**BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE- 587 102**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| | | |
|---|---|---|
| **22UME121C** | **ELEMENTS OF MECHANICAL ENGINEERING** | **Credits: 03** |
| **L:T:P - $N_L$ : $N_T$ : $N_P$ : 3 : 0 : 0** | | **CIE Marks : 50** |
| **Total Hours/Week : 4** | | **SEE Marks : 100** |

| **UNIT - I** | **10 Hrs.** |
|---|---|
| **Energy sources and power plants:**<br>Review of energy sources, construction and working of hydel power plant, thermal power plant. Nuclear power plant, solar power plant, tidal power plant, wind power plant, Environmental issues like global warming, ozone depletion.<br>**Steam formation and steam turbines:**<br>Introduction, Formation of steam, TS, PH, PV diagram, Types of steam, Steam properties, Specific volume enthalpy and internal energy and Entropy (Numerical problems)<br>**Steam turbine:** Classification and working principle of impulse and reaction turbines.<br>**Water turbines:** Introduction, Classification, Working principle and operation of Kaplan, Francis and Pelton turbine. | |
| **UNIT – II** | **10 Hrs.** |
| **Automobile Engineering:**<br>Introduction, Classification of IC engines, Parts of IC engine, IC Engine nomenclature, Working of 4 stroke petrol and diesel engines. Comparison between SI and CI engines. Calculations IP, BP, mechanical efficiency, thermal efficiency, volumetric efficiency, specific fuel consumption, brake specific energy consumption, Problems of 4 stroke engine. Clutch, Gear box, Differential. Introduction ***to electric and hybrid vehicles***.<br>**Refrigeration & Air-conditioning (HVAC):**<br>Introduction, Definition of Refrigeration, Principle of Refrigeration, Unit of Refrigeration (TR), Co-efficient of performance, Relative co-efficient of performance. Working of vapor compression refrigeration system (VCRS), Working of vapor absorption refrigeration system (VARS) and comparison. Working principle of air conditioning. | |
| **UNIT – III** | **10 Hrs.** |
| **Fundamentals of Machine Tools and Operations:**<br>Fundamentals of Machining and machine tools, Construction and Working Principle of Lathe, Milling, drilling machines and applications. (No sketches of machine tools, sketches to be used only for explaining the operations).<br>**Introduction to Advanced Manufacturing Systems:** Introduction, components of CNC, advantages and applications of CNC, 3D printing.<br>**Metal Joining Processes: Soldering, Brazing and Welding:**<br>Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy-acetylene welding. | |
| **UNIT – IV** | **10 Hrs.** |
| **Mechanical Power Transmission:**<br>**Gear Drives**: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple and compound gear trains (simple numerical problems).<br>**Belt Drives**: Introduction, Types of belt drives (Flat and V-Belt Drive), length of the belt and tensions ratio (simple numerical problems).<br>**Introduction to Mechatronics and Robotics:** open-loop and closed-loop mechatronic systems. Joints & links, Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection. | |

**Reference Books** (Title of the Book/Name of the author/Name of the publisher/Edition and Year)


1. Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008.
2. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010.
3. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012.
4. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1.


**Course Outcomes:**

CO1: Calculate the enthalpy and internal energy of different types of steams and identify the different types of energy resources, steam turbine and waterturbines

CO2: Compute and analyze the performance of IC engines used in automobiles and concept of electric, hybrid vehicles for future mobility and refrigeration and air conditioning

CO3: Illustrate the different conventional, advance manufacturing systems and various metal joiningprocesses.

CO4: Solve problems on velocity ratio of gear trains and belt drives and interpret different gear drives and belt drive and also identify the aspects of future mobility and applications of of robotics

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO4 |
| **1** | 1 | 2 | - | - | - | - | 1 | - | - | - | - | 1 | 1 | - | - | - |
| **2** | 1 | 2 | - | 1 | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - |
| **3** | 1 | 1 | - | - | 1 | - | - | - | - | - | - | 1 | 1 | - | - | - |
| **4** | 1 | 2 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - |

| 22UME223C | Computer Aided Engineering Drawing | 03 - Credits |
|---|---|---|
| L:T:P :: 2:0:2 | | CIEMarks:50 |
| TotalHours:40 | | SEEMarks:50 |

| UNIT-I | 10Hrs. |
|---|---|

**Introduction:** Significance of engineering drawing, BIS Conventions of Engineering Drawing. Free hand sketching of Engineering Drawing. Introduction to Computer Aided Drafting software, Co-ordinate system and reference planes HP, VP, and RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.

**Orthographic Projections of Points and Lines:**

Introduction to Orthographic projections: Orthographic projections of points in 1$^{st}$ and 3$^{rd}$ quadrants (for practice only, not for CIE and SEE).

