# 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)**

**Academic Year 2023-24**

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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## Department of Mechanical Engineering

### 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,

| | |
|---|---|
| **PO**1: | **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. |
| **PO**6: | **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**<br>**B.E. in Mechanical Engineering**<br>**Scheme of Teaching and Examinations2023**<br>**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**<br>**(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** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | BSC | 22MA301 | Mathematics for Mechanical Engineering | 2 | 1 | 0 | 3 |
| 2 | IPCC | 22ME302 | Material Science and Engineering | 2 | 0 | 1 | 3 |
| 3 | PCC | 22ME303 | Mechanics of Materials | 2 | 1 | 0 | 3 |
| 4 | IPCC | 22ME304 | Manufacturing Process | 2 | 0 | 1 | 3 |
| 5 | PCCL | 22ME305 | Computer Aided Machine Drawing | 1 | 0 | 2 | 3 |
| 6 | ESC | 22ME306A | Electric and Hybrid Vehicle Technology | 3 | 0 | 0 | 3 |
| | | 22ME306B | Smart Materials & Systems | | | | |
| 7 | AEC | 22ME307 | Advanced Python Programming | 0 | 0 | 2 | 1 |
| 8 | UHV | 22SCR | Social Connect and Responsibility | 0 | 0 | 2 | 1 |
| **Total** | | | | **12** | **2** | **08** | **20** |

**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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## MATHEMATICS FOR MECHANICAL ENGINEERING

**Course Code: 22MA301** **L-T-P-C: 2-1-0-3**
**Exam Hours: 3** Hours / Week : **04**
**SEE: 50** **Total Hours: 40**

**Course Objective:**
To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems.

**Course Outcomes:**

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

| COs | Outcomes | PO1 | PO2 |
|---|---|---|---|
| CO1 | use the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors. | 3 | 2 |
| CO2 | examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyze the system of equations to compute the number of linearly independent Eigen vectors. | 3 | 2 |
| CO3 | Examine for adopting different techniques of integration so as to compute Fourier series, Laplace transform of a given function. | 3 | 2 |
| CO4 | model the real-life problems/engineering application problems and solve the same. | 3 | 2 |

**Course Contents**

| **Module-1** | 10 Hours |
|---|---|
| **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.<br>**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<br>**Self -Study--**Unit impulse functions (Dirac – delta function), Application of Fourier series to Laplace equation, heat conduction. | |

| **Module–2** | 10 Hours |
|---|---|

**Fourier Series:** Periodic functions and their graphical representation, to find the function for standard graphs(saw tooth wave, triangular wave, sine wave etc.).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 seriesin mechanical 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. Finite difference methods—ritz method—solution of linear differential equations.

| **Module–3** | 10 Hours |
|---|---|

**Linear Algebra:** Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous 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 Hours |
|---|---|

**Linear Algebra**: Eigen values and Eigen vectors, properties, Illustrative examples,

**applications**-Stretching of an elastic membrane, to determine the growth of a population model. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system). Rayleigh power method to find the highest eigen value.

Diagonalization and powers of 3X3 matrices when Eigen values are already given.

**Self Study--** Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors. Application –to find the principal stresses.

**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.

## ACTIVITIES:

a. To represent sawtooth periodic motion of a follower operated by a Cam which rotates uniformly, in the form of Fourier series.
b. Application of Fourier series to Laplace equation, heat conduction.
c. Fourier series representation for the excitation described by the wave form,
d. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).
e. Lenovo input output method – application to balance the economy of a Country.
f. Applications of factorization of matrices-google recommendation.
g. Jordan canonical form when minimal polynomial and characteristic polynomial is given and its application in Engineering.
h. Diagonalize a matrix and determining the principal stresses.
i. Application of Laplace transformation.
j. Application of eigen value eigen vectors in data compression, Signature testing, Face recognition. Google page ranking.
k. Least square solution of system of equations- a matrix approach
l. Unit impulse functions (Dirac – delta function)- application.

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| | | | |
|---|---|---|---|
| **Course Title** | **MATERIAL SCIENCE & ENGINEERING (LAB INTEGRATED)** | | |
| **Course Code** | **22ME302** | **LTPC** | **2-0-1-3** |
| **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 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 curvesand 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.<br>**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 & 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 | **3** |
| **2** | Determine Compressive strength of Ferrous & Non -Ferrous materials. | **20** | **CO1** | 1, 4, 7 | **3** |
| **3** | Determine Bending strength of Ferrous & Non -Ferrous materials. | **20** | **CO1** | 1, 4, 7 | **3** |
| **4** | Determine impact strength of Ferrous & Non -Ferrous materials. | **20** | **CO1** | 1, 4, 7 | **3** |
| **5** | Determine hardness of Ferrous & Non -Ferrous materials. | **20** | **CO1** | 1, 4, 7 | **3** |
| **6** | Grain size calculation for a given Microstructure | **20** | **CO2** | 1, 4, 3 | **3** |
| **7** | Heat treating a given material and evaluation of mechanical properties. | **20** | **CO2** | 1, 4, 7 | **3** |
| | | | | | |
| | **Average of 7 Experiments = 20 marks** | **08 Hrs.** | | | |

