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ताळगांव पठार,
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(Accredited by NAAC)

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GU/Acad –PG/BoS -NEP/2024/507 Date: 12.09.2024

# CIRCULAR

The University has decided to implement the Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Engineering in Mechanical Engineering** under the National Education Policy (NEP), 2020 based on All India Council for Technical Education (AICTE) and National Credit Framework (NCrF) Guidelines from the Academic Year 2024-2025 onwards.

The Syllabus of Semesters I and II of the **Bachelor of Engineering in Mechanical Engineering** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is attached.

The Dean, Faculty of Engineering and Principals of affiliated Colleges offering the **Bachelor of Engineering in Mechanical Engineering** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.09.12 17:33:53 +05'30'

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,
1. The Dean, Faculty of Engineering, Goa University.
2. The Principals of affiliated Engineering Colleges.

Copy to,
1. The Director, Directorate of Technical Education, Govt. of Goa
2. The Chairperson, BoS in Mechanical Engineering.
3. The Controller of Examinations, Goa University.
4. The Assistant Registrar, Prof. Examinations, Goa University.
5. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

**MECHANICAL ENGINEERING PROGRAMME AND**
**MECHANICAL AND AUTOMATION ENGINEERING (AY 2024-25)**

| SEMESTER - I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No** | **Course Category** | **Course Code** | **Title of the Course** | **L** | **T** | **P** | **Credits** |
| **1.** | **Major** | **MEC-100** | Fundamentals of Mechanical Engineering | **3** | **0** | **0** | **3** |
| | | **MEC-101** | Fundamentals of Mechanical Engineering Lab | **0** | **0** | **1** | **1** |
| **2.** | **Minor** | **CIV-111** | Basics of Civil Engineering | **3** | **0** | **0** | **3** |
| | | **CIV-112** | Basics of Civil Engineering Lab | **0** | **0** | **1** | **1** |
| | | **OR** | | | | | |
| | | **SHM-111** | Biology for Engineers | **3** | **0** | **0** | **3** |
| | | **SHM-112** | Biology for Engineers Lab | **0** | **0** | **1** | **1** |
| **3.** | **MC** | **SHM-132** | Applied Physics | **2** | **0** | **0** | **2** |
| | | **SHM-133** | Applied Physics Lab | **0** | **0** | **1** | **1** |
| **4.** | **AEC** | **AEC-153** | Communication & Technical Writing | **2** | **1** | **0** | **3** |
| **5.** | **VAC** | **VAC-158** | Environmental Science and Sustainability | **2** | **0** | **0** | **2** |
| | | **VAC-159** | Environmental Science and Sustainability Lab | **0** | **0** | **1** | **1** |
| **6.** | **SEC** | **SEC-145** | Engineering Drawing and Design Project | **0** | **0** | **3** | **3** |
| | | | **Total** | **12** | **1** | **7** | **20** |

| SEMESTER - I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No** | **Course Category** | **Course Code** | **Title of the Course** | **L** | **T** | **P** | **Credits** |
| **1.** | **Major** | **EEE-100** | Fundamentals of Electrical & Electronics Engineering | **3** | **0** | **0** | **3** |
| | | **EEE-101** | Fundamentals of Electrical & Electronics Engineering Lab | **0** | **0** | **1** | **1** |
| **2.** | **Minor** | **ITE-111** | Basics of Computing using Python | **3** | **0** | **0** | **3** |
| | | **ITE-112** | Basics of Computing using Python Lab | **0** | **0** | **1** | **1** |
| | | **OR** | | | | | |
| | | **SHM-113** | Engineering Chemistry | **3** | **0** | **0** | **3** |
| | | **SHM-114** | Engineering Chemistry Lab | **0** | **0** | **1** | **1** |
| **3.** | **MC** | **SHM-134** | Applied Mathematics - I | **2** | **1** | **0** | **3** |
| **4.** | **AEC** | **AEC-151** | Creative Thinking & Innovation | **2** | **0** | **0** | **2** |
| | | **AEC-152** | Creative Thinking & Innovation Lab | **0** | **0** | **1** | **1** |
| **5.** | **VAC** | **VAC-156** | Indian Knowledge System | **2** | **0** | **0** | **2** |
| | | **VAC-157** | Indian Knowledge System Lab | **0** | **0** | **1** | **1** |
| **6.** | **SEC** | **SEC-141** | Civil and Mechanical Workshop | **0** | **0** | **3** | **3** |
| | | | **Total** | **12** | **1** | **7** | **20** |



Issued on: 12/09/2024

**Semester I**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : MEC-100**
**Title of the Course : Fundamentals of Mechanical Engineering**
**Number of Credits : 3**
**Effective From AY : Ay 2024-25**

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| **Pre-requisites for the course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Understand the principles of statics and dynamics, Laws of thermodynamics, heat and work concept and manufacturing processes.<br>2. Comprehend the principles of statics and dynamics, Laws of thermodynamics, heat and work concept and manufacturing processes.<br>3. Analyse the principles of statics and dynamics, Laws of thermodynamics, heat and work concept and manufacturing processes.<br>4. Apply the the principles of statics and dynamics, Laws of thermodynamics, heat and work concept and manufacturing processes. | |
| **Content:** | | **No. of Hours** |
| **Unit 1** | **Basic Concepts and Equilibrium:** Concept of a rigid body, Laws of motion, Force systems, Principle of Transmissibility of forces, Concurrent and Non-Concurrent forces, Composition and resolution of forces, Moment of a force, Principle of moments, Resultant of force systems. Equilibrium of forces, Lami's theorem, Free body diagrams, Applications. Types of beams, Determinate beams, Types of loads, Types of supports and support reactions of determinate beams.<br>**Friction**: Theory of friction, Types of friction, Static and kinetic friction, Angle of friction, Limiting Friction, Laws of friction, Coefficient of friction, Angle of repose, Applications involving rigid body on a horizontal or an inclined plane, Ladder and Wedge friction cases. | **14** |
| **Unit 2** | **Centroid and Moment of Inertia:** First moment of an area and Centroid, second moment of area, Radius of gyration, Parallel Axes Theorem, Perpendicular axes Theorem, Polar moment of inertia, Finding moment of inertia of simple composite sections.<br>**Kinetics of Rigid Body:** Work Energy principle, Impulse Momentum equation, D'Alembert Principle and related applications. | **10** |
| **Unit 3** | **Introduction to Thermodynamics**: Definition of thermodynamics. Thermodynamic systems—system, boundary and surroundings, closed system, open system, isolated system, adiabatic system, homogeneous system, heterogeneous system; Macroscopic and | **12** |

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| | microscopic points of view. Thermodynamic equilibrium Properties of systems, State, Process, Cycle, Point function. Path function, Temperature, Zeroth law of thermodynamics.<br>**Heat Work and Energy Interaction**: Work Transfer, Displacement work, Displacement work in various process, P-V representation, other types of work transfer, Net work done by system, Heat transfer- path function, Specific heat and latent heat concepts, Statements of First and Second law of thermodynamics. | |
| **Unit 4** | **Introduction to manufacturing processes and their Applications:**<br>Metal cutting: Turning, Drilling, Milling<br>Metal Joining: Welding (Manual Metal Arc welding, Gas welding), Brazing Soldering.<br>Casting and Forging: Pattern making, Moulding and Foundry processes, Forging (open and closed die forging)<br>Sheet Metal Working: Shearing, Punching, blanking, piercing, bending, Die Forming<br>**Machine Tools (Basic elements, working principle and types of operations):** Lathe Machine – Centre Lathe, Types of lathe, Lathe specifications, Parts of lathe, Drilling Machine, Grinding machine, Power saw, Milling Machine, Introduction to CNC machines, working of CNC machines.<br>**Additive Manufacturing:** Definition, Fused Deposition Modelling (FDM) process. | **09** |
| **Pedagogy** | **Inquiry based learning, Integrative and Reflective Learning** | |
| **References/ Readings:** | **Text Books**<br>1. Bhavikatti S.S., Rajshekharappa K.G.; 'Engineering Mechanics', New Age International Publication, 2010, ISBN: 978-93-88818-47-6<br>2. Hajra Choudhury S. K., Bose S. K., Hajra Choudhury A. K., Roy N.; 'Elements of Workshop Technology, Vol I and II'. Media Promoters & Publishers Pvt. Ltd., 2010, ISBN: 978-81-85099-15-6<br>3. Nag P.K., 'Engineering Thermodynamics', McGraw Hill Education, 2017, ISBN: 978-93-52606-42-9<br>**Reference Books**<br>1. Cengel Y. A., Boles M. A.; 'Thermodynamics – An Engineering Approach'; Tata McGraw Hill Publications. 2017, ISBN: 978-93-39221-65-2.<br>2. Tayal A. K.; 'Engineering mechanics'; Umesh Publications, 2010, ISBN: 978-93-80117-38-6. | |
| **Course Outcome:** | After going through this course, the student will be able to:<br>1. Understand the principles of static equilibrium for rigid bodies, beams, theory of friction, centroid and moment of inertia of plane areas, D'Alemberts Principle for kinetics of rigid bodies, Laws of thermodynamics, heat and work concept and manufacturing processes.<br>2. Comprehend the principles of static equilibrium for rigid bodies, beams, theory of friction, centroid and moment of inertia of plane areas, D'Alemberts Principle for kinetics of rigid bodies, Laws of | |

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| | thermodynamics, heat and work concept and manufacturing processes.<br>3. Analyze the rigid bodies, beams, moment of inertia and centroid for plane composite areas, rigid body kinetic forces using D'Alembert's Principle, thermodynamic properties and processes and manufacturing processes.<br>4. Evaluate the forces in case of rigid bodies and beams in static equilibrium, moment of inertia for composite plane areas, use D'Alemberts Principle for solving rigid body Kinetics problems, heat and work of different thermodynamic processes and specify the manufacturing processes for manufacture. |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **MEC-101**
**Title of the Course** : **Fundamentals of Mechanical Engineering Lab**
**Number of Credits** : **1**
**Effective From AY** : **2024-25**