**Projections of lines** located in first quadrant only, line parallel to both the planes, perpendicular to one plane and parallel to other, inclined to one plane and parallel to other, inclined to both the planes. Determinations of true length and true inclinations with principal planes.

| UNIT–II | 10Hrs. |
|---|---|

**Orthographic Projections of planes:**

Projections of planes- perpendicular to the both the planes, parallel to one plane and perpendicular to other, inclined to one plane and perpendicular to other and inclined to both the planes.(Placed in First quadrant only using change of position method).

| UNIT–III | 10 Hrs. |
|---|---|

**Orthographic Projections of solids**

Orthographic Projection of right regular solids (Solids Resting on HP only): Prisms, Pyramids, Cones, and Cylinders (triangle, square, rectangle, pentagon, and hexagon) with axis/base inclined to HP and profile views.

**Development of Lateral Surfaces of Solids**

Development of Lateral Surfaces of right regular prisms, pyramids, cylinders and cones resting with base on HP only

| UNIT–IV | 10Hrs. |
|---|---|

**Isometric Projections:**

Isometric scale, Isometric Projection of hexahedron (cube), right regular prisms, pyramids, Cylinders, Cones and spheres. Isometric Projection of combination of two simple solids (Co-Axial only).

**Free hand Sketching;** True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc.

**Drawing Simple Mechanisms;** Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart & Four-wheeler carts etc.. (Free hand sketches).

**Scheme of Examination**

**CIE**- Continuous Internal Evaluation - Theory (Using grid sheet)

| CIE | Max Marks | Reduced Marks |
|---|---|---|
| I | 40 Marks | 20 Marks |

| | | |
|---|---|---|
| II | 40 Marks | 20 Marks |
| | Assignment | 10 Marks |
| Reduced to 50% of Marks | | 25 Marks |

**CIE -** Continuous Internal Evaluation - Practical (Lab print outs)

| **Particulars** | **Max Marks** | **Reduced Marks** |
|---|---|---|
| Lab classes (using sketch book and print outs) | 30 Marks | 15 Marks |
| Lab CIE | 20 Marks | 10 Marks |
| | | 25 Marks |

Total Marks: C I E (Theory + Practical )

| Theory<br>(Using grid sheet) | Practical | Total |
|---|---|---|
| 25 Marks | 25 Marks | 50 Marks |

**SEMESTER END EXAMINATION**

The Lab-SEE of three hours is conducted as per the model question paper for 100 marks and scaled down to 50 Marks. 50%weightage for sketch and 50% weightage for printouts in both CIE and SEE.

**QUESTION PAPER FORMAT AWARD OF MARKS**

| **Q. No.** | **Question** | **Marks** |
|---|---|---|
| 1 | Straight lines OR Planes | 30 Marks |
| 2 | Solids | 40 Marks |
| 3 | Development of Surfaces OR Isometric Projections | 30 Marks |
| | Total Marks | 100 marks |

| **Q.No** | **Solutions & Sketching on Grid Sheets** | **Computer display & Printout** | **Total** |
|---|---|---|---|
| 1 | 50% (15 Marks) | 50% (15 Marks) | 100% (30 Marks) |
| 2 | 50% (20 Marks) | 50% (20 Marks) | 100% (40 Marks) |
| 3 | 50% (15 Marks) | 50% (15 Marks) | 100% (30 Marks) |

**Reference Books:**


1) K.R.Gopalkrishna, ''Engineering Drawing', vol. I and II, 23rd edition, Subhas, 2014.
2) N.D.Bhat "Engineering Drawing"
3) R.K.Hegde and Niranjan Murthy, ''Engineering Graphics''1st edition, Sapna, 2003.
4) P.I.Varghese, ''Engineering Graphics'', McGraw Hill, 2013


**Course Outcomes:**

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

**CO 1:** Draw and communicate the objects with definite shape and dimensions
**CO 2:** Recognize and draw the shape and size of objects through different views.
**CO 3:** Develop the lateral surface of the objects
**CO 4:** Draw isometric views and freehand sketches of mechanisms and simple machine parts
**CO 5:** Create a drawing views using CAD software.

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | | | 3 | 1 | | 1 | 1 | 3 | | 1 | 1 | 1 | | |
| CO2 | 3 | 2 | | | 3 | 1 | | 1 | 1 | 3 | | 1 | 1 | 1 | | |
| CO3 | 3 | 2 | | | 3 | 1 | | 1 | 1 | 3 | | 1 | 1 | 1 | | |
| CO4 | 3 | 2 | | | 3 | 1 | 1 | | 1 | 3 | | 1 | 1 | 1 | | |
| CO5 | 3 | 2 | | | 3 | 1 | | | | 3 | | 1 | 1 | 1 | | |

| 22UME142B | COMPOSITE MATERIALS | Credits: 03 |
|---|---|---|
| L:T:P - 2 : 2: 0 | | CIE Marks: 50 |
| Total Hours/Week: 4 | | SEE Marks: 50 |

| UNIT-I | 10 Hrs |
|---|---|

**Introduction to composite materials** **5 Hours**

Definition and classification of composites based on matrix and reinforcement, Characteristics of composite materials, Fibrous composites, Laminate composites and particulate composites.