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## MECHANICS OF MATERIALS

**22ME303** **LTPC: 2-1-0-3**
Exam Hours :**3** 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.** | Explainthe 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.** | Evaluatethe 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.<br>**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.<br>**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.<br>**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.<br>**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.<br>**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.<br>**Self-study:** Identify situations involving long and short column effect. | |

**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

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| | | | |
|---|---|---|---|
| **Course Title** | **MANUFACTURING PROCESS(Lab Integrated)** | | |
| **Course Code** | **22ME304** | **LTPC** | **2-0-1-3** |
| **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.<br>**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.<br>**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)<br>➢ Use of foundry tools and other equipment, preparation of molds using two boxes. Use of split and match plate patterns and cores<br>➢ Preparation of one forging model involving upsetting, drawing, and bending operations. | **26** |

**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.

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| | | | |
|---|---|---|---|
| **Course Title** | **COMPUTER AIDED MACHINE DRAWING** | | |
| **Course Code** | **22ME305** | **LTPC** | **1-0-2-3** |
| **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**.**<br>**Shaft Couplings:** Muff coupling, Split muff coupling, Flange couplings (Solid and Protected types), Pin type flexible coupling, Universal coupling, Oldham coupling.<br>**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 marks of **30** shall be set **from 1, 2,** and **3**.
ii. Two Questions **each of 15 marks** for a total marks of **30** shall be set **from 4**.
iii. Question 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.

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## ELECTRIC AND HYBRID VEHICLE TECHNOLOGY

**22ME306A** **LTPC: 3-0-0-3**
Exam Hours :0**3** 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

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **SMART MATERIALS AND SYSTEMS** | | |
| **Course Code** | **22ME306B** | **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.<br>**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 behavior, Discovery and Early developments, Summary of material properties. Applications of ER and MR fluids (Clutches, Dampers, others).<br>**Fibre Optics:** Introduction, Physical Phenomenon, Characteristics, Fibre optic strain sensors, Twisted and Braided Fibre Optic sensors, Optical fibers 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.<br>**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).

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# ADVANCED PYTHON PROGRAMMING

**22ME308A** **LTPC: 0-0-2-1**
**Exam Hours: 03** **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 analyzeand 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 |

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## SOCIAL CONNECT & RESPONSIBILITIES

**22SCR56** **LTPC: 0-0-2-1**
**Exam Hours: 3** **Hours / Week: 2**
**SEE: 50 Marks** **Total Hours: 14**

**Objective:** Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology
**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 the social responsibility | 6 | - |
| 2. | Practice sustainability and creativity | 9 | - |
| 3. | Showcase planning and organizational skills | 9, 10 | - |

**Course contents:**

| Module – 1 | 04 Hrs. |
|---|---|
| **Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature. | |
| **Module – 2** | **03 Hrs.** |
| **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, photoblog and documentary on evolution and practice of various craft forms. | |
| **Module – 3** | **03 Hrs.** |
| **Organic farming and waste management:** usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus. | |
| **Module – 4** | **04 Hrs.** |
| **Water Conservation:** knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.<br>**Food Walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking. | |
| A total of 14hrs engagement per semester is required for the 5th semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two faculty mentors. Faculty mentors will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors have to design the evaluation system. | |
| 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 on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing | |

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| MALNAD COLLEGE OF ENGINEERING, HASSAN<br>B.E. in Mechanical Engineering<br>Scheme of Teaching and Examinations2023<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)<br>(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** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | PCC | 22ME401 | Engineering Thermodynamics | 3 | 2 | 0 | 4 |
| 2 | IPCC | 22ME402 | Machining Science (Tradition & Non -Traditional) | 2 | 0 | 2 | 3 |
| 3 | PCC | 22ME403 | Theory of Machines | 3 | 2 | 0 | 4 |
| 4 | IPCC | 22ME404 | Measurements Science& Metrology | 2 | 0 | 2 | 3 |
| 5 | PCCL | 22ME405 | Energy Conversion Laboratory | 0 | 0 | 2 | 1 |
| 6 | ESC | 22ME406A | Micro Electro Mechanical Systems | 3 | 0 | 0 | 3 |
| | | 22ME406B | Robotics and Automation | | | | |
| 7 | BSC | 22ME407 | Biology For Engineers | 2 | 0 | 0 | 2 |
| 8 | AEC | 22ME408 | Introduction to AI & ML | 0 | 0 | 2 | 1 |
| 9 | UHV | 22UHV | Universal Human Values | 1 | 0 | 0 | 1 |
| **Total** | | | | **12** | **4** | **10** | **22** |

