SMART MATERIALS AND SYSTEMS**		
Course Code	**23ME306B**	**LTPC**	**3-0-0-3**
Exam	**03 Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

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).

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	1												
CO2	3	1												
CO3	3	1												
CO4	3	1												

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

Course Title	**ADVANCED PYTHON PROGRAMMING**		
Course Code	**23ME307**	**LTPC**	**0-0-2-1**
Exam	**03 Hours**	**Hours / Week**	**02**
SEE	**50 Marks**	**Total hours**	**26**

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 Data Frame
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

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	-	-	-	-

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

Course Title	**Social Connect & Responsibility**		
Course Code	**23SCR**	**L-T-P**	**(0-0-2)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
CIE	**100 Marks**	**Total Hours**	**20 hours**

Course Objective:

Provide a formal platform for students to communicate and connect with their surroundings and create responsible connection with society.

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 problems through immersion, design & technology.	3,5,6
2	Communicate and connect with their surroundings.	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 present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **Food Walk** City's culinary practices, food lore, and indigenous materials of the region used 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 for Assessment Process:

Continuous Internal Evaluation (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 and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated don't he basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

- Dairy recording the details of activity conducted
- Planning and scheduling he social connect
- Information/Data collected during the social connect
- Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59

Unsatisfactory and fail	<=39

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	-	-

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

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	23ME401	Engineering Thermodynamics	4	1	0	4	5
2	IPCC	23ME402	Machining Science (Tradition & Non-Traditional)	2	0	2	3	4
3	PCC	23ME403	Theory of Machines	4	1	0	4	5
4	IPCC	23ME404	Measurements Science& Metrology	2	0	2	3	4
5	PCCL	23ME405	Energy Conversion Laboratory	0	0	2	1	2
6	ESC	23ME406A	Micro Electromechanical Systems	3	0	0	3	3
		23ME406B	Robotics and Automation					
7	BSC	23ME407	Biology For Engineers	2	0	0	2	2
8	AEC	23ME408	Introduction to AI & ML	0	0	2	1	2
9	UHV	23UHV	Universal Human Values	1	0	0	1	1
10	MC	23NYP2	NSS/YOGA/PE	0	0	2	0	2
Total				**18**	**2**	**08**	**22**	**30**

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

Course Title	**ENGINEERING THERMODYNAMICS**		
Course Code	**23ME401**	**LTPC**	**4-1-0-4**
Exam	**03 Hours**	**Hours / Week**	**05**
SEE	**50 Marks**	**Total hours**	**52**

Course Objective: To impart students with thermodynamic principles that govern 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

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	2	-	-	-	1	-	-	-	-	-	-	-
CO3	-	3	2	-	-	-	1	-	-	-	-	-	-	-

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

Course Title	**MACHINING SCIENCE (Lab Integrated)**		
Course Code	**23ME402**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**02+02**
SEE	**50 Marks**	**Total hours**	**26+26**

Course objectives: 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:

COs	**Statement**	**Pos**	**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	-

COURSE CONTENTS:

Module – I	
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.	**7 Hrs.**
Module – II	
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.	**6 Hrs.**

Module – III	
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).	**6 Hrs.**

Module – IV	
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.	**6 Hrs.**

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.

TEXTBOOK

1. P. N. Rao, "Manufacturing Technology – Foundry, Forming and Welding", TMH, 3rd Edition, 2008. ISBN 10: 0-07-0087989.
2. A.B. Chattopadhyay, "Machining and Machine Tools"' Wiley India Pvt. Ltd. 2nd Edition, 2012, ISBN: 978-81-265-3098-4.

REFERENCE:

1. P. N. Rao, "Manufacturing Technology – Metal cutting and machine tools", TMH, 2nd Edition, 2009. ISBN 10: 0-07-0087695.
2. Pandey and Shan, **Modern machining process,** TATA McGraw Hill 2000. ISBN 0070965536.