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| **Pre-requisites for the Course:** | **Nil** | |
| **Course Objectives:** | **The course will enable students to:**<br>1. Understand the principles of resolution, composition of forces, friction force determination, trusses, laws of thermodynamics, refrigeration and Air Conditioning and 3 d printing.<br>2. Comprehend the principles of resolution, composition of forces, friction force determination, trusses, laws of thermodynamics, refrigeration and Air Conditioning and 3 d printing.<br>3. Observe and take readings while conducting experiments<br>4. Arrive at appropriate inferences after conducting experiments on resolution and composition of forces, friction force determination, jib crane apparatus, thermodynamic laws, refrigeration and Air Conditioning. | |
| **LIST OF EXPERIMENTS** | | **No. of Hours** |
| | **Minimum 8 Experiments to be performed from the following list.**<br>1. To verify the law of polygon of forces<br>2. To verify the law of moments using parallel force apparatus (Simply supported beam apparatus)<br>3. To VERIFY the forces in the members of Jib Crane Apparatus using Lami's theorem<br>4. To determine the coefficient of friction for bodies on horizontal and inclined plane for different contact surfaces (like wood and glass, aluminium and glass etc.) and determine angle of repose<br>5. To analyze trusses using method of joints<br>6. To analyze trusses using method of sections<br>7. To investigate the First Law of Thermodynamics using IC engines<br>8. To investigate the second Law of Thermodynamics using IC Engines<br>9. To investigate the second Law of Thermodynamics using refrigeration/AC systems<br>10. To verify the zeroth law of thermodynamics<br>11. To demonstrate 3D printing of a simple object | **30** |
| **Pedagogy** | Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments | |
| **Course Outcome** | After going through this course, the student will be able to:<br>1. Understand the principles governing the above experiments<br>2. Comprehend the principles governing the experiments performed | |

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| | above.<br>3. observe, take readings and calculate the results for the governing parameters of the experiments conducted.<br>4. Infer appropriate outcomes from the experiments conducted. |

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**Minor Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : CIV-111**
**Title of the Course : Basics of Civil Engineering**
**Number of Credits : 3**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | NIL | |
| **Course Objectives:** | The course aims to provide the student with:<br>1. Knowledge of different types of materials, structures, and equipment used in building construction.<br>2. Basic knowledge about transportation engineering.<br>3. Basic knowledge of planning and components water supply project. | |
| **Content:** | | **No. of hours** |
| **Unit 1** | **Types of Civil Engineering Structures:** Buildings, Bridges, Tunnels, Railways, Port & Harbour, Airport, Dams, Water supply systems, Water tanks. Typical uses and importance of each structure.<br>**Fundamentals of Building Materials**: Properties and uses of Stones, bricks, blocks, mortars, sand, coarse aggregates, Structural Steel, High Tensile Steel, Cement and different types and properties; Recycling of Construction & Demolition wastes. | **11** |
| **Unit 2** | **Basics of Building Construction and equipment**:<br>Introduction to:<br>Plain cement concrete, Reinforced & Prestressed Concrete constructions, Components of building, sub-structure and superstructure, load bearing and framed structures.<br>Types of foundations, bearing capacity of soil, Brick masonry and Stone masonry works- types of masonry constructions. | **11** |
| **Unit 3** | **Transportation Engineering:**<br>Importance of Transportation, Different modes of transportation, Overview of Road, Rail, Air and Water Transportation, Comparison of various modes of Transportation. Highway planning and development in India, Classification of Rural and Urban roads. Components of highway pavement and materials used.<br>Traffic characteristics, Traffic studies: Traffic Volume study,<br>Spot speed studies, Travel time - Delay study, PCU, Origin and Destination studies, Parking studies, Road accident studies. Traffic regulations and control devices.<br>Construction equipment - Excavators, lifting and earthmoving equipment, mixers and compactors. | **12** |
| **Unit 4** | **Water Supply Engineering:**<br>Typical village/town Water Supply System, Sources of Water, Water Treatment, Water Supply Mechanism, Storage Facilities, Water Distribution, Types of Water Supply, Basics on Planning | **11** |

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| | and Estimating Components of Water Supply, Principles of Water Supply System, Calculate Daily Domestic Need of Water. | |
| **Pedagogy:** | Constructive, Collaborative and Inquiry based learning | |
| **References/ Readings:** | **Text Books:**<br>1. B. C. Punmia, A. K Jain, and A. K Jain, "Basic Civil Engineering", Laxmi Publications (P) Ltd.,New Delhi, Jan 2004.<br>2. S. Gopi, "Basic Civil Engineering", Pearson, 1st Edition, ISBN: 978-8131729885. | |
| | **Reference Books**:<br>1. G. S. Birdie and T.D.Ahuja, "Building Construction and Construction Material, Publisher , Dhanpat Rai Publishing Company, 2012.<br>2. S S Bhavikatti, "Elements of Civil Engineering", New Age International Private Limited, 2010. | |
| **Course Outcomes:** | 1. Understand the different building materials and structures.<br>2. Understand the different types of transportation systems<br>3. Identify the equipment used in construction of different structures.<br>4. Apply the concepts learnt in planning water supply scheme, selecting transportation, construction method and equipment. | |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **CIV-112**
**Title of the Course** : **Basics of Civil Engineering Lab**
**Number of Credits** : **01**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the Course:** | NIL | |
| **Course Objectives:** | The course aims to provide the student with:<br>1. Knowledge of different types of materials, structures, and equipment used in building construction.<br>2. Basic knowledge about transportation engineering.<br>3. Basic knowledge of planning and components water supply project. | |
| **Content:** | | **No. of Hours** |
| | **List of Experiments: Any eight experiments to be performed from below list**<br>1. Study and sketching of models of different building components and structures (at least 4).<br>2. Determination of physical properties of civil engineering materials (any four materials).<br>3. Determination of compressive strength of civil engineering materials (any four materials).<br>4. Tension test on steel bars (unit weight, tensile strength and elongation).<br>5. To determine hardness of building materials using BHN.<br>6. Study of construction equipment required for building construction (any three).<br>7. Study of construction equipment required for transportation infrastructures like roads and bridges, railways, airports (any three).<br>8. Study of water treatment plant and its components.<br>9. Estimation of water demand and water distribution network for small city or town.<br>10. Study of plumbing details for G+2 residential building. | **30** |
| **Pedagogy** | Constructive, Collaborative and Inquiry based learning. | |
| **Reference/ readings:** | **Text Books:**<br>1. B. C. Punmia, A. K Jain, and A. K Jain, "Basic Civil Engineering", Laxmi Publications (P) Ltd.,New Delhi, Jan 2004.<br>2. S. Gopi, "Basic Civil Engineering", Pearson, 1st Edition, ISBN-13:978-8131729885. | |
| | **References**<br>1. G. S. Birdie and T.D.Ahuja, "Building Construction and Construction Material, Publisher , Dhanpat Rai Publishing Company, 2012.<br>2. S S Bhavikatti, "Elements of Civil Engineering", New Age International Private Limited, 2010. | |
| **Course Outcomes:** | 1. Understand the different building materials and their strength properties. | |

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| | 2. Understand the different types of transportation systems and their requirements.<br>3. Study the type equipment used the in construction of different building and transportation structures.<br>4. Apply the concepts learnt in planning water supply scheme, selecting transportation, construction method and equipment. |

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**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SHM-111**
**Title of the Course : Biology for Engineers**
**Number of Credits : 3**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives** | The students shall be able to:<br>1. Learn about enzymes and compare different mechanisms of enzyme action.<br>2. Study DNA as a genetic material in the molecular basis of information transfer.<br>3. Understand classification of biological processes at the reductionistic level<br>4. Study and use thermodynamic principles to biological systems. | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Classification based on Cellular Structure:** Biomolecules and biopolymers: Structure and Function Organic and inorganic molecules;<br>Unique Properties of water, Vitamins and Minerals, Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA)<br>Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells;<br>Cell organelles – structure and function; Cell membrane Levels of organization: cells, tissues, organs, systems & organism. | **10** |
| **Unit 2** | Energy transformations in Chloroplast: Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems Energy transformations in Mitochondria: Cellular respiration (glycolysis and Kreb cycle) and ATP generation<br>**Bioenergetics:** Thermodynamic principles applied to biology, negative entropy changes in biological systems, Free Energy, Chemical Equilibrium.<br>Expression and Transmission of Genetic Information: DNA replication, Enzyme driven process of DNA cloning, Protein synthesis- Transcription & translation<br>Techniques for optimization: a. At molecular level: Recombinant DNA Technology, DNA hybridization, PCR, DNA microarray | **12** |
| **Unit 3** | **Transport Phenomena in Biological Systems:** Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide Heat Transport - Body temperature regulation.<br>**Communication:** Cell junctions, Cell-cell communications – cell signaling, Hormones, Pheromones and cell behavior | **11** |