Factors which determine the properties of composites, Benefits of composites, properties and types of reinforcements and matrices, Reinforcement-matrix interface. 5 Hours

| UNIT–II | 10 Hrs. |
|---|---|

**Polymer matrix composites**

Introduction, Polymer matrices, Processing methods like Lay up and curing, open and closed mold process-hand lay up techniques, laminate bag molding. 5 Hours

Production procedures for bag molding, filament winding, pultrusion, pulforming, thermo-forming, molding methods, properties of PMCs and applications, Some commercial PMCs. 5 Hours

| UNIT–III | 10 Hrs. |
|---|---|

**Metal matrix composites**

Introduction, Metallic matrices, Classification of MMCs, Need for production of MMCs, Interface reactions, processing methods like Powder metallurgy, diffusion bonding. 5 Hours

Melt stirring, Compo/Rheo casting, Squeeze casting, Liquid melt infiltration, Spray deposition and In situ Processes, Properties of metal matrix composites, Applications, Some commercial MMCs. 5 Hours

| UNIT–IV | 9 Hrs. |
|---|---|

**Cutting, Machining and Joining of Composites**

Continuous fibers, Iso-stress condition, Iso-strain condition, critical volume fraction of fiber and minimum volume fraction of fiber, Numericals on modulus of rigidity, and mechanics of discontinuous fibers. 5 Hours

Cutting and machining of composites: Reciprocating knife cutting, cutting of cured composite, Joining of composites: Mechanical fastening, Adhesive bonding. 4 Hours

**Reference Books**


1. Composite Science and Engineering, K. K. Chawla, Springer Verlag, 1998
2. Introduction to composite materials Hull and Clyne Cambridge University Press, 2nd Edition, 1990
3. Composite Materials: Engineering and Science F. L. Mathew and R. D. Rawlings, Woodhead Publishing Limited, 1999
4. Composite materials handbook, MeingSchwaitz, McGraw Hill Book Company, 1984
5. Mechanics of Composite Materials, Robert M. Jones, McGraw Hill Kogakusha Ltd, 1998
6. Composite materials, S. C. Sharma, Narosa Publishing House, 2000
7. Mechanics of composites, Artar Kaw,CEC Press, 2002


**Course Outcomes**

**After completion of the course student will be able to**

**CO1:** Solve the numerical problems on modulus of elasticity of the FRP composites. Illustrate the types of composites. Factors influencing the mechanical behaviour.

**CO2:** Analyse the critical volume fraction of fibres in the FRP composites.

**CO3:** Synthesize polymer matrix and metal matrix composites.

**CO4:** Use the abrasive water jet machining of composites. Illustrate the cutting and joining of composites.

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | - | - | - | - | 1 | - | 1 | - | - | 2 | 1 | 1 | - |
| CO2 | 1 | 2 | 1 | - | - | - | - | 1 | - | 1 | - | - | 1 | 2 | 1 | - |
| CO3 | - | 1 | 1 | 2 | - | - | - | 1 | - | 1 | - | - | - | 1 | 1 | 2 |
| CO4 | - | | 1 | 1 | 2 | - | - | 1 | - | 1 | - | - | - | - | 1 | 2 |

| 22UME143B | INTRODUCTIONS TO ROBOTICS | 03 - Credits (3 : 0 : 0) |
|---|---|---|
| Hrs./Week : 03 | | CIE Marks : 50 |
| Total Hours : 40 | | SEE Marks : 50 |

| UNIT - I | 10 Hrs. |
|---|---|
| **Robot Basics**<br>Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot.<br>**ROBOT ELEMENTS**<br>End effectors-Classification, Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation | |
| **UNIT – II** | **10 Hrs.** |
| **ROBOT KINEMATICS AND CONTROL**<br>Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation.<br>Control of robot manipulators – Point to point, Continuous Path Control, Robot programming | |
| **UNIT – III** | **10 Hrs.** |
| **ROBOT SENSORS**<br>Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence. | |
| **UNIT – IV** | **10 Hrs.** |
| **ROBOT APPLICATIONS**<br>Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nano-robots, Future Applications. | |
| **Learning Resources:**<br>1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology, Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.<br>2. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.<br>3. Klafter.R.D, Chmielewski.T.A, and Noggin’s., “Robot Engineering: An Integrated Approach”’, Prentice Hall of India Pvt. Ltd., 1994.<br>4. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, Tata- McGraw Hill Pub. Co., 2008<br>5. Yu. “Industrial Robotics”, MIR Publishers Moscow, 1985. | |
| | |
| **Course Outcomes:**<br>**On completion of the course the student will be able to:**<br>1. list and explain the basic elements of industrial robots<br>2. Analyse robot kinematics and its control methods.<br>3. Classify the various sensors used in robots for better performance.<br>4. Summarize various industrial and non-industrial applications of robots. | |