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **ENGINEERING THERMODYNAMICS** | | |
| **Course Code** | **22ME401** | **LTPC** | **3-2-0-4** |
| **Exam** | **03 Hours** | **Hours / Week** | **05** |
| **SEE** | **50 Marks** | **Total hours** | **52** |

**Course Objective:**To impart students with thermodynamic principles that governs the behaviour 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 in order 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, Temperature measurement, 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- Limitations of first law of Thermodynamics - 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:** Kelvin-Planck and Clausius statements and its equivalence-Refrigerators, Heat Pump–COP - Perpetual Motion Machines (PMMK-II) - Reversible and Irreversible process Carnot's Theorem - Second law efficiency – Numerical Problems. **Entropy& Thermodynamic relations** - Clausius theorem - The Clausius inequality - Availability and irreversibility -Principle of increase in entropy- Calculation of entropy using Tds relations-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- Practical Rankine cycle, Rankine cycle with Reheat and regeneration– Numerical Problems.<br>**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.

**TEXT BOOKS:**

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

**DATA HAND BOOK:**

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

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **MACHINING SCIENCE (Lab Integrated)** | | |
| **Course Code** | **22ME402** | **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 | - |
| 2. | describe the parameters affecting tool wear, tool life, and surface finishing processes | 1, 2 | - |
| 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.<br>**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.<br>**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).<br>**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.

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| **Course Title** | **THEORY OF MACHINES** | | |
|---|---|---|---|
| **Course Code** | **22ME403** | **LTPC** | **3-2-0-4** |
| **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 andcarry 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.<br>**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.<br>**Governors**: Principle of Governors, Types, force analysis of Porter, Proell and Hartnell governors, Controlling force, stability, sensitiveness, effort and power of governors, governor characteristics. | |

**TEXT BOOKS**:

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.

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **MEASUREMENT SCIENCE AND METROLOGY (Lab Integrated)** | | |
| **Course Code** | **22ME404** | **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: M**ethods 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: S**tandards 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: | Hours |
|---|---|
| ➢ Calibration of Load cell, LVDT, Determination of young's modulus for a given material in bending using strain gauges, Speed measurement using stroboscope.<br>➢ Calibration of Pressure gauge and Calibration of thermocouple.<br>➢ Measurement of angle by Sine center, Measurement of gear tooth elements using gear tooth Vernier calliper, Roundness testing and Mechanical comparators.<br>➢ 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.

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| | | | |
|---|---|---|---|
| **Course Title** | **ENERGY CONVERSION LABORATORY** | | |
| **Course Code** | **22ME405** | **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 & 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.

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **MICRO ELECTRO MECHANICAL SYSTEMS** | | |
| **Course Code** | **22ME406A** | **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.<br><br>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.** Nitaigour Premch 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.

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| | | | |
|---|---|---|---|
| **Course Title** | **Robotics and Automation** | | |
| **Course Code** | **22ME406B** | **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** | **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. | |

**TEXT BOOKS:**

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

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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| **Course Title** | **BIOLOGY FOR ENGINEERS** | | |
|---|---|---|---|
| **Course Code** | **21BEME407** | **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 beable:

| # | Course Outcomes | Mapping to POs | MappingtoPSOs |
|---|---|---|---|
| 1. | Explain the structure and functions of variousorgan systems in human Body in an engineering perspective | PO1, PO3, PO12 | |
| 2. | Relate the basic principles of engineering mechanics to human body | | |
| 3. | Explain the mechanical characteristics of various part sinhuman body | | |
| 4. | Describe the importance of different biomaterials and the irproperties | | |

| **MODULE-1** | **3Hrs** |
|---|---|

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

| **MODULE-2** | **4Hrs** |
|---|---|

**2:SkeletalSystem:**Structuralcompositionofbone,MechanicalPropertiesofbones,StressandStrain,Bendin gMoment and torsional Loads, Area Moment of Inertia, Joints of human body and Degrees of Freedom

| **MODULE-3** | **4Hrs** |
|---|---|

**MODULE – 3: Human Body as a Mechanical System** – spine as levers, tendon as pulleys, teeth as wedges,
MusculoSkeletalsystemaswheelandaxle,jointsasscrews,feetasinclinedplanes.Overviewofskeletal,musc ular,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.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.

**MALNAD COLLEGE OF ENGINEERING, HASSAN**
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**INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**22ME408** **LTPC: 0-0-2-1**
**Exam Hours: 03** **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, datamodeling & 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. | |

**TEXT BOOKS:**

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.