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| | Defense mechanisms: In plants: Herbivory, secondary metabolites In animals: Innate and Adaptive immune systems<br>Engineering perspectives of biological sciences: Biology and engineering crosstalk – At cell level: Hybridoma technology At tissue level: Plant Tissue Culture, Animal Tissue Culture;<br>Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Biomimicry, nanobiotechnology | |
| **Unit 4** | **Human Organ Systems and Bio Designs**<br>Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators)**.** | **12** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding | |
| **References /Readings:** | **Text Books:**<br>1. Lodish H, Berk A, Zipursky SL, et al. (2000) Molecular Cell Biology. W. H. Freeman.<br>2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers.<br>3. Stent, G. S.; and Calender, R.W.H. "Molecular Genetics (Second edition)", Freeman and company, CBS Publisher, ISBN 978-0716710288<br>4. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022 | |
| | **Reference Books**<br>1. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.<br>2. Nelson, D. L., Cox M.W.H, "Principles of Biochemistry", (V Edition), Freeman and Company CBS Publication, ISBN 978-13192280002 | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Understand enzymes and distinguish between different mechanisms of enzyme action.<br>2. Explain DNA as a genetic material in the molecular basis of information transfer.<br>3. Classify biological processes at the reductionistic level<br>4. Apply thermodynamic principles to biological systems. | |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **SHM-112**
**Title of the Course** : **Biology for Engineers Lab**
**Number of Credits** : **1**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the course:** | Nil | |
| **Course Objectives:** | **The students shall be able to:**<br>1. Remember the structure of unicellular and multicellular cells<br>2. Learn the Chromosome map and Mendel's law<br>3. learn the Lipids and Carbohydrates and DNA from Cauliflower<br>4. Carry out experiments to determine activity of enzymes and photosynthesis. | |
| **Contents:** | **List of Experiments** | **No. of hours** |
| | 1. Study of Prokaryotic cells using Gram's staining technique<br>2. Study of Eukaryotic Cell using suitable staining technique- (Buccal epithelial Cells/yeast cells)<br>3. Study of ultrastructure of prokaryotes or eukaryotes<br>4. Demonstrate segregation and independent assortment using simple genetic traits like flower color in pea plants or coat color in mice using Punnett squares.<br>5. Determine the genotype and phenotype ratios of the offspring and discuss the concepts of dominance and recessiveness.<br>6. Study of activity of salivary amylase under optimum conditions (Conversion of starch to glucose).<br>7. Qualitative tests to identify proteins and lipids in the given solution<br>8. Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant<br>9. Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant<br>10. Staining of photosynthetic bacteria from pond water<br>11. Determination of total chlorophyll in shade and sun plants. | **30** |
| **Pedagogy:** | • Inquiry based learning<br>• Constructive planning of experiments<br>• Collaborative approach in performing experiments | |
| **Instructions:** | **Minimum 8 experiments to be performed** | |
| **References/ Readings:** | **Text Books:**<br>1. Stent, G. S.; and Calender, R.W.H. "Molecular Genetics (Second edition)", Freeman and company, CBS Publisher, ISBN 978-0716710288<br>2. Uma Devi Koduru, "General Biology", Khanna Book Publishing Company, ISBN 9789-3915-05028, January 2022<br>**Reference Books**<br>1. Nelson, D. L., Cox M.W.H, "Principles of Biochemistry", (V Edition), Freeman and Company CBS Publication, ISBN 978-13192280002 | |

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| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Understand the structure and ultrastructure of prokaryotic and eukaryotic cell.<br>2. Students will be able to analyze the problems related to genetic transfers.<br>3. Students will be able to Apply the techniques involved in biochemical methods for analysis of biomolecules<br>4. Students will be able to apply the laws of thermodynamics techniques to understand the physiology of living organisms. |

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**Multidisciplinary Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SHM-132**
**Title of the Course : Applied Physics**
**Number of Credits : 2**
**Effective from AY : 2024-25**

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| **Pre-Requisites for the Course:** | **Nil** | |
| **Course Objectives:** | **The student shall be able to**<br>1. Understand the interference of light & its applications<br>2. Explain the transport phenomenon is semiconductors.<br>3. Describe the working, types & applications of Lasers<br>4. Analyze the optical properties & applications of optical fibers**.** | |
| **Content:** | | **No. of Hours** |
| **Unit 1** | **Interference of light:** Geometric and optical path, Phase change at reflection (only statement), Interference based on division of amplitude, Interference in thin parallel films due to reflected & transmitted light, Interference in wedge shaped film (due to reflected light), Newton's rings for reflected light.<br>**Applications of Newton's rings:** Determination of radius of curvature of Plano-convex lens, wavelength of light used and refractive index of liquid. | **8** |
| **Unit 2** | **Semiconductors:** Band theory of solids-Energy Gap, Classification of solids, Mobility, Drift velocity, Conductivity of charge carriers. Hall effect-derivation of Hall coefficient, Applications of Hall effect - carrier concentration and mobility**.**<br>**Introduction to Nanomaterials:** Definition of nanomaterials, Properties, Examples of nanomaterials, Applications. | **7** |
| **Unit 3** | **Lasers:** Laser characteristics, Stimulated emission of radiation, Active medium, Metastable state, Condition for light amplification, Population inversion (qualitative), Pumping Mechanism, Optical resonator. Einstein's coefficients; **Types of lasers:** Ruby laser, He-Ne laser, Semiconductor laser, Nd:YAG laser, CO2 laser, Dye laser. applications of lasers in science, engineering and medicine. | **8** |
| **Unit 4** | **Optics and Optical Fibers**: Refraction of light, Snell's law, Critical angle, Total internal reflection. Propagation of light in optical fiber, Structure of an optical fiber, Acceptance angle and cone, Numerical aperture & Fractional index change, Modes of propagation, Types of optical fibers: single, multimode, GRIN fibers, V-Numer Number of modes. Losses in optical fibres. Applications. | **7** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding | |

| | |
|---|---|
| **References/ Reading:** | 1. M. N. Avadhanulu and P. G. Kshirsagar; “A textbook of Engineering Physics”, S. Chand & company Pvt. Ltd. Revised edition 2015.<br>2. A.S. Vasudeva, “Modern Engineering Physics”, S. Chand & Company Pvt. Ltd. Revised Edition. 2015<br>3. Uma Mukherji, “Engineering Physics”, Narosa Publications. 2012<br>4. R. K. Gaur & S. L. Gupta; “Engineering Physics”, Dhanpat Rai Publications Pvt. Ltd. Reprint 2013. |
| **Course Outcome:** | 1. Understand the concepts of interference of light, lasers, optical fibres and semiconductors.<br>2. Explain thin film interference, types of lasers, optics of fibres and transport phenomenon in semiconductors.<br>3. Relate the concepts logically & derive the necessary formulae.<br>4. Calculate various physical parameters based on thin film interference, lasers, optical fibres and semiconductors. |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **SHM-133**
**Title of the Course** : **Applied Physics Lab**
**Number of Credits** : **1**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | **The course will enable students to:**<br>1. To collect & record data neatly by performing the experiments related to thin film interference, semiconductors, lasers & fibre optics.<br>2. To understand the underlying concepts & principles of the experiments performed.<br>3. To calculate various physical parameters by applying necessary formulae.<br>4. To draw meaningful conclusions through proper analysis of data. | |
| **Content:** | **List of Experiments** | **No. of Hours** |
| | 1. Radius of curvature of a plano convex lens using Newtons rings.<br>2. R.I of a liquid using Newton's rings.<br>3. Determination of thickness of thin object by Air wedge.<br>4. Determination Wavelength of laser.<br>5. Determination of particle size.<br>6. Determination of divergence of laser.<br>7. NA & acceptance angle of an optical fibre.<br>8. Photo diode characteristics & power response.<br>9. Determination of critical angle for a given pair of media.<br>10. Communication system using optical fibre.<br>11. Energy gap of a semiconductor.<br>12. Hall Effect<br>13. Photoelectric effect - Determination of Planck's constant using LED/photo diode<br>14. Thermistor characteristics<br>15. Dielectric constant – charging & discharging of capacitor. | **30** |
| **Pedagogy:** | • Inquiry based learning<br>• Constructive planning of experiments<br>• Collaborative approach in performing experiments | |
| **Instructions** | **Total 10 experiments** to be conducted including **2 demonstrations** | |
| **References/ Readings:** | 1. Arora C.L. "Practical Physics", S Chand & Co., ISBN: 978-81-21909099, 8121909090.<br>2. Avadhanulu M. N., Kshirsagar P. G., "A text book of Engineering Physics" ; S. Chand & company Pvt. Ltd., Revised edition 2015.<br>3. Vasudeva A. S., "Modern Engineering Physics"; S. Chand & Company Pvt. Ltd. Revised Edition. 2015 | |

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| **Course Outcomes:** | After going through this course, the student will be able to:<br>1. Record the readings carefully, and show them neatly on a lab record book.<br>2. Demonstrate the various principles and basic phenomenon involved in the experiments by following proper procedure.<br>3. Calculate the various physical parameters involved in the experiments by using formulae derived in the theory.<br>4. Draw conclusions from the results obtained by organizing the data in a proper manner to justify the aim of the experiment |

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**Ability Enhancement Courses**

**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : AEC-153**
**Title of the Course : Communication and Technical Writing**
**Number of Credits : 3 (2L+1T)**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students will be able to:<br>1. Embibe precise language skills with suitable vocabulary, apt style<br>2. Acquire the skills and techniques of writing in professional life<br>3. Appreciate importance of interpersonal skills to progress professionally<br>4. Demonstrate effective presentation exhibiting verbal and non-verbal skills | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Communication:** Stages of Communication, Channels of Communication, Verbal Communication, Non-verbal Communication, Barriers to Effective Communication, Critical thinking in Communication, Global Communication, Social Media Communication, Cross Cultural Communication.<br>**Listening:** Hearing and listening, Active listening, Empathetic Listening, Critical Listening, Appreciative Listening, Barriers to listening. Exercises on listening comprehension.<br>**Reading:** Skimming and Scanning, Reading Different Kinds of Texts, Note Making Techniques, Topicalising, Methods of Sequencing, Summarizing, Paraphrasing an article from any source.<br>**Speaking:** Pitch, Tone, Articulation, Intonation, and Body Language. Public Speaking Skills, Barriers to Effective Speakingand how to overcome them through preparation, practice, and perseverance. Conversation Skills and Situational Dialogues. | **08** |
| **Unit 2** | **Inter-Personal Skills:** Developing a professional attitude; self-esteem; and emotional intelligence.<br>**Group Discussion:** Group Discussions, Dos and Don'ts, Traits of a good GD Member.<br>**Presentations:** Effective ways of content delivery and presentation<br>**Interviews:** Interview Process, Characteristics of the Job Interview, Pre-interview preparation techniques.<br>**Company Meetings:** Notice, Agenda, Minutes of the Meeting. | **07** |
| **Unit 3** | **Formal Writing:** Formal letter-writing, Structure of a Formal/Business Letter, Complete/Full Block Style Format, Types of Formal Letters (Leave request, Admission request, Queries to higher authorities, Job Application)<br>**Email-writing:** Etiquette in Email writing, Characteristics of Successful Email Messages, Email Format, Standard Email | **07** |