| Course Outcomes | Programme Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | - | - | - | - | 1 | - | 1 | - | - | 2 | 1 | 1 | - |
| CO2 | 1 | 2 | 1 | - | - | - | - | 1 | - | 1 | - | - | 1 | 2 | 1 | - |
| CO3 | - | 1 | 1 | 2 | - | - | - | 1 | - | 1 | - | - | - | 1 | 1 | 2 |
| CO4 | - | | 1 | 1 | 2 | - | - | 1 | - | 1 | - | - | - | - | 1 | 2 |

| 22UME112C | INTRODUCTION TO MECHANICAL ENGINEERING | 03-Credits(2 :2: 0) |
|---|---|---|
| Hrs./Week:03 | | CIEMarks:50 |
| TotalHours:40 | | SEEMarks:50 |

| UNIT-I | 10Hrs. |
|---|---|

**Introduction:** Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Energy:** Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion

**Engineering Materials:** Types and applications of Ferrous & Nonferrous Metals, silica, ceramics, glass, graphite, diamond and polymer. Shape Memory Alloys.

| UNIT–II | 10Hrs. |
|---|---|

**Machine Tool Operations:**

Working Principle of lathe, Lathe operations: Turning, facing, knurling. Working principles of Drilling Machine, drilling operations: drilling, boring, reaming. Working of Milling Machine, Milling operations: plane milling and slot milling.

(No sketches of machine tools, sketches to be used only for explaining the operations).

**Introduction to Advanced Manufacturing Systems:** Introduction, components of CNC, advantages and applications of CNC, 3D printing.

**Joining Processes**: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding and types of flames.

| UNIT–III | 10 Hrs. |
|---|---|

**Introduction to IC Engines**: Components and Working Principles, 4-Strokes Petrol and Diesel Engines,Application of IC Engines.

**Insight into Future Mobility;** Electric and Hybrid Vehicles, Components of Electric and HybridVehicles. Advantages and disadvantages of EVs and Hybrid vehicles.

| UNIT–IV | 10Hrs. |
|---|---|

**Introduction to Mechatronics and Robotics**: open-loop and closed-loop mechatronic systems. Classification based on robotics configuration: polar cylindrical, Cartesian coordinate and spherical. Application, Advantages and disadvantages.

**Automation in industry:** Definition, types – Fixed, programmable and flexible automation, basic elements with block diagrams, advantages

**Introduction to IOT:** Definition and Characteristics, Physical design, protocols, Logical design of IoT, Functional blocks, and communication models.

**Reference Books:**


1. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010.
2. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.
3. Internal Combustion Engines, V. Ganesan, Tata McGraw Hill Education; 4th edition, 2017
4. Robotics, AppuKuttan KK K. International Pvt Ltd, volume 1
5. Dr SRN Reddy, RachitThukral and Manasi Mishra, " Introduction to Internet of Things: A Practical Approach", ETI Labs
6. Raj kamal, "Internet of Things: Architecture and Design", McGraw hill.
7. Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008
8. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012

| **Course Outcomes:** |
|---|
| **CO1:** Explain the role of Mechanical Engineering w.r.t the emerging trends and technologies in various sectors, knowledge of various sources of energy and engineering materials<br>**CO2:** Describe different conventional, advanced manufacturing systems and various metal joining processes<br>**CO3:** Compute and analyze the performance of IC engines used in automobiles and concept of electric and hybrid vehicles for future mobility<br>**CO4:** Enlighten about the fundamentals of Mechatronics, Robotics, Automation in industry and IOT |
| **Question paper pattern for SEE:**<br>1. PART A (Compulsory): Answer all questions each carrying 1 or 2 marks covering the entire syllabus (20 marks)<br>2. PART B: Answer 4 full questions choosing one full question from each unit.<br>Each full question carries 20 marks and should not have more than 4 subdivisions. |
| Assignment Test for 10 Marks:<br>Assignment 1: 5 marks Multiple choice questions<br>Assignment 2: 5 marks 10 Questions from previous SEE question papers |

**Table: Matrix to describe mapping of Pos with Cos**

| Course Outcomes (Cos) | Program Outcomes (Pos) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** |
| **CO1** | 1 | 1 | - | 2 | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - |
| **CO2** | 1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | - | - | - |
| **CO3** | 1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | - | - | - |
| **CO4** | 1 | 1 | - | - | 2 | - | - | - | - | 1 | - | 1 | 1 | - | - | - |