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| | | | |
|---|---|---|---|
| **Course Title** | **UNIVERSAL HUMAN VALUES** | | |
| **Course Code** | **21UHV** | **LTPC** | **1-0-0-1** |
| **Exam** | | **Hours / Week** | **02** |
| **SEE** | **50 Marks** | **Total hours** | **26** |

Course Objective:

The courses aims at development of value 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):With mapping shown against the Program Outcomes (POs)} upon completion of the course, students shall be able to:**

| COs | Statement | POs |
|---|---|---|
| CO1 | 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. | PO6, PO7, PO8, PO9, PO12 |
| CO2 | Differentiate between the characteristics and activities of different orders and Study the mutual fulfillment among them and need to take appropriates taps to ensure right participation (in terms of nurturing, protection an dright utilization) in the nature. | PO6, PO7, PO8, PO9, PO12 |
| CO3 | 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. | PO6, PO7, PO8, PO9, PO12 |

**Course Outcomes and Program Outcomes Mapping:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| CO1 | | | | | | 2 | 1 | 3 | 2 | | | 1 | | |
| CO2 | | | | | | 2 | 1 | 3 | 2 | | | 1 | | |
| CO3 | | | | | | 2 | 1 | 3 | 2 | | | 1 | | |

## Course Contents:

| MODULE-1- | 08Hrs. |
|---|---|
| **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** | **06Hrs.** |
|---|---|
| **Harmony in the Human Being**: Understanding Human beingas 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 Bodytoensure self-regulation and Health. | |
| **MODULE-3** | **08Hrs.** |
| **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.<br>Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnected ness 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 beused), pollution, depletion of resources and role of technology etc. | |
| **MODULE-4** | **06Hrs.** |
| **Implications of the Holistic Understanding–a Look at Professional Ethics:**<br>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 to wards<br>Value-based Life and Profession. | |
| ***Self-Learning Activities-***<br>1. Sharing about One self and Exploring Natural Acceptance<br>2. Exploring Harmony of Self with the Body<br>3. Exploring the Feeling of Respect<br>4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence<br>5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order | |
| ***Text Book and Teachers Manual-***<br>1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, RA sthana, P Bagaria, 2nd Revised Edition, Excel Books, NewDelhi,2019.ISBN978-93-87034-47-1<br>2. TheTeacher'sManualTeachers'ManualforAFoundationCourseinHumanValues and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, ExcelBooks, NewDelhi,2019.ISBN978-93-87034-53-2 | |

***Reference Books-***

1. JeevanVidya: Ek Parichaya, ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2. HumanValues, A.N.Tripathi, NewAgeIntl.Publishers, NewDelhi,2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamch and Gandhi
5. Small is Beautiful-E.F Schumacher.
6. Slow is Beautiful-Cecile And rews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj–Pandit Sunderlal.
9. Red is covering India-by Dharampal
10. Hind Swarajor Indian Home Rule-by Mohandas K.Gandhi.
11. India Wins Freedom-Maulana A bdulKalamAzad
12. Vivekananda-Romain Rolland(English)
13. Gandhi-Romain Rolland(English)

***Scheme of evaluation-***

The assessment aim sat impartial and reasonable mplication of the concept to the student. Key points of assessment are-

1. Student's participati on n classroom discussions.
2. Assess men to find ividual and the peeris to bed one by the tutor.
3. CIE is conducted for 50 marks in activity format.
4. SEEfor50marks:Lab assessment.

***Mode of Evaluation Scheme:***

**CIE Scheme:** Semester & Section:

| Event | Evaluation Scheme | Marks |
|---|---|---|
| Activity1 | Module1-**Inscriptionofone'srole model-Aimsat Motivation**<br>1. Writing the motivational story and exploring the irstruggles in achieving the same.<br>2. Understanding of individual's self needs, getting clarity of what is the goal of one-actions to be taken by self to achieve the same. | 20 |
| Activity2 | Module2-**AimsatSelf-realization,Self-knowledge&will power**<br>Group activity - Discuss the hitches of individual's and learn to share. | 10 |
| Activity3 | Module3-**Aimsat Respectfulness & Empathy**<br>Pen down the activities which helped satisfaction of oneself by serving the family, friend and society. | 10 |
| Activity4 | Module4-**AimsatProfessionalism &ethics**<br>Group activity Discussion on the human behavior al aspect in working environment. | 10 |
| **Total** | | **50** |

***SEE Scheme:***

1. The evaluation is conducted as per the allotted batches
2. Each groups are supposed to come up with a case study pertaining to module or the concept assigned to them.
3. The case study is explained to the allotted examiner.
4. Allocation of marks is purely based on the
    a) Case Study report
    b) Viva voce (Discussion)