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| | Practices.<br>**Resume Writing:** Format, Structure, Tone, and keyword-usage. | |
| **Unit 4** | **Technical Writing:** Concept and definition of technical writing, features of technical writing – style and language, eliminating Common Grammatical Errors.<br>**Report-Writing:** Introduction, Types & Usage. Book format<br>**Proposals:** Types and Structure of Formal Proposals<br>**Referencing:** Introduction to Referencing | **08** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding<br>One or more assignments to be carried out on topics covered in each unit above – Total Time allotted: 15 Hrs.<br>One or more assignments to be carried out on topics covered in each unit above- Total time allotted 15 hours | |
| **References/ Readings:** | **Text Books**<br>1. Raman Meenakshi, Sharma Sangeeta, "Technical Communication", Oxford Publication 2004.<br>**Reference Books**<br>2. Rizvi Ashraf, "Effective Technical Communication", Mc Graw Hill, 2nd Edition<br>Beer David, McMurrey, "Guide to writing as an Engineer", John Willey, New York, 2004 | |
| **Course Outcome:** | **After going through this course, the student will be able to:**<br>1. Remember precise language skills with suitable vocabulary, apt style<br>2. Understand the skills and techniques of writing in professional life<br>3. Explain importance of interpersonal skills to progress professionally<br>4. Demonstrate effective presentation – verbal and non-verbal skills | |

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**Value Added Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : VAC-158**
**Title of the Course : Environmental Science and Sustainability**
**Number of Credits : 2**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The student will be able to<br>1. Understand and explore the interconnectedness of ecosystems and the importance of biodiversity for ecological balance<br>2. Explain various causes for environmental degradation and individuals contribution in the environmental pollution<br>3. Apply tools and frameworks for reporting and measuring sustainability practices.<br>4. Analyze effective mechanisms to handle e-waste | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Environment and Biodiversity:** Definition, scope and importance of environment - need for public awareness. Eco-system and Energy flow - ecological succession. Types of biodiversity: genetic, species and ecosystem diversity - values of biodiversity, India as a mega-diversity nation - hot - spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ. | **07** |
| **Unit 2** | **Environmental Pollution:** Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Air Pollution: Types of particulates, Topography, Effects of air pollution on living organisms, plants, materials, stratosphere. Control measures for air pollution, Air quality;<br>**Water pollution:** Point and non-point sources, causes of water pollution, control measures. Soil pollution: Causes of soil degradation, problems with pesticide use. Noise pollution: Effects on noise pollution on physical health, mental health, permitted noise levels, control measures. | **07** |
| **Unit 3** | **E-Waste Management**<br>Introduction, Type of contaminants in e-waste, toxic substances and precious metals associated with e-waste and their health impacts, treatment strategies of e-waste: Recycling, landfill disposal, biological treatment, advanced methods, Conclusions.<br>**Urban E-waste:** Introduction, Driving factors of E-waste, Raw materials in electrical and electronic equipment and their waste, Physical techniques - Dismantling, Crushing, shredding, and milling, Sieving and separation; Chemical techniques - Pyrometallurgy, Hydrometallurgy (Acid/alkaline leaching, Cyanide leaching, Thiourea leaching, Thiosulfate leaching); | **08** |

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| | Biometallurgy - Bioleaching, Biosorption. Organic pollutant types from E-waste - Polycyclic aromatic hydrocarbons/poly nuclear aromatic hydrocarbons; Polychlorinated biphenyls, polybrominated biphenyls, and polybrominated diphenyl ethers, Electrokinetic remediation concept and it use for the removal of organic waste. | |
| **Unit 4** | **Sustainability and Management**<br>**Sustainability** – Concept (IAPT equation), needs and challenges – economic, social and Environmental aspects of sustainability. From unsustainability to sustainability - millennium development goals and protocols. Concept of Carbon Credit, Carbon Markets and Carbon Offsets- Basic definitions, creation comparison of carbon credits and Offsets. Zero waste 3R concept and Circular economy concepts.<br>**Material Recovery Facility (MRFs)**- Definition, Importance, Classification- based on technology used and its characteristics: Mixed MRF, Dry MRF, Manual MRF, Semi-automatic MRF, Mechanical MRF/automated MRF; Criteria for Location of MRFs; Constituents in an MRF: Standard Process Flow of MRF; Unit Processes in MRF; Value chain of MRF. | **08** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding<br>Reflective thinking leading to right understanding | |
| **References/ Readings:** | **Text Books**<br>1. Benny Joseph, "Environmental Science and Engineering", McGraw Hill Education, ISBN: 978-9387432352<br>2. Bharucha, Erach, "Textbook of Environmental Studies for Undergraduate Courses", India, Universities Press (India) Pvt. Limited, 2005.<br>3. Kaushik Anubha, Kaushik C. P., "Perspectives in Environmental Studies", New Age International Publishers, ISBN: 978-9386418630.<br>**Reference Books**<br>1. Allen David T., Shonnard David R. , "Sustainable Engineering-Concepts, Design and case studies" ; Prentice Hall, ISBN: 978-0132756549.<br>2. JezAreta A. , AlexanderBradD. , and Shaikh Ayaz R., "Carbon Credit and Carbon Offset Fundamentals", Mintz.<br>3. Majeti Narasimha Vara Prasad et.al, "Handbook of Electronic waste management", Elsevier Publication, 2019, ISBN: **978-0128170304**.<br>4. Mensah Justice, "Sustainable Development: Meaning, History, Principles, Pillars and implications for Human Action: Literature Review", Cogent Social Sciences.<br>5. Swachh Bharat Mission Advisory on Material Recovery Facility (MRF) for Municipal Solid Waste | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Understand key environmental concepts and the importance of biodiversity conservation | |

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| | 2. Explain the environment, human health and socio-economic impacts of different types of pollution<br>3. Assess the health and safety risks associated with e-waste handling and disposal and implement measures to mitigate these risks<br>4. Apply sustainable practices for utilization of resources. |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **VAC-159**
**Title of the Course** : **Environmental Science and Sustainability Lab**
**Number of Credits** : **1**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Understand the use of Titrimetric analysis as a tool for analysis of Water and Soil quality.<br>2. Calibrate and operate basic Instruments involved in Water, Soil, Air and Noise pollution.<br>3. Compute various parameters involved in analysis of Water and Soil quality.<br>4. Corelate the Parameters measured with applicable standards. | |
| **Contents:** | **List of Experiments** | **No. of Hours** |
| | 1. Calibration of pH meter, conductivity meter and Nephelometer and determination of pH,conductivity and TDS of a given water sample.<br>2. To determine the acidity and alkalinity of a given water sample.<br>3. To determine the hardness of a water sample by measuring the amount of calcium present.<br>4. To determine the concentration of sulphate of a given water sample and Determination of dissolved oxygen in water sample<br>5. To determine chloride ion concentration in a water sample and Determination of free $CO_2$ in water sample<br>6. To determine the BOD of Water sample.<br>7. To determine the COD of water sample.<br>8. Determination of Oil and Grease wastewater sample.<br>9. Determination of Organic Carbon, NPK and CEC of a given soil sample.<br>10. Determination of Total Nitrogen in Soil Sample.<br>11. To Determine Available Phosphorus in soil sample.<br>12. Ambient noise monitoring.<br>13. Soil Electrical Conductivity.<br>14. Measurement of SPM; RSPM in ambient air by High Volume Sampler<br>15. Colorimetric estimation of any element or compound (Cu, Fe, Sulphate, nitrite, etc) | **30** |
| **Pedagogy:** | • Inquiry based learning<br>• Constructive planning of experiments<br>• Collaborative approach in performing experiments | |
| **Instructions** | **Minimum 10 experiments to be performed** | |

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| **References/ Readings:** | 1. "Practical Manual Chemical Analysis of Soil and Plant Samples" ICAR-Indian Institute of Pulses Research.<br>2. G Svehla, B Sivasankar, "Vogels Qualitative Inorganic Analysis", Pearson Education Limited, 7th edition, 2018, ISBN: 978-8126511143<br>3. J Mendham, Rc Denney, "Vogels Text Book of Quantitative Chemical Analysis", Pearson Education Limited, 6th edition, 2018.<br>4. SUnita Rattan;"Experiments in Applied Chemistry", S KKataria& Sons, 3rd edition 2010. |
| **Course Outcome** | After going through this course, the student will be able to:<br>1. Understand the use Titrimetric analysis as a tool for analysis of Water and Soil quality.<br>2. Calibrate and operate basic Instruments involved in Water, Soil, Air and Noise.<br>3. Compute various parameters involved in analysis of Water and Soil quality.<br>4. Correlate the Parameters measured with applicable standards. |

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**Skill Enhancement Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SEC-145**
**Title of the Course : Engineering Graphics and Design Project**
**Number of Credits : 3**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Convert ideas into engineering drawing.<br>2. Understand the principles of projections in engineering drawing.<br>3. Apply the projection principles for projections of lines, solids and planes.<br>4. Read the orthographic and isometric drawings and convert them in an assembled mini project. | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Introduction to Engineering Drawing***: Types of Lines, Dimensioning, Scales<br>**Engineering Curves**: Conic sections, Ellipse (Focus Directrix Eccentricity method, Concentric circles method), Parabola (Focus Directrix Eccentricity method, Rectangle method), Hyperbola (Focus Directrix Eccentricity method), Cycloid, Involute (circle, square)<br>**Projection***: Introduction, Principle of Projection, Method of projection, Planes of projection, Four quadrants, first and third angle projection, Reference line, Symbols of projection<br>**Projection of Points***: Introduction, Point situated in first, second, third & fourth quadrant<br>**Projection of lines:** Introduction, Line parallel to both the planes, Line inclined to one and parallel to other plane, Line inclined to both the planes. Traces* | **18** |
| **Unit 2** | **Projection of Planes using first angle:** Introduction, Types of planes, Projection of planes, Projection of planes perpendicular to both the reference planes, Perpendicular to one plane and parallel to other plane, Plane inclined to both planes.<br>**Projection of solids using first angle**: Introduction, Type of solids (Cone, cylinder, prism, pyramid), Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both reference planes | **18** |
| **Unit 3** | **Section of solids using first angle:** Sectional Planes, Section of solids, True Shape of Section.<br>**Development of Surfaces using first angle*:** Introduction, Method of development, Development of lateral surfaces of Prism, Pyramid, Cylinder, Cone. (Development with only one cutting plane for Prism and Pyramid to be asked for exams) | **18** |

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| | **Intersection of Surfaces using first angle *:** Cylinder – cylinder, Cone – Cylinder, Prism – Prism, Prism – Cylinder, Pyramid-Cylinder<br>A mini project based on sections, development and intersections of surfaces to be done and submitted. | |
| **Unit 4** | **Isometric Projection using first angle:** Introduction, Isometric axes, Isometric scale, Isometric projection and Isometric views<br>**Orthographic Projection using first angle:** 2 Views and 3 Views (Only 2 views to be asked for exams)<br>**DESIGN PROJECT:** A mini Project based on the skills acquired from unit 3 topics. | **36** |
| | **List of Practical Contents** | |
| | 1. At least 6 sheets covering topics from Unit 1, 2 and 4 to be planned evenly over the entire semester<br>2. At least one Problem each from isometric and orthographic projection to be drafted on computer aided software.<br>3. One mini design project based on unit 3 to be done and submitted | |
| **Pedagogy** | Inquiry based learning, Constructive and Collaborative Learning | |
| **References / Readings:** | **Text Book:**<br>1. Bhat N.D., 'Engineering Drawing', Charotar Publication, 2023, ISBN:978-93-85039-70-6<br>**Reference Book:**<br>1. Gopalkrishna K.R., 'Engineering Drawing I & II', India Subhas Stores book Corner,2017, ISBN: 978-93-83214-23-5 | |
| **Course Outcomes:** | After going through this course, the student will be able to:<br>1. Demonstrate the imagination skills required in converting idea into drawing.<br>2. Understand the principles of projection systems in engineering graphics.<br>3. Apply the projection principles in solving problems in engineering graphics.<br>4. Analyze and interpret Orthographic and Isometric projection and make parts. | |

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**SEMESTER II**
**Major Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : EEL-100**
**Title of the Course : Fundamentals of Electrical and Electronics Engineering**
**Number of Credits : 3**
**Effective from AY : 2024-25**

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| **Prerequisites for the Course:** | Nil | |
| **Course Objectives** | The course will enable the students to<br>1. Understand various energy resources, AC and DC Circuits, Electrical Power and Digital Logic<br>2. Demonstrate the knowledge of theorems, electrical circuit, electromagnetic induction in electrical applications.<br>3. Apply the concepts to solve Electrical Circuits<br>4. Analyze Boolean expressions, DC and AC circuits, transformer losses and power in single / three phase circuits | |
| **Content:** | | **No. of Hours** |
| **Unit 1** | **Introduction to Energy sources**: Different sources of generation of electrical energy - conventional sources of energy- Thermal, hydro & nuclear. Non conventional sources – solar, wind, fuel cell.<br>**Batteries**: Series and parallel connection of Batteries, Battery specifications.<br>**Electrical Circuits & Analysis of DC circuits**: Kirchoff's laws, Loop analysis/mesh analysis & nodal analysis. Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum Power transfer theorem, Voltage and current relationship for R, L and C, Independent voltage and current sources, V-I and I-V source transformations, Voltage / current division concept, Star-Delta transformation. | **12** |
| **Unit 2** | **A.C Fundamentals**: Representation of AC quantity (Mathematical, Phasor, waveform). Frequency, Time period, average value, RMS value, Maximum /Peak value, Form factor, Peak factor, Phase angle and phasor diagram, active power, reactive power, apparent power, power factor, AC quantities in complex notations, complex impedance, R-L, R-C, and RLC circuits<br>**Three phase systems**: Representation of three phase system, concept of phase sequence & its significance, Star and Delta connections, Line and phase quantities and their relationship, Balanced supply and balanced load conditions, phasor diagram, Three phase power relationship. Measurement of single phase and 3 phase power. | **11** |

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| **Unit 3** | **Electromechanical Energy Conversion**: Magnetic circuits - MMF, flux, reluctance, inductance, concept of leakage flux. Singly and multiply excited systems, Energy stored in Magnetic field.<br>**Elementary machines**: Generated EMF in Machines, Distribution factor, MMF of a coil, torque in round rotor machines<br>**Single phase transformer**: Construction (core and shell type), principle of operation, EMF equation, equivalent circuit, phasor diagram, voltage regulation, losses in transformer, OC and SC test, efficiency | **11** |
| **Unit 4** | **Introduction to Digital Systems**: Binary, Octal, Decimal, Hexadecimal systems and conversion between systems.<br>**Codes**: Excess 3 code, Gray code, ASCII code, Compliments, Representation of signed numbers, Binary arithmetic – addition, subtraction (1's and 2's complement), multiplication and division. Fixed and floating-point numbers, BCD numbers and BCD arithmetic. **Basic logic operations and Theorems**: (AND, OR, NOT, NAND, NOR, XOR, XNOR)- truth tables, symbols and logic expressions. De Morgan's theorems, Fundamental theorems of Boolean algebra. | **11** |
| **Pedagogy:** | Inquiry based, Reflective and Integrative Learning | |
| **References/ Readings:** | **Text Books**<br>1. P.V. Prasad, S. Sivanagaraju, "Electrical Engineering Concepts and Applications", Cengage, ISBN: 978-81-315-1787-1, 2012<br>2. Theraja, B. L.," Fundamentals of Electrical Engineering and Electronics", S. Chand Publishing, 2006.<br>3. Mehta, V. K., and Mehta Rohit, "Basic Electrical Engineering", S. Chand Publishing, 2008<br>4. Mano, M. Morris," Digital logic and computer design", Pearson Education India, 2017.<br>**Reference Books**<br>1. Vincent Del Tero, "Principles of Electrical Engineering", PHI Publication, 1972<br>2. Leach, Donald P., and Albert P. Malvino," Digital principles and applications", Glencoe/McGraw-Hill, 1994. | |
| **Course Outcomes:** | **After taking this course, student will be able to:**<br>1. Understand concepts of DC, AC, working of transformer, Energy sources and digital logic circuits<br>2. Analyze and solve the electrical circuits using by applying appropriate theorem and digital circuits<br>3. Apply A.C fundamentals and Three phase principles to electrical circuits and D.C circuit theorems, Boolean laws<br>4. Implement various electrical circuits and digital logic circuits | |

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**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : EEL-101**
**Title of the Course : Fundamentals of Electrical and Electronics Engineering Lab**
**Number of Credits : 1**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The course will enable the students to:<br>1. Identify electrical and electronic components, determine specifications, component values and infer results from measurements /waveforms<br>2. Use test and measuring instruments for performing AC / DC Measurements and verification of Electrical Theorems / Laws<br>3. Understand single and three phase circuit, phasor relationships and power measurement<br>4. Assemble and test Digital circuits | |
| **Content:** | **List of Experiments** | **No. of hours** |
| **Part A** | 1. Identification electrical and electronic components (Such as resistors, capacitors, inductors, transformer, diodes and ICs) and usage of Test and measuring instruments (Such as Power Supply, Digital Multimeter, Function Generator, Analog and Digital Storage Oscilloscope -DSO)<br>2. Study of single phase domestic wiring system | **6** |
| **Part B** | 1. Verification of Kirchoff's Law<br>2. Verification of Thevenin's theorem and Norton's theorem<br>3. Verification of Superposition theorem and Maximum power transfer theorem<br>4. Measurement of power in single phase circuit<br>5. Measurements of active power & reactive power in 3 phase circuit by using two wattmeter method<br>6. Understanding Phasor relationship for R, RL, RC, and RLC circuits | **12** |
| **Part C** | 1. Open circuit and Short circuit test on transformer<br>2. Load Test on Single phase Transformer<br>3. Verification of Truth table for Logic gates<br>4. Minimization and Realization of given logic expression using universal gates<br>5. Verification of Half adder and Full adder circuit implementation using logic gates | **12** |
| **Pedagogy:** | Inquiry based Learning, Constructive and Collaborative Learning. | |
| **Instructions:** | **Minimum 10 experiments to be performed**<br>1. Part A is compulsory<br>2. Minimum 4 experiments each to be performed from Part B and Part C<br>3. Lab Journal to be maintained by every student | |
| **References/ Readings:** | **Reference Books:**<br>1. Mathew Susan S. , Chacko Saji T. , "Fundamentals of Electrical & | |

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| | Electronics Engineering (with Lab Manual)", Khanna Book Publishing Co, 2021<br>2. Bhargava Cherry, "Digital Electronics, A comprehensive Lab manual", BS Publications 2020. |
| **Course Outcomes:** | After taking this course, student will be able to:<br>1. Identify electrical and electronic components and determine component values and their specifications<br>2. Assemble and test electrical and electronic circuits<br>3. Observe, Measure and note readings<br>4. Interpret results and infer conclusion |

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**Minor Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : ITH-111**
**Title of the Course : Basics of Computing Using Python**
**Number of Credits : 3**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The course will enable students to:<br>1. Understand the fundamental concepts of computers and Python programming.<br>2. Illustrate competency in Python programming by effectively utilizing basic programming constructs<br>3. Apply expertise in Python programming by utilizing functions and a various data structures in different contexts.<br>4. Develop Python programs to address practical, real-world challenges. | |
| **Content:** | | **No. of hours** |
| **Unit 1** | **Introduction to Computers:** Importance of computers, characteristics of computers, classification of computers, uses of computers.<br>**Anatomy of Digital Computer:** parts of computer, CPU: Control Unit and ALU. secondary storage devices, keyboards, mouse, scanners, readers, digital cameras, monitors, and printers.<br>**Operating Systems:** Introduction, functions of an operating system, classification of operating systems.<br>**Introduction to Computer Problem Solving:** Introduction, problem-solving aspect, top-down design. | **10** |
| **Unit 2** | **Introduction:** Features of Python, execution of Python programs, Python virtual machines, memory management, garbage collection, comparison between C and Python.<br>**Data Types:** Comments, docstrings, built-in data types, strings, sets, literals, user-defined data types, constants, identifiers, reserved words and naming conventions in python.<br>**Operators:** Arithmetic, assignment, unary, relational, logical, Boolean, bitwise, membership, identity operators, operator precedence and associativity.<br>**Control statements:** if, if-else, if-elif else, while, for, nested loops, break, continue, pass, assert and return statements | **12** |
| **Unit 3** | **Array in Python:** Advantages of arrays, creating, importing, indexing and slicing, processing of array, types of array, working with single and multi-dimensional arrays using numpy, creating array using array() functions, mathematical operations on array like: addition and multiplication<br>**Strings and Characters:** Creating, length, indexing, slicing, repeating, concatenation, comparing of strings, checking | **12** |

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| | membership, removing spaces, finding substring, counting substring, changing case. | |
| **Unit 4** | **Functions:** Difference between function and method, defining, calling, returning result, returning multiple values from functions, formal and actual parameters, positional, keyword and default arguments, variable length arguments, local and global variables, passing a group of elements to a function.<br>**List and Tuples:** Creating lists using range () function, updating concatenating, repetition of lists, methods to process lists, finding the biggest and smallest element in a list, sorting the list elements, tuples, creating, accessing tuples, basic operations on tuples. | **11** |
| **Pedagogy:** | Inquiry-Based Learning, Reflective, Integrative Learning | |
| **References/ Readings:** | **Text Books**<br>1. Alexis Leon and Mathews Leon, "Fundamentals of Information Technology", Vikas Publication, Second edition, 2009.<br>2. Dr. R. Nageswara Rao; "Core Python Programming", Dreamtech press, Third edition, 2018.<br>1. Kenneth. A. Lambert, Cengage, "Fundamentals of Python First Programs", Cengage publisher, ISBN: 978-93-5350-289-8<br>2. R.G. Dromey, "How to Solve it by Computers", Pearson Education.<br>**Reference Books**<br>3. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. | |
| **Course Outcomes:** | After going through this course, the students will be able to:<br>1. Describe the fundamental aspects of computers and Python programming.<br>2. Illustrate the concepts of the Python programming such as data types, control statements, operators.<br>3. Demonstrate proficiency in Python programming by developing code that incorporates arrays, functions, lists, and tuples.<br>4. Create Python programs to provide solutions for real-life challenges. | |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **ITH-112**
**Title of the Course** : **Basics of Computing Using Python Lab**
**Number of Credits** : **1**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The course will enable students to:<br>1. Understand basic Python programming concepts.<br>2. Illustrate the knowledge of syntax and semantics of Python programming language.<br>3. Design and implement Python programs using basic concepts, arrays, strings, functions.<br>4. Evaluate and modify any given Python program as per the requirement. | |
| **Content:** | **List of Programs/Experiments** | **No. of Hours** |
| | 1. Python program to demonstrate basics, data types, and base conversion.<br>2. Python program to demonstrate usage of operators, and control statements.<br>3. Python program to demonstrate usage of control statements and loops.<br>4. Python program to demonstrate creation and manipulation of one-dimensional numpy array.<br>5. Python program to demonstrate creation and manipulation of two-dimensional numpy array.<br>6. Python program to demonstrate slicing, and indexing operations on strings.<br>7. Python program to demonstrate, repetition operations on strings<br>8. Python program to demonstrate inbuilt functions on strings.<br>9. Python program to demonstrate functions.<br>10. Python program to demonstrate basic operations on the list data structure.<br>11. Python program to demonstrate basic operations on the tuple data structure.<br>**12.** Python program to demonstrate applications of lists and tuples. | **30** |
| **Pedagogy:** | Inquiry-based Learning, Constructive and Collaborative Learning. | |
| **Instructions:** | **Minimum 10 Experiments to be performed.** | |
| **References/ Readings:** | **Text Books**<br>1. Leon Alexis and LeonMathews, "Fundamentals of Information Technology", Vikas Publication, Second edition, 2009.<br>2. Rao R. Nageswara, "Core Python Programming", Dreamtech press, | |

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| | Third edition, 2018.<br>**Reference Books**<br>1. Brown C., "Python: The complete Reference, McGrawHill Education, 4th Edn, 2018.<br>2. Dromey R.G., "How to Solve it by Computers", Pearson Education.<br>3. Kurama Vamsi, "Python Programming: A Modern Approach", Pearson India, 2017.<br>4. LambertKenneth. A., Cengage, "Fundamentals of Python First Programs, Course Technology Ptr", Second edition,2019. |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Illustrate Python language features, encompassing data types, operators, control statements, lists, and tuples.<br>2. Demonstrate Python language concepts in a development environment.<br>3. Develop Python programs to solve real life problems.<br>4. Analyze the syntax and semantics of given data types, data structures, and Python code. |

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**Name of the programme** : **B.E. Mechanical Engineering**
**Course code** : **SHM-113**
**Title of the course** : **Engineering Chemistry**
**Number of Credits** : **3**
**Effective from AY** : **2024-25**

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| **Pre-requisites of the course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Deal with industrial technologies and applications related to chemistry.<br>2. Meet the basic needs of an individual, the society and the environment | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Electrochemical Energy Systems:** Single electrode potential: concept, sign convention, Determination of standard electrode potential, Nernst equation and related numerical. Electrochemical cells: Galvanic and Concentration cells- Construction, Representation, Determination of EMF, Role of Electrochemical series and numerical. Electrodes: Reference Electrodes –Calomel and Silver/Silver chloride electrodes; Ion Selective electrodes, glass electrode; Construction, representation, pH determination using the electrodes.<br>**Batteries**: Basic concepts, Characteristics, classification. Construction, working and applications of Zn-Air Battery and Li-ion polymer battery.<br>**Fuel Cells:** Basic construction and working with reference to Hydrogen–Oxygen Fuel cell with KOH as electrolyte.<br>**Fuels:** Definition, Classification with reference to combustible fuels; Important terms-Calorific value, GCV, NCV. Crude oil-Mining and purification, grading of Gasoline and Diesel. Blending of gasoline with ethanol.<br>**Non-Conventional Sources of Energy**: Solar and Biogas- working principles and constructions involved therein | **12** |
| **Unit 2** | **Corrosion:** Definition and Mechanism of corrosion- Direct chemical corrosion and Electrochemical corrosion. Types of Corrosion: Galvanic corrosion, differential aeration corrosion(with reference to waterline and Pitting corrosion), Inter-granular and stress corrosion. Factors Influencing corrosion: Nature of metal and Environment; Corrosion Control Measures: Proper design, Purity and alloying, Cathodic protection, Modifying environment, Metal cladding, Inorganic coatings(phosphate and anodized) and Protective Metal coatings e.g. (Hot metal coatings (Galvanization & Tinning), Electroless (PCB preparation) and Electroplating (Chromium Plating).<br>**Green Chemistry:** Objectives and significance of Green Chemistry; Basic components of green chemistry: Alternative | **11** |

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| | feedstocks (adipic acid preparation), reagents (methylation by use of DMC), reaction conditions (Use of aqueous solvent) and final products (Synthesis of acetyl acetate esters); Concept of atom Economy. Industrial application of Green Chemistry (with reference to Products from natural materials, Green Solvents and Green fuels). | |
| **Unit 3** | **Polymers:** Definition, Classification-based on source of availability, structure, number of monomers and their arrangement, type of polymerization and response to heat, Basic concepts- monomers, Degree of polymerization, Functionality. Methods of Polymerization- Bulk, Suspension, Emulsion and solution. Structure-Property relationships in Polymers- chemical, Electrical (conducting polymer e.g. polyacetylene), optical, Mechanical and Crystallinity in Polymers (Tg and Tm). Degradation of PolymersOxidation, weathering, Environmental stress cracking and thermal. Compounding of polymers to yield plastics: ingredients involved. Elastomers: Processing of natural rubber, comparison between natural and synthetic rubber.<br>I**nstrumental Techniques: covering Principles**, working and applications of UV visible, Gas Chromatography and Differential Scanning Calorimeter (DSC). | **11** |
| **Unit 4** | **Water Technology:** Impurities in water, water analysis- Determination of pH, Turbidity, Dissolved solids, Hardness, Alkalinity, BOD and COD including numericals. Specifications for drinking water; BIS and WHO standards. Municipal treatment for large scale production of potable water. Large scale production of potable water using saline water- Flash Evaporation, Electrodialysis and reverse Osmosis method. Sewage treatment.<br>**Composites:** Definition, constituents of composites, Types of composites-Fibre, particulate and layered. Applications of composites. | **11** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding | |
| **References/ Readings:** | **Text Books**<br>1. Jain and Jain; Engineering Chemistry; Dhanpat Rai Publishing Co.; 2013.<br>2. S. S. Dara; Engineering Chemistry; Chand & Co.; 2011.<br>3. Shashi Chawla; A Text Book of Engineering Chemistry; Dhanpat Rai Publishing Co.; 2011.<br>**Reference Books**<br>1. M.G. Fontana; Corrosion Engineering; McGraw Hill Publication.<br>2. M.M. Uppal; Engineering Chemistry; Khanna Publication. | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Understand basic concepts relevant to electrochemical systems, corrosion, polymer and water technology<br>2. Identify types of fuels cells, types of corrosion, polymeric unit, and contaminants in water | |

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| | 3. Analyze suitability of chemical materials for engineering applications<br>4. Apply the concepts of electrochemical energy system, corrosion, polymers and water technology to solve real life problems |

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**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SHM-114**
**Title of the Course : Engineering Chemistry Lab**
**Number of Credits : 1**
**Effective from AY : 2024-25**

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| **Prerequisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Deal with industrial technologies and applications related to chemistry.<br>2. Meet the basic needs of an individual, the society and the environment. | |
| **Contents:** | | **No. of hours** |
| | 1. Introduction to the Chemistry laboratory session: Discussion on basic aspects like calculation of normality & Molarity, preparations of solutions, Acquaintance with glassware and other laboratory facilities<br>2. Determination of Standard Electrode potential and verification of Nernst Equation<br>3. Study of corrosion activity of Aluminum metal in Acid and Base Solution<br>4. Study of deposition of Ni metal on Aluminium by Electroless plating<br>5. Determination of Viscosity by using Ostwald Viscometer<br>6. Elemental analysis using Colorimeter<br>7. Determination of pH, Turbidity and Dissolved solid content of water<br>8. Determination of Hardness of a given water sample<br>9. Determination of Alkalinity of a given water sample<br>10. Determination of Dissolved oxygen content in water<br>11. Determination of COD of a water sample<br>12. Determination of molecular weight of polymer using Ostwald viscometer<br>13. Analysis of an ore using titrimetric method of analysis<br>14. Separation of miscible liquids using Fractional distillation method<br>15. Titrimetric analysis involving use of Conductometer<br>16. Synthesis of Polymer | **30** |
| **Pedagogy:** | Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments | |
| **Instructions:** | **Minimum 10 experiments to be performed** | |
| **References/ Readings** | 1. J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, "Vogels Textbook of Quantitative Chemical Analysis", Pearson Education. India, 2006, ISBN: 9788177581805<br>2. Rattan, S. "Experiments in Applied Chemistry: For Engineering Students". Kataria Publishers, India, 2012. | |

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| **Course Outcomes:** | **After going through this course, the student will be able to**<br>1. Understand basic concepts relevant to electrochemical systems, corrosion, polymer and water technology<br>2. Identify types of fuels cells, types of corrosion, polymeric unit, and contaminants in water<br>3. Analyze suitability of chemical materials for engineering applications<br>4. Apply the concepts of electrochemical energy system, corrosion, polymers and water technology to solve real life problems |

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**Multidisciplinary Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SHM-134**
**Title of the Course : Applied Mathematics - I**
**Number Of Credits : 3 (2L+1T)**
**Effective From AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Understand the significance of Taylor's series expansion, familiarity with functions of several variables and their analytic properties.<br>2. Knowledge of differential vector calculus.<br>3. Tools to deal with first order and first degree ordinary differential equations.<br>4. Knowledge and skills to handle mathematical operations and problems involving complex numbers. | |
| **Contents:** | | **No of Hours** |
| **Unit 1** | **Differential Calculus:** Higher order derivatives, Leibnitz theorem, Taylor's series expansion in one variable.<br>Partial derivatives, maxima, minima, and saddle points; method of Lagrange multipliers. Solution of partial differential equations of the type Pp + Qq = R. | **08** |
| **Unit 2** | **Vector Differentiation: V**ector differentiation, Scalar and Vector fields, Directional Derivatives, Divergence and Curl of Vector fields, Gradient of a Scalar field. | **07** |
| **Unit 3** | **Differential Equations of First Order and First Degree:**First order and first degree ordinary differential equations, method of separation of variables, homogeneous differential equations, equations reducible to homogeneous form.<br>**Exact differential equations, e**quations reducible to exact form by using integrating factors.<br>**Linear differential equations,** equations reducible to linear form, Bernoulli's equation. | **08** |
| **Unit 4** | **Complex Variables: C**omplex numbers and their properties, Modulus and Argument of a Complex number, Polar and Exponential form of Complex number, Geometric interpretation of Complex numbers, De Moivre's theorem and its applications.<br>Exponential, Trigonometric, Hyperbolic and Logarithmic functions, Inverse Trigonometric and Hyperbolic functions. | **07** |
| **Pedagogy:** | Inquiry based learning, Constructive, Integrative and Reflective learning.<br>One or more assignments to be carried out on topics covered in each unit above- Total time allotted 15 hours | |
| **References/ Readings:** | **Text Books**<br>1. Grewal, B. S., "Higher Engineering Mathematics", Khanna Publishers, India 2014<br>2. Weir, M. D., Hass, J., Giordano, F. R. "Thomas' Calculus", Pearson | |

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| | Addison Wesley, United Kingdom, 2005. |
| | **Reference Books**<br>1. Kapoor, A. K. "Complex Variables: Principles and Problem Sessions", Singapore, World Scientific, 2011.<br>2. Kreyszig, Erwin, "Advanced Engineering Mathematics", United Kingdom, Wiley, 2020. |
| **Course outcomes:** | **After going through this course the student will be able to:**<br>1. Express a function of one variable in the form of a power series, understand partial differentiation and its applications, and solve first-order partial differential equations.<br>2. Understand and apply the concepts of differential vector calculus.<br>3. Solve first-order and first degree ordinary differential equations.<br>4. Perform various operations on complex numbers and understand the analytic properties of complex trigonometric and hyperbolic functions. |

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**Ability Enhancement Courses**

**Name of the Programme : B.E. Mechanical Engineering**
**Course code : AEC-151**
**Title of the course : Creative Thinking and Innovation**
**Number of credits : 2**
**Effective from AY : 2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Explain the steps involved in the creative thinking process<br>2. Apply the various techniques for stimulating creativity and innovation thinking<br>3. Analyze the techniques to design and develop new products<br>4. Synthesize the creative design with analysis to develop new products. | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Introduction:** Creative thinking, blocks to creativity, factors that influence creative design, engineering design and creative design, influence of society, technology and business on creativity, force field analysis, market pull & technology push, attribute of a creative person, thinking in groups.<br>**Emotional design:** Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective design; designs with personality – machines that senses emotions and induce emotions- Robots, personality products, products for games, fun, people and places; Simulation – dimensional or mathematical, virtual simulation, physical simulation, scale down models. | **8** |
| **Unit 2** | **Generation Of Ideas:** Need or identification of a problem, market survey, data collection, review & analysis, problem definition, Kipling method, challenge statement, problem statement initial specifications, Brain storming, analogy technique or synectics, check list, trigger words, morphological method, interaction matrix method, analysis of interconnected decision making, record-discuss-clarify-verify. | **8** |
| **Unit 3** | **Theory Of Inventive Problem Solving (Triz):** Common features of good solutions – resolve contradiction, use available resource, increase the ideality, trade-off, inherent contradiction, 30 key TRIZ principles – multifunction, preliminary action, compensation, nested doll, blessing in disguise, segmentation, separation, regional influences, symmetry change, opaque & porous, inflate and deflate, colour, recycle & recover, phase transformation, energy, imaging, environment, composition, economical, surface response, equipotential, static & dynamic, continuous & intermittent, servo systems, smart systems, dimensions. | **8** |
| **Unit 4** | **Product Design & Intellectual Property Rights (IPR)**<br>Recording of ideas, evaluation of ideas, detail design, prototyping, patent act, patent laws, drafting patent applications, product | **6** |

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| | deployment, useful life assessment and recycling and sustainability. | |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding. | |
| **References/ Readings:** | **Text Books:**<br>1. Chakrabarti, Amaresh, "Creative Engineering Design Synthesis", Springer, 2002.<br>2. Floyd Hurt, "Rousing Creativity: Think New Now", Crisp Publ Inc. 1999, ISBN 1560525479.<br>**Reference Books:**<br>1. Adair John, 'The Art of Creative Thinking', Kogan Page Publication, 2011, ISBN 978-0-7494-5483-8.<br>2. Norman, Donald A., "Emotional Design", Perseus Books Group New York, 2004, ISBN 123-1-118-027-6.<br>3. Rantanen, Kalevi, Domb Ellen, 'Simplified TRIZ' – II edn., Auerbach Publications, Taylor & Francis Group, 2010, ISBN: 978-142-0062-748. | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Explain the steps involved in the creative thinking process.<br>2. Apply the various techniques for stimulating creativity and innovation thinking.<br>3. Analyze the techniques to design and develop new products.<br>4. Synthesize the creative design with analysis to develop new products. | |

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**Name of the Programme : B.E. Mechanical Engineering**
**Course code : AEC-152**
**Title of the course : Creative Thinking and Innovation Lab**
**Number of credits : 1**
**Effective from AY : 2024-25**

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| **Prerequisites for the Course:** | NIL | |
| **Course Objectives:** | The students shall be able to:<br>1. Identify the problem or limitations of existing devices, processes and systems.<br>2. Explain the need for improved/ development of new devices, process or system<br>3. Analyze creative and innovative techniques / solutions<br>4. Develop designs, drawings, models of devices, processes and systems | |
| **Contents:** | | **No. of hours** |
| | • Groups of three or four students will be made,<br>• Each group shall choose any one of the following topics, in consultation with the faculty<br>• Identify a problem statement and come up with creative ideas and innovative solutions.<br>(a) Renewable Energy;<br>(b) Agriculture, Aqua Culture, Food Processing;<br>(c) Waste Processing;<br>(d) Technologies for Healthcare;<br>(e) Technologies for law enforcement;<br>(f) Application of Robots<br>(g) Technologies for Mobility | **30** |
| **Pedagogy:** | Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments | |
| **References/ Readings:** | **Text Books:**<br>1. Chakrabarti, A., "Creative Engineering Design Synthesis", Springer, 2002.<br>2. Hurt, F., "Rousing Creativity: Think New Now", Crisp Publishers Inc., 1999, ISBN 1560525479.<br>**Reference Books:**<br>1. Adair, J., "The Art of Creative Thinking", Kogan Page Publication, 2011, ISBN 978-0-7494-5483-8.<br>2. Norman, D. A. "Emotional Design", Perseus Books Group New York, 2004, ISBN 123-1-118-027-6.<br>3. Rantanen, K., Domb, E., "Simplified TRIZ", 2nd Edn., Auerbach Publications, Taylor & Francis Group, 2010, ISBN: 978-142-0062-748. | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Identify the problem or limitations of existing devices, processes and systems.<br>2. Explain the need for improved/ development of new devices, process | |

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| | or system<br>3. Analyze creative and innovative techniques / solutions<br>4. Develop designs, drawings, models of devices, processes and systems. |

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**Value Added Courses**
**Name of the Programme : B.E. Mechanical Engineering**
**Course code : VAC-156**
**Title of the course : Indian Knowledge System**
**Number of credits : 2**
**Effective from AY : 2024-25**

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| **Prerequisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Remember the contributions made by ancient Indian civilization<br>2. Understand the importance of Indian Knowledge System<br>3. Explain the relevance of Indian Knowledge System in Today's context<br>4. Apply the Indian Knowledge System in Daily Practices. | |
| **Contents:** | | **No. of Hours** |
| **Unit 1** | **Historical Perspective of Indian Civilization :3**000 BCE to 2000 CE, Education System in Ancient India - Universities-Takshashila, Nalanda, Vikramashila; Knowledge of Materials and Processes; Mathematics; Astronomy; Indian Calendar, Public Administration and Governance; Economics and Trade; Relevance in today's context. | **07** |
| **Unit 2** | **Town Planning;** Architecture & Sculpture; Vastu Shastra; Jyothishya,<br>Vedas-Rig, Yajur, Sama, Athrva; Brahmana, Aranyaka, Upanishad, Vedangas, Vedanta, Jainism, Buddhism; Universal Human Values-Dharma, Artha, Kama, Moksha; Character: Sattva, Rajas, Tamas; Relevance in today's context in terms of content and values | **08** |
| **Unit 3** | **Ayurveda-**mind-body relation, five koshas, vatta-pitta-kapha, dravya-guna-karma, Medicinal values of fruits, vegetables, spices; disease prevention and cure; Health & Wellness – Ashtanga Yoga – Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, Samadhi; Relevance in today's context in terms of content and value. | **07** |
| **Unit 4** | **Linguistics;** Music and Musical Instruments – Dhvani Siddhanta; Traditional Dance Forms – Bharata Natyashastra, Navarasa; Mudras; Dress Materials /Textiles, weaving, dyeing of cotton and silk fabric. Relevance in today's context in terms of content and values. | **08** |
| **Pedagogy:** | Inquiry based learning, Integrative approach to multidimensional understanding Reflective thinking leading to right understanding. | |
| **References/ Readings:** | **Text Books:**<br>1. Iyengar B. K. S., "Light on Yoga", Aquarian-Thorsons Publication, 1991, ISBN:978-18-55381-16-67.<br>2. Mahadevan B., Bhat, V., Pavana, N., "Introduction to Indian Knowledge Systems", PHI-EEE, 2022, ISBN:978-93-91818-20-3.<br>**Reference Books:**<br>1. Chidatmananda Swami, 'Ancient Indian Society', Chinmaya Mission. | |

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| | 2. Gaur R. R., Asthana R., Bagaria G. P. "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.<br>3. Prajnanananda Swami, "History of Indian Music", Advaita Ashram, Kolkata. |
| **Course Outcomes:** | After going through this course, the student will be able to:<br>1. Remember the contributions made by Ancient Indians to Global Knowledge.<br>2. Understand the importance of the Indian Knowledge System in the Global Context.<br>3. Explain the relevance of Indian Knowledge System to Today's Context<br>4. Apply the Knowledge into Daily Practices. |

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**Name of the Programme** : **B.E. Mechanical Engineering**
**Course Code** : **VAC-157**
**Title of the Course** : **Indian Knowledge System Lab**
**Number of Credits** : **1**
**Effective from AY** : **2024-25**

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| **Pre-requisites for the Course:** | Nil | |
| **Course Objectives:** | The students shall be able to:<br>1. Study the various features of Indian Knowledge System.<br>2. Learn specific characteristics of Indian Knowledge System.<br>3. Observe and examine various knowledge aspects in practice in Today's world.<br>4. Examine the application of IKS to certain practices in Today's world. | |
| **Contents:** | | **No. of Hours** |
| | Four Member Student groups shall be formed and they shall be given two topics to conduct a detailed study on the contributions of Indian, give periodic presentation, submit a final report<br>1. Astronomy and Calendar<br>2. Mathematics<br>3. Architecture & Town Planning<br>4. Public Administration and Governance<br>5. Painting,<br>6. Dance<br>7. Music and musical instruments<br>8. Vedas & Other Texts<br>9. Ayurveda<br>10. Yoga | **30** |
| **Pedagogy:** | Inquiry based learning, Constructive planning of experiments Collaborative approach in performing experiments | |
| **References/ Readings:** | **Text Books:**<br>1. BKS Iyengar, 'Light On Yoga', Aquarian-Thorsons Publication, 1991, ISBN:978-18-55381-16-67.<br>2. Mahadevan, B., Bhat, V., Pavana, N., "Introduction to Indian Knowledge Systems", PHI-EEE2022, ISBN:978-93-91818-20-3.<br>**Reference Books:**<br>1. Gaur, R. R., Asthana, R., Bagaria, G. P., "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.<br>2. Swami Chidatmananda, "Ancient Indian Society", Chinmaya Mission.<br>3. Swami Prajnanananda, "History of Indian Music", Advaita Ashram, Kolkata. | |
| **Course Outcomes:** | **After going through this course, the student will be able to:**<br>1. Understand the various features of Indian Knowledge System.<br>2. Explain specific characteristics of Indian Knowledge System.<br>3. Examine certain aspects in practice in today's world.<br>4. Investigate application of IKS to certain practices in Today's world. | |

**Name of the Programme : B.E. Mechanical Engineering**
**Course Code : SEC141**
**Title of the Course : Civil and Mechanical Workshop**
**Number of Credits : 3**
**Effective From : AY 2024-25**

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| **Pre-requisites for the course** | Nil | |
| **Course Objectives** | The student shall be able to:<br>1. Plan the work for converting the raw material into the specified job.<br>2. Use the appropriate tools in carrying out the required work operations.<br>3. Use correct procedures in performing various operations on the work pieces.<br>4. Convert the raw material into a finished job using various tools and equipment, following safe work practices. | |
| **Content** | | **No. of Hours** |
| | **1. Fitting**<br>Demonstration of various tools and equipment used in fitting shop.<br>**Practical Experiments**: at least one job covering simple fitting practice. | **18** |
| | **2. Carpentry and Pattern making**<br>Demonstration of wood cutting machines, various tools and equipment used by a carpenter.<br>**Practical Experiments**: at least one of the following jobs<br>i. Wooden joint<br>ii. Wood turning | **18** |
| | **3. Plumbing**<br>Demonstration of various tools and equipment used by a plumber.<br>Demonstrations of various plumbing fittings.<br>**Practical Experiments**: At least one job on G.I pipe or P.V.C pipe fitting by threading or using appropriate adhesives involving various fittings. | **18** |
| | **4. Turning and Machining**<br>Demonstration of lathes, drilling machines, grinding machines, milling machines and shaper tools & equipment.<br>**Practical Experiments**: At least one job on lathe covering operations such as facing, centre drilling, plain turning, step turning, taper turning and chamfering. | **18** |
| | **5. Welding**<br>Demonstration of various tools and equipment used by a welder.<br>**Practical Experiments**: At least one job on electric arc welding. | **18** |
| | **Practical Jobs mentioned above must be completed and submitted at the end of the term.** | |
| **Pedagogy** | Inquiry based learning, Constructive and Collaborative Learning | |
| **References** | **Reference Books:**<br>1. Veerana D. K. "Workshop / Manufacturing Practices (with Lab Manual) (English)", Khanna Publishing ISBN: 978-93-91505-332 | |

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| | 2. Narvekar Shekhar R., “AutomobileGarage Equipment & Vehicle Testing”, First Edn., Rajhans Publishers, 2018 Ed.<br>3. Khanna R. S., “Basic Workshop Practice”, S. Chand & Co. ISBN: 9788121939171<br>4. John K C, “Mechanical Workshop Practice”, PHI Learning, ISBN: 978-81-20341-661 |
| **Course Outcomes** | **After going through this course, the student will be able to:**<br>1. Understand the transformation of raw material to finished product.<br>2. Identify the tools, machines and effort required to complete the job.<br>3. Demonstrate the skills required for fitting, carpentry, pattern making, Plumbing, Turning/Machining and welding jobs.<br>4. Execute the skills in fitting, carpentry, pattern making, Plumbing, Turning/Machining and welding to process the specified jobs using safe practices. |

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