Model No.	EXPERIMENT NAME	Marks	COs	Pos	Level
1	Performing the following operations using lathe (Individual Experiment) a) Turning b) Facing and c) Counter Sinking	**20**	**CO1**	1,2,9,10	**3**
2	Performing the following operations using lathe (Individual Experiment) a) Step turning b) Chamfering	**20**	**CO1**	1,2,9,10	**3**
3	Performing the following operations using lathe (Individual Experiment) a) Knurling b) Taper Turing	**20**	**CO1**	1,2,9,10	**3**
4	Performing gear cutting operation using milling machine (Group Experiment)	**20**	**CO2**	1,2,9,10	**3**

5	Conversion of round rod into square block using shaper (Group Experiment)	**20**	**CO2**	1,2,9,10	**3**
6	Demonstration of thread cutting operation using lathe.	---	---	---	---
7	Demonstration of boring and face milling operation.	---	---	---	---
	Average of All models = 20 marks	**26 Hrs.**			

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				

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

Course Title		**THEORY OF MACHINES**	
Course Code	**23ME403**	**LTPC**	**4-1-0-4**
Exam	**03 Hours**	**Hours / Week**	**05**
SEE	**50 Marks**	**Total hours**	**50**

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. Jagadeesh Lal, *Theory of Mechanisms and Machines*, Metropolitan Book Co. Pvt. Ltd, 2005. ISBN: 8120000749.

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**									
CO2	3	**2**			**1**									
CO3	3	**2**												
CO4	3	**2**												

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

Course Title	**MEASUREMENT SCIENCE AND METROLOGY (Lab Integrated)**		
Course Code	**23ME404**	**LTPC**	**2-0-2-3**
Exam	**03 Hours**	**Hours / Week**	**02+02**
SEE	**50 Marks**	**Total hours**	**26+26**

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 Vernier calliper, 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 Puneeth Sawhney, "Mechanical Measurements and instrumentation", Dhanpat Rai & Sons, 12th edt., 2013.

(Lab Activity)	Experiment Name	Marks	COs	POs	Level
1	i) Calibration of Load cell and LVDT (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 vernier calliper 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.**			

Course Articulation Matrix

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**		

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

Course Title	**ENERGY CONVERSION LABORATORY**		
Course Code	**23ME405**	**LTPC**	**0-0-2-1**
Exam	**03 Hours**	**Hours / Week**	**02**
SEE	**50 Marks**	**Total hours**	**26**

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 & Saybolt viscometer.
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 from 6, 7 or 8	25 Marks
3.	Viva Voce	10 Marks
	Total:	50 Marks

Course Articulation Matrix

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**					

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

Course Title	**MICRO ELECTROMECHANICAL SYSTEMS**		
Course Code	**23ME406A**	**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.

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									
CO2	3				2									
CO3	3				2							1		

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

Course Title	**Robotics and Automation**		
Course Code	**23ME406B**	**LTPC**	**3-0-0-3**
Exam	**03Hours**	**Hours / Week**	**03**
SEE	**50 Marks**	**Total hours**	**40**

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	**10 Hrs.**
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) Stamatios Manesis & 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

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	**23ME407**	**L-T-P-C**	**2-0-0-2**
Exam	**3Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**26**

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	Mapping to PSOs
1.	Explain the structure and functions of various organ systems in human Body 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 to Human Anatomy: Overview of human anatomy, Structural organization of the human body cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.

MODULE-2	**4Hrs**

Skeletal System: Structural composition of bone, Mechanical Properties of bones, Stress and Strain, 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, Musculo Skeletal system as wheel and axle, joints as screws, feet as inclined planes. Overview of skeletal, 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. ParkJ B.Biomaterials science and engineering. SpringerScience&BusinessMedia;2012Dec.6.

Reference books:

1. Vaccari,

D.A.,Strom,P.F.,&Alleman,J.E.(2005).Environmentalbiologyforengineersandscientists.JohnWiley & Sons.
2. Netter,F.(2019).Atlas of Human Anatomy(7thed.).Philadelphia, PA: Saunders.
3. Tamura,R.,Yoshida,K.,&Toda,M.(2019).Currentunderstandingoflymphaticvesselsinthecentralnervoussystem.NeurosurgicalReview,43(4), 1055–1064.https://doi.org/10.1007/s10143.

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

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

Course Title	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**		
Course Code	**23ME408**	**LTPC**	**0-0-2-1**
Exam	**03Hours**	**Hours / Week**	**01**
SEE	**50 Marks**	**Total hours**	**14**

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.

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	-	-	-	-	-	-	-	-	-

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

Course Title	**UNIVERSAL HUMAN VALUES**		
Course Code	**23UHV**	**L-T-P**	**(0-0-2)1**
CIE	**50 marks**	**Hours/Week**	**2 Hrs.**
SEE	**50 marks**	**Total Hours**	**28 Hrs.**

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:Ek Parichaya, 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-Romain Rolland (English)
13. Gandhi-Romain Rolland